

**RESURFACING OF RUNWAY AND ALLIED WORKS AT AF STATION PURNEA IN BIHAR****CONTENTS**

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SIGNATURE OF CONTRACTOR

DY DIRECTOR (CONTRACTS)  
FOR ACCEPTING OFFICER

## NOTICE INVITING TENDER


1. A tender is invited for the work as mentioned in Appx 'A' to this notice of tender.
2. The work is estimated to cost as indicated in aforesaid appendix 'A'. This estimate, however, is not a guarantee and is merely given as a rough guide and if the work costs more or less, the tenderer/ bidder will have no claim on that account. The tender shall be based on as mentioned in aforesaid Appendix 'A'.
3. The work is to be completed within the period as indicated in aforesaid Appendix 'A' in accordance with the phasing, if any, indicated in the tender from the date of handing over the site, which will be on or about two weeks after the date of acceptance of tender.
4. Normally contractors whose names are on the MES approved list for the area in which the work lies, and within whose financial category the estimated amount would fall, may tender/bid. Contractors whose names are on the MES approved list of any MES formation and who have deposited standing security and have executed standing security bond, may also tender/bid without depositing earnest money alongwith the tender/bid. Not more than one tender/bid shall be submitted/uploaded by one contractor or one firm of contractors. Under no circumstances will a father and his son(s) or other close relations who have business dealing with one another be allowed to tender/bid for the same contract as separate competitor. A breach of this condition will render the tenders/bids of both parties liable for rejection.
5. The office of the **CCE (NEP) (AF) Chabua**, Chabua Air Field, Dibrugarh, Pin- 786102, Assam, will be the Accepting Officer here-in-after referred to as such for the purpose of the contract. After acceptance of tender, **CE (AF) Shillong Zone** will be accepting officer for all purposes including execution and billing.
6. The technical bid and Financial bid (Cover -1 and Cover -2) shall be uploaded by the tenderer/ bidder on or before the date and time mentioned in NIT. A scanned copy of DD with enlistment details/documents shall be uploaded as packet1/Cover-1 ('T' bid) of the tender/bid on e-tendering portal. DD is refundable in case T bid is not accepted resulting in non-opening of 'Q' bid. The applicant contractor shall bear the cost of bank charges for procuring and encashing the DD and shall not have any claim from Government whatsoever on this account.
  - 6.1 The Tender form and conditions of contract and other necessary documents shall be available on defproc.gov.in site for download and shall form part of contract agreement in case the tender/bid is accepted.
  - 6.2 In case of contractor who has not executed the Standing Security Bond, the cover-1 shall be accompanied with by Earnest money of amount as mentioned in Appendix 'A' in the form of deposit at call receipt in favour of CCE(NEP) at Chabua by a schedule Bank or in receipt treasure challan the amount being credited to the revenue deposited of the CCE(NEP) at Chabua.
  - 6.3 The CCE will return the Earnest money wherever applicable to all unsuccessful tenderers/ bidders by endorsing an authority on the deposit-at-call receipt for its refund, on production by the tenderer/bidder a certificate of the Accepting Officer that a bonafied tender/bid was received and all documents were returned.
  - 6.4 The CCE will either return the Earnest Money to the successful tenderer/bidder by endorsing an authority on the deposit-at-call receipt for its refund on receipt of an appropriate amount of security deposit or will retain the same in part or full on account of security deposit if such a transaction is feasible.

- 6.5 Copies of the drawing and other document pertaining to the work signed for the purpose of identification by the Accepting officer or his accredited representative, sample of materials and stores to be supplied by the contractor will also be available for inspection by the tenderer/bidder at the office of Accepting Officer and concerned GE/GE(I)/AGE (I) during working Hours.
7. **PERFORMANCE SECURITY**  
Performance Security deposit of 5% of contract amount shall be provided by successful bidder in favour of CE (AF) Shillong zone by way of Bank Guarantee within 30 days of acceptance of Tender/allotment of contract by CCE (NEP), The Bank Guarantee shall be returned as per Schedule 'A' Notes of this tender document.
8. The tenders/bidders are advised to visit the site of work by making prior appointment with GE/GE(I) who is also Executing Agency of the work (See Appendix 'A'). The tenderers/bidders are deemed to have full knowledge of all relevant documents, samples, etc., whether they have inspected them or not.
9. A tender/bid which proposes any alteration to any of the conditions laid down or which proposes any other condition or prescription whatsoever, is liable to be rejected.
10. The uploading of bid implies that bidder has read this notice and the Condition of Contract and has made himself aware of the scope and specification of work to be done and of the conditions and rates at which stores, tools and plants etc. will be issued to him and local condition and other factors having bearing on the execution of the work.
11. Tenderers/bidders must be in possession of a copy of MES Standard Schedule of Rates (see Appendix 'A') including amendments and errata thereto.
12. Invitation for e-tender does not constitute any guarantee for validation of 'T' bid and subsequent opening of finance bid of any application/bidder, even of enlistment contractor of appropriate class, merely by virtue of enclosing DD. Accepting Officer reserves the right to reject the 'T' bid and not open the finance bid of any applicant/bidder. 'T' bid validation shall be decided by the Accepting Officer base on, inter alia, capability of the firm as per criteria given in Appx 'A' to this NIT. The applicant contractor/bidder will be informed regarding non-validation of his 'T' bid assigning reasons thereof through the e-procurements website. The application contractor/bidder if he so desires may appeal to the next higher Engineer authority viz. ADG(NEI) Guwahati with copy to the Accepting Officer on email before the schedule date of opening of Finance Bid. The decision of the Next Higher Engineer Authority (NHEA) shall be final and binding. The contractor/bidder shall not be entitled for any compensation whatsoever for rejection of his bid.
13. The Accepting Officer reserves his right to accept a tender submitted by a public sector undertaking giving a price preference over other tender which may be lower, as are admissible under the Government policy. No claim for any compensation or otherwise shall be admissible from such tenderer whose tender may be rejected on account of the said policy.
14. Accepting Officer does not bind himself to accept the lowest or any tender or to give any reason for not doing so.
15. This **Notice Inviting Tender (NIT)** including Appendix 'A' shall form part of the contract.

SIGNATURE OF CONTRACTOR

DY DIRECTOR (CONTRACTS)  
FOR ACCEPTING OFFICER

## Appendix 'A' Notice of Tender

1	<b>Name of Work</b>	:	Resurfacing of Runway and allied work services at Purnea
2	<b>Estimated Cost</b>	:	Rs. 225,00.00 lakh (Approximately at par market)
3	<b>Period of Completion</b>	:	18 Months (Eighteen months)
4	<b>Cost of Tender Documents</b>	:	Rs. 3,000.00 in the shape of DD/Banker cheque from any schedule Bank in favour of CCE (NEP) (AF) Chabua.
5	<b>Website / Portal Address</b>	:	<a href="http://www.defproc.gov.in">www.defproc.gov.in</a> and <a href="http://www.mes.gov.in">www.mes.gov.in</a>
6	<b>Type of Contract</b>	:	The tender shall be based on drawings and specifications (IAFW-2159) and General Condition of Contracts (IAFW-2249) with schedule 'A' (list of items of work) to be priced by tenderer. The tenderers are required to quote their lump sum amounts for pre-priced parts of schedule 'A' and quote rate against items of other parts of schedule 'A'.
7	<b>Information &amp; Details</b>	:	 <p>Refer Critical Dates</p>
	(a) <b>Bid Submission Start Date</b>	:	
	(b) <b>Bid Submission End Date</b>	:	
	(c) <b>Date / Time for Opening of Bid (Cover-1)</b>	:	
8	<b>Eligibility Criteria</b>	:	
	<b>(A) For MES Enlisted Contractors</b>	:	<p>They shall satisfy the following :-</p> <p>(a) Residual capacity requirement as in Para 8(C)(a) below.</p> <p>(b) Prequalification criteria as in Para 8(C)(b) below.</p> <p>(c) Enlistment in Class 'SS' category a(i) and a(iii).</p> <p>(d) Not carrying adverse remarks in WLR of competent engineer authority on the date of opening of financial bids.</p>
	<b>(B) For Other Contractors</b>	:	<p>The firms not enlisted with MES shall satisfy the following:-</p> <p>(i) Residual capacity requirement as in Para 8(C)(a) below</p> <p>(ii) Prequalification criteria as in Para 8(C) (b) below.</p>
		:	<p>(iii) They should meet enlistment criteria of 'SS' class MES contractors &amp; category a(i) and a(iii).with regards to Annual turnover, solvency, working capital, immovable property/fixed assets, T&amp;P, Engineering Establishment, no recovery outstanding in any Govt Department, Police verification/Passport etc. Enlistment criteria may be seen in Para 1.4 of Section 1 of Part I of MES Manual on Contracts – 2007 (Reprint 2012) as available in all MES formations. These firms shall also submit copy of police verification from police authority of the area where the registered office of the firm is located/notarized copy of valid passport of proprietor/each partner/each director.</p>

		<p>(iv) The firm shall submit affidavit with regards to no recovery outstanding or Arbitration involving recovery outstanding in any dept.</p> <p>(v) They should not carry adverse remarks in WLR/ or any other similar report of any authority as on the date of opening of financial bids.</p> <p>(vi) The firm should be profit making. To ascertain this they have to upload balance sheet of last three years.</p> <p>(vii) Affidavit that no Foreign National / Partners / Directors are involved in constitution of firm and staff.</p> <p>(viii) Joint ventures shall not be accepted.</p>
	<b>(C) For all Contractors</b>	<p>(a) Applicant's residual capacity as worked out by following formula should be more than estimated cost of work: -</p> <p><b>Residual capacity = (2 x A x N) – B,</b> Where : <b>A = Maximum turnover in last 5 financial years.</b> <b>N = Period of completion of contracted (Tendered) work (in years calculated till 2 decimal places)</b> <b>B = Value of balance work in all Govt. &amp; Private Works</b></p>
		<p>(b) <b>Prequalification criteria:</b> -</p> <p>(i) <b>Financial Turn over:-</b>Average annual financial turnover during the last 3 years ending 31<sup>st</sup> Mar of the 2018 should be at least 30% of the estimated cost i.e. <b>Rs. 6,750.00</b> lakh.</p> <p>(ii) 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 :-</p> <p><b>(aa) Three</b> satisfactorily completed runway pavement works involving similar pavement (rigid/ flexible as the case may be) in the last seven years each costing not less than the amount equal to 40% of the estimated cost or each having quantity of runway pavement specific items of work not less than 40% of the estimated quantities of the tender for which PQC is being given. 40% of the estimated cost i.e. <b>Rs. 9,000.00</b> lakh. OR</p> <p><b>(ab) Two</b> satisfactorily completed runway pavement works involving similar pavement (rigid/ flexible as the case may be) in the last seven years each costing not less than the amount equal to 50% of the estimated cost or each having quantity of runway pavement specific items of work not less than 50% of the estimated quantities of the tender for which PQC is being given. 50% of the estimated cost i.e. <b>Rs. 11,250.00</b> lakh. OR</p> <p><b>(ac) One</b> satisfactorily completed runway pavement works in the last seven years, costing not less than the amount equal to 80% of the estimated cost or having quantity of runway pavement specific items of work not less than 80% of the estimated quantities of the tender for which PQC is being given. 80% of the estimated cost i.e. <b>Rs. 18,000.00</b> lakh.</p> <p>Note: - For the purpose of Quantity executed, the total Quantity of Pavement Quality Concrete(PQC) will be considered, which is 1.50 lakh Cum (Approx.).</p>

		<p>(iii) Value of Completed works:- The value of previously completed works will be enhanced @7.5% per annum to bring them at par with the present cost.</p> <p>iv) Tools and Plants (T &amp; P) for PQC:-</p> <p>The firm must have under its control a minimum specified T &amp; P required for site on the date of submission of bid . To establish this fact, ownership/ MOU documents of the T &amp; P is to be submitted. The list of minimum T &amp; P to be available with the firm (in possession / MOU) at the time of submission of bid is given in Annexure- I . Besides above the firm must have major T&amp;P and same is mandatory for this work. List of major plants and equipment (Minimum essential) required for work is also given in Annexure - II.</p> <p>(v) <b>EPF &amp; GST Registration No:</b> - Firm shall be having EPF &amp; GST Registration.</p> <p>(vi) Bidders shall compulsorily submit following details in respect of similar works considered for pre-qualification purpose :-</p> <p>(aa) Acceptance letter of the work wherein cost of work awarded is given.</p> <p>(ab) Completion certificate.</p> <p>(ac) Relevant pages of paid final bill indicating amount of work actually done, if available.</p> <p>(ad) Relevant pages of technically checked final bill with the certificate of concerned EE/GE/PM/Executing agency stating that bill has been technically checked at EE/GE/PM/CCE/CE level and completion cost may be considered as per bill attached, if available.</p> <p>(ae) Relevant pages of last paid Running account payments /latest payments, if final bill is not prepared /checked and documents either as per (ac) or (ad) above are not available.</p> <p>(af) Based on these documents, actual work done cost shall be taken for pre-qualification purpose.</p> <p>(c) Contractor will not be allowed to execute the work by subletting or through power of attorney holder on his behalf to a third party / another firm except Sons / Daughter of Proprietor / Partner / Director and firm's own employees, Director, project Manager. This shall be subject to certain conditions which will be prescribed in the Notice of Tender forming part of the tender documents.</p>
9	Tender issuing and Accepting Officer	: CCE (NEP) (AF) Chabua (after acceptance of the bid, CE (AF) Shillong zone shall be the Accepting Officer for the purpose of Administration of Contract, execution of work and payments. Only signing of original CA and distribution of CTC will be carried out by CCE(NEP) after acceptance of contracts.

10	Executing agency	:	GE (AF) Purnea. M/s CES (I) Pvt Ltd. is the Detailed Engineering and Project Management Consultant (DEPMC) appointed to aid and advise GE in supervision of the work.
11	Earnest money	:	Rs. 15,00,000.00 (Rupees Fifteen Lakh only) in favour of CCE (NEP) (AF) Chabua.

**Notes: -**

1. Defect liability period shall be 03 (Three) years for all works, except for water proofing treatment and ATT for which higher defect liability will be applicable.
2. Contractor enlisted with MES will upload following documents (**Scanned copy in pdf format**) for checking eligibility:-

- (i) Application for the tender on Tenderer's letter head. In this, the contractor should explain with calculation details supported with documentary evidence as to how he is qualifying for this tender in terms of conditions given in Para 8(A)(a) and 8(A)(b) above.

Tendered/bidder to note that if they do not submit their calculation details and/ or supporting documents correctly, Deptt. will make calculation. If the firm does not qualify as result of Deptt. calculation, then bidder only will be responsible for the same. This is notwithstanding the fact that Deptt. will check the details and calculation also in respect of the contractors who have given the calculations.

- (ii) Enlistment letter.
- (iii) DD toward cost of tender.
- (iv) Documents in support of residual capacity and Pre-Qualification Criteria (PQC) which shall include :-
  - (aa) Copy of turnover certificate from CA for last 5 (five) years (FY) notarized copy of relevant pages of balance sheet of these FYs showing the turnover (gross receipts).
  - (ab) List of works in hand for contracts with Government department & private works, completed value thereof and residual work to be completed during completion period of subject work in a self-explanatory tabular form given below. This shall be submitted duly signed by proprietor/all partners/authorized Director of Pvt/Public Ltd. as applicable.

Sl No	Name of work	CA No	Value of work	Date of acceptance	Date of commencement	Date of completion	%age Progress	Value of work completed	Value of balance work in hand	Acceptance office detail
1	2	3	4	5	6	7	8	9	10	11

- (ac) Copies of completion certificate in three highest value works (after adjusting the values as per para 8 (C) (a)(iii) above) during last seven years. This will be in tubular form giving name of work, Accepting Officer's details, viz Address, Telephone, Fax No, E-mail ID etc, date of acceptance of tender and actual date of completion. This shall be duly signed by proprietor/ all partners/authorized Director of Pvt/Public Ltd, as applicable. It should indicate whether extension was granted or compensation was levied. Attested copy of acceptance letter and completion certificate shall be enclosed of each work. In case performance report has been given by the client same shall also be submitted duly attested as per table given in para(iv)(ab) above as per table given in note (iv)(ab).

- (ad) Affidavit on non-judicial stamp paper of Rs. 100/- (minimum) in the form of hard copy declaring their turnover for last 5 (five) years and value of contracts in hand in **Government department & private** and details of works completed and residual work to be completed.
- (ae) Documents for completion cost as per SI No 8 (C) (b) (v) duly signed by authorized person of the firm.
- (v) Affidavit on non-judicial stamp paper of Rs. 100/- (minimum) in the form of hard copy declaring List of T&P in control with documentary evidence
- (vi) Affidavit on non-judicial stamp paper of Rs. 100/- (minimum) in the form of hard copy declaring List of Qualified persons as supervisory staff for execution of work
- (vii) **GST registration No:** -Certificate of registration No of GST shall be uploaded as applicable on date of submission of tender.
- (viii) **Provident Fund Code No :-** Certificate of registration No of EPF shall be uploaded.  
Hard copy of these documents will be submitted **within 05 days** of the last date & time of opening of 'T' bid.

- (ix) **INTEGRITY PACT**  
Format of Integrity Pact is at Annexure-V of NIT. Scanned copy of Integrity Pact duly signed shall be submitted as part of Tech Bids and original duly signed on each page will be submitted in the office of CCE (NEP) (AF) Chabua with Demand Draft. CCE (NEP) (AF) will sign the Pacts and scanned copy will be uploaded along with Tech bid evaluation. After acceptance of contract, the Integrity Pact of the contractor, who has been awarded the contract, will be forwarded to CE (AF) Shillong Zone. CE (AF) Shillong Zone will again sign the Pact and distribute CTC copy of the Pact to CDA, NHEA, Contractor, concerned CWE/GE and any other concerned authority.

3. **Contractor not enlisted with MES will be required to upload the following :-**

- (i) Application for the tender on tenderer's letter head. In this, the contractor should explain with calculation details supported with documentary evidence as to how he is qualifying for this tender in terms of conditions given in Para 8(A) (a) and 8(A) (b) above. Tenderer/bidder to note that if they do not submit their calculation details and/or supporting documents correctly, Deptt. will make calculation. If the firm does not qualify as a result of Deptt. calculation, then bidder only will be responsible for the same. This is notwithstanding the fact that Deptt. will check the details and calculation also in respect of the contractors who have given the calculations.
- (ii) DD toward cost of tender and DD/FDR towards Earnest Money Deposit(EMD).
- (iii) Documents in support of residual capacity and Pre-Qualification Criteria (PQC) which shall include :-
  - (aa) Copy of turnover certificate from CA for last 5 (five) years (FY) notarized copy of relevant pages of balance sheet of these FYs showing the turnover (gross receipts).
  - (ab) List of works in hand for contracts with Government department & private works, completed value thereof and residual work to be completed during completion period of subject work in a self-explanatory tabular form given below. This shall be submitted duly signed by proprietor/all partners/authorized Director of Pvt/Public Ltd. as applicable.



SI No	Name of work	CA No	Value of work	Date of acceptance	Date of commencement	Date of completion	%age Progress	Value of work completed	Value of balance work in hand	Acceptance office detail
1	2	3	4	5	6	7	8	9	10	11

- (aa) Copies of completion certificate in three highest value works (after adjusting the values as per para 8 (C) (a)(iii) above) during last seven years. This will be in tubular form giving name of work, Accepting Officer's details, viz Address, Telephone, Fax No, E-mail ID etc, date of acceptance of tender and actual date of completion. This shall be duly signed by proprietor/ all partners/authorized Director of Pvt/Public Ltd, as applicable. It should indicate whether extension was granted or compensation was levied. Attested copy of acceptance letter and completion certificate shall be enclosed of each work. In case performance report has been given by the client same shall also be submitted duly attested as per table given in para(iv)(ab) above as per table given in note(iv)(ab).
- (ad) Affidavit on non-judicial stamp paper of Rs. 100/- (minimum) in the form of hard copy declaring their turnover for last 5 (five) years and value of contracts in hand in **Government department & private** and details of works completed and residual work to be completed.
- (iv) Necessary documents to prove their eligibility for enlistment in required class & category of work and T&P, Qualified staff as per PQ criteria, including affidavit for no recovery outstanding List of documents required for enlistment in MES has been given in para 1.5 of section 1of part I of MES Manual on contracts 2007(reprint 2012).This will include the following amongst others:-
- (aa) Solvency certificate and working Capital Certificate issued by scheduled bank as per format given in Annx III.
- (ab) Affidavits for possession of movable & immovable properties by proprietor/partner owing the immovable property along with valuation Certificates form Regd. Valuer in support of movable & immovable properties.
- In case of Limited company the immovable property is required to be in the name of company.
- (ac) Tools & Plants- The Affidavits duly notarized shall be submitting listing out the Details of T&P available with the firm with vintage and documentary evidence of ownership/MOU.
- (ad) Engg Establishment -The Firm should have minimum number of skilled qualified and experienced supervisory staff available at site throughout the currency of the contract as listed in above. Replacement of staff without similar experience shall not be permitted.
- (ae) Constitution of firm on an affidavit on non-judicial stamp paper of Rs. 100/- duly notarized indicating status of firm. Please note that firms registered under Companies Act only will be eligible for upload of following documents to quote for the subject tender. Joint ventures shall not be eligible for bidding. The tenderer shall submit Notarized Memorandum of Articles of Association with registration certificate of

- register of firms. The firm should declare that all the directors are Indian citizen.
- (af) Certified copy of PAN No. /TIN No. of the company.
- (ag) Certified copies of enlistment letters with various Govt. Departments / PSUs.
- (ah) Balance sheet of last 5 years.
- (ai) Power of attorney shall be executed on stamp paper of adequate value as applicable. Scanned copy of the same will be forwarded along with the bid submission. Power of Attorney in favour of any person other than Director/senior Employee of the firm shall not be accepted and not allowed. The Power of Attorney holder should not be partner/proprietor of any other civil construction firm.
- (aj) Postal address and Police Station Area of Directors of the firm. Department will carry out Police Verification of Directors as applicable in case the firm's bid is found to be lowest and Accepting Officer decided to accept the bid. Scanned copy of police verification of Directors shall be uploaded. Alternatively, certified true copy of valid passport of Directors may be uploaded.
- (ak) Indemnity Bond on non-judicial stamp paper of value of Rs. 100/- duly attested by Notary (on format enclosed) at Annx-IV.
- (al) Certified copy of Sales Tax Certificate / VAT/ GST.
- (am) Notarized affidavit on non-judicial stamp paper of Rs. 100/- that there are no recoveries outstanding with any organization and there are no arbitration / litigation cases involving recoveries known to be existing on the firm at the time of submitting these details to our office and firm has not been banned by any Govt. Deptt. / Semi Govt. / PSU / State Govt. agencies for participation in tendering.
- (an) Notarized affidavit on non-judicial stamp paper of Rs. 100/- that the Directors of the company have no relationship with any Gazetted / Commissioned Officers and JEs in MES / Corps of Engineers / Ministry of Defence.
- (ao) Affidavit on non-judicial stamp paper where arbitration invoked during last five years and its present status including details of any recoveries pending with any organization.
- (ap) Affidavit on judicial stamp paper that the firm is not banned/blacklisted with any organization for participating in tender. Any firm which is banned due to slow progress in WLR or against which a Technical BOO has been ordered for defective work shall be considered automatically ineligible to quote to the tender.
- (v) **GST registration No:** -Certificate of registration No of GST shall be uploaded as applicable on date of submission of tender.
- (vi) **Provident Fund Code No :-** Certificate of registration No of EPF shall be uploaded.
- (vii) Documents in support of residual capacity and pre-qualification same as those listed in Note 2 (iv) above.

(viii) **INTEGRITY PACT**

Format of Integrity Pact is at Annexure-V of NIT. Scanned copy of Integrity Pact duly signed shall be submitted as part of Tech Bids and original duly signed on each page will be submitted in the office of CCE (NEP) (AF) Chabua with Demand Draft. CCE (NEP) (AF) will sign the Pacts and scanned copy will be uploaded along with Tech bid evaluation. After acceptance of contract, the Integrity Pact of the contractor, Integrity Pact signed by both parties shall form part of Contract Agreement.

Hard copy of these documents will be submitted **within 05 days** of the last date & time of opening of 'T' bid.

Hard copy of these documents will be submitted **within 05 days** of the last date & time of opening of 'T' bid.

4. **Applicable for all Contractors:** -

- (i) Application/bids not accompanied by scanned copies of requisite DD/Banker cheque towards cost of tender and earnest money (as applicable) shall not be considered for validation of 'T' bid and their finance bids will not be opened.
- (ii) Tenders/bidders to note that they should ensure that their original DDs and earnest money (as applicable) are received **within 5 days of bid submission end date**.
- (iii) In case of applications/bids from **enlisted contractor of MES**, where scanned copies of requisite DD/banker cheque towards cost of tender has been uploaded but physical copies are not received by the stipulated date, finance bids will be opened. However non-submission of physical copies of cost of tender shall be considered as wilful negligence of the bidder with ulterior motives and such bidder shall be banned from bidding for a period of six months commencing from the date of opening of finance bid.
- (iv) In case of applications/bids from **un-enlisted contractors**, where scanned copies of requisite DD/bankers Cheque towards cost of tender has been uploaded but physical copies are not received by the stipulated date, finance bids will not be opened. Name of such Contractors alongwith complete address shall be circulated for not opening of their bids for a period of six months commencing from the date of opening of finance bid.
- (v) In case of applications/bidders (enlisted contractor as well as un-enlisted contractor) where scanned copies of requisite Earnest money (as applicable) where uploaded but the same are not received in physical form within stipulated time, such bids shall not qualify for opening of finance bid.

5. In case of rejection of technical/prequalification bid, contractor may appeal to next higher Engineer authority i.e. ADG(NEI) Guwahati, E-mail ID : [adgnei-mes@gov.in](mailto:adgnei-mes@gov.in) against rejection with copy to this office on e-mail ID : [dircontcenep2-mes@nic.in](mailto:dircontcenep2-mes@nic.in), whose decision shall be final and binding. However Contractor / Bidder shall not be entitled to any compensation whatsoever for rejection of technical / prequalification bid.

6. A tenderer is supposed to check if any revised BOQ has been uploaded, and quote in Revised BOQ only. Thus uploading quotation in pre-revised BOQ shall be considered as a wilful negligence by the bidder and his quotation shall be considered non bonafide.

7. During evaluation of 'T' bid (cover 1) of tendering, uploading of copy of GST number in addition to other documents required shall be mandatory. The contractor not in possession of this number or having not uploaded scanned copy of GST No or copy of proof of application for GST (temporary or copy of GST registration No) shall be disqualified in 'T' bid evaluation and his finance bid shall not be opened.

8. During evaluation of 'T' bid (cover 1) of tendering, uploading of copy of provident fund code number in addition to other documents required shall be mandatory. The contractor not in possession of this number or having not uploaded scanned copy of EPF No or copy of proof of application for EPF (temporary or copy of EPF registration of allotted EPF No) shall be disqualified in 'T' bid evaluation and his finance bid shall not opened.
9. Firms who have deposited cost of tender in first call need not to deposit cost of tender in 2<sup>nd</sup> call/subsequent calls if tender is re-invited.
10. **Affidavit for list of balance work in hand:** Bidder shall clearly furnish details of balance work in hand with two headings viz works with Govt. Deptts & Private works. Bidder shall cover in his affidavit that none of the work in hand had been concealed. The list of balance work shall be given latest upto the date of affidavit. In case the affidavit is of earlier date than that of bid submission start date the firm shall on his letter head duly signed shall give undertaking that No work has been awarded to them in intervening period otherwise the details of work is to be given on letter head.
11. Bidder's attention drawn to Para 8 of notice of tender Para 5.5 of instructions on filling & submission of tender that any tender/bid which proposes any alteration to any of the condition laid down or which proposed any other condition or prescription whatsoever, is liable to be rejected. Bidder is advised to upload only cover 1 documents and quoted BOQ.
12. Successful bidder, whether enlisted or unenlisted contractors, will be required to lodge performance security of 5% of accepted amount in approved form valid for three years and two months post completion date, which will be released only after payment of final bill, completion of defect liability and submission of no demand certificate (IAFW-451)
13. **Jurisdiction of Courts:** Court of the place from where tender/bid has been issued/uploaded i.e. Dibrugarh shall only have jurisdiction to decide any dispute of or in respect of this tender/bid. After acceptance of tender/bid Condition 72 of IAFW-2249(GCC) shall be applicable except that the 'place of issue of tender' will be substituted with **SHILLONG**.

27818/CCE(NEP)/E8

Dated : 2018

CCE (NEP) (AF) Chabua

P.O : Chabua Airfield

Dist : Dibrugarh (Assam)

PIN : 786 102

(R K Das )

EE (QS&amp;C)

Dy Director (Contracts)

For Accepting Officer

## Annx- I to Appx 'A' of NIT

**1. LIST OF MAJOR PLANT AND EQUIPMENT (MINIMUM ESSENTIAL AT THE STAGE OF BIDDING)**

Sl. No.	T & P items	Minimum Quantity	Vintage (in year)
1.	Paver with electronic sensor (minimum width of paver finisher 09 meter) for laying bituminous layer.	01 No	05
2.	Dual mode tandem vibratory roller (08 to 10 ton capacity)	02 Nos	08
3.	Computerized ready mix concrete plant of 1x60 Cum/hr with printing facility.	01 Nos	05
4.	Slip form paver with electronic sensor (minimum 08 to 13 meter width) for laying concrete pavement.	01 No	05
5.	Fix form Paver (width of paving up to 14.5m)=	01 No	05
6.	Air Compressors 350 cfm	01 No	08
7.	Wheel loaders/Excavator 6.5 to 16 Tonnes	01 No	05

Annexure -II to Appx "A" (NIT)

**1. LIST OF MAJOR PLANT AND EQUIPMENT (MINIMUM ESSENTIAL AT THE STAGE OF EXECUTION OF WORKS)**

Sl. No.	T & P items	Minimum Quantity	Vintage (in year)
1.	Paver with electronic sensor (minimum width of paver finisher 09 meter) for laying bituminous layer.	01 No	05
2.	Computerized hot mix plant (Batch mix) of 1x30 TPH	01 No	05
3.	Pneumatic tyre roller (07 to 25 ton capacity)	01 No	05
4.	Dual mode tandem vibratory roller (08 to 10 ton capacity)	02 Nos	08
5.	Bitumen sprayer 10 to 12 ton motorized	01 No	08
6.	Insulated Bitumen containers of suitable capacity near hot mix plants.	02 Nos	08
7.	Computerized ready mix concrete plant of 1x90 Cum/hr with printing facility.	02 Nos	05
8.	Computerized ready mix concrete plant of 1x60 Cum/hr with printing facility.	01 Nos	05
9.	Slip form paver with electronic sensor (minimum 08 to 13 meter width) for laying concrete pavement	01 No	05
10.	Hand held heavy duty needle vibrator (electrically operated/ diesel driven) for PQC.	06 Nos	08

11.	Fix form Paver (width of paving up to 14.5m)	01 No	05
12.	Machine for joint filling	01 No	08
13.	Diamond cutter for joints (Diesel / electric driven) (Two full depth concrete cutting machine)	04 Nos.	08
14.	WMM plant of 90 to 12 TPH capacity	01 No	08
15.	Vibratory type sand screeners	01 No	08
16.	Mechanized runway marking and painting equipment	01 No	08
17.	Air Compressors 350 cfm	01 No	08
18.	Profilometer / Roughometer	01 No	08
19.	Core cutting machine (150mm diameter & 100mm diameter bit)	01 No	08
20.	Field testing equipment to test 'K' value & 'CBR' value	01 No	08
21.	Lab testing equipments for site lab		08
22.	Total station survey equipment	01 No	08
23.	Dumpers	10 Nos	05
24.	Transit Mixer	02 Nos	05
25.	JCB	02 Nos	05
26.	Wheel loaders/Excavator 6.5 to 16 Tonnes	01 No	05
27.	Motor graders	01 No	05
28.	Diamond bit cutters	01 No	05
29.	Texturing machine	01 No	05
30.	Dharam Kanta of suitable capacity (100 Ton)	01 No	05

## 2. TESTING EQUIPMENTS REQUIRED FOR SETTING OF SITE LAB

Sl. No.	Particulars of equipments	Nos. required
1.	<b><u>Balances</u></b>	
	(i) 7Kg to 10 Kg capacity- semi self-indicating type- Accuracy 1gm	2
	(ii) 500 gm capacity - semi self-indicating type- Accuracy 0.0001gm	2
	(iii) Chemical Balance – 100gm capacity self-indicating type	1
	(iv) Pan Balance – 5 Kg capacity self-indicating type	1
	(v) Physical Balance – 0.001gm accuracy	1
	(vi) Platform scale – 300 Kg capacity	1
2.	Ovens- Electrically operated , thermo statically controlled	
	(i) Up to 100° C for Sensitivity 1°C	1
	(ii) Up to 200° C for determination on loss heating bitumen	1

3.	Sieves : as per IS 460-1962	
	(i) Set of IS sieves with lid and pan 450mm diameter 80mm, 63mm, 40mm, 20mm, 16mm, 12.5mm, 10mm, 4.75mm, 2.36mm, 1.18mm, 0.6mm, 0.3mm and 0.15mm size.	1 set
	(ii) (a) Set of IS sieves with lid and pan 450mm diameter 63mm, 53mm, 45mm, 37.5mm, 26.5mm, 19mm, 13.2mm, 9.5mm, 6.7mm and 4.75mm size.	1 set
	(b) Set of IS sieves with lid and pan 200mm diameter 2.36mm, 2mm, 1.18mm, 0.6mm, 0.425mm, 0.3mm and 0.075mm size.	1 set
4.	Sieve shaker capable of taking 200mm and 300mm dia sieves electrically operated with time switch assembly.	1
5.	Providing rings – complete with dial gauge and calibration charts.	
	(i) 250Kg capacity	2
	(ii) 2000Kg capacity	2
	(iii) 05 Kg capacity	2
6.	Dial Gauge	
	(i) 25mm travel 1.1mm/ division	
7.	Load frame 5 tonne capacity electrically operated with speed control.	1
8.	200 Tonne compression testing machine	1
9.	Stop Watches 1.0 sec, accuracy	4
10.	Glassware comprising brakers, Pipettes, dishes, measuring cylinders (100 to 1000 cc capacity) rods and funnels.	3 doz each
11.	Hot plates 200mm dia (1No. 5000watt)	02
12.	Enamel trays	
	(i) 600mm x 450mm x 50mm	6
	(ii) 450mm x 300mm x 40mm	6
	(iii) 300mm x 250mm x 40mm	6
	(iv) Circular plates of 250mm dia	6
	<b><u>BITUMEN</u></b>	
1.	Constant temperature both for accommodating bitumen test specimen, electrically operated and thermostatically controlled	1
2.	Petrol gas generator (Laboratory model or any other alternative arrangement for heating of specimens in laboratory)	1
3.	Penetrometer automatic type adjustable weight arrangements, and needles as per IS 1203-1958.	1
4.	Laboratory mixer about 0.02 cum capacity electrically operated fitted with heating jacket.	1
5.	Hubbard – Field stability test apparatus complete	1
6.	Marshall compaction apparatus as per ASTB 1559-62 T complete with electrically operated loading unit compaction pedestal hearing head assembly, dil micrometer land bracket, for flow measurement, load transfer bar, specimen mouth (4inch dia ) with base plate, collars specimen extractor, compaction hammer 4.53 kg ( 10 lb) x 457mm (18 in) fall	1
7.	Distant reading thermometers	1
8.	Centrifugal type bitumen extractor hand operated/ motorized complete with petrol/ commercial benzene	1 Set
9.	Field density bottle along with cutting tray, chisel, hammer and standard sand.	02
10.	3 meter straight edge	01
11.	Camber board	01

12.	Core cutting machine with 10 cm dia diamond cutting edge	02 Set
13.	Equipment for conducting	01 Set
14.	Non-nuclear Density Gauge	01
<b>CONCRETE AND MATERIALS</b>		
1.	Water still	02
2.	Vicat needle apparatus for setting time test with plungers , as per IS-269-1967	
3.	Moulds	
	(i) 150mm x 150mm x 700mm	36
	(ii) Cubicals 150mm, 75mm(each size)	36
4.	High frequency mortar cube vibrator	01
5.	Concrete power driven , 1 cubic feet capacity	01
6.	Variable frequency and amplitude vibrating table size 1 meter X 1 meter, as per IS 2514-1963	01
7.	Flakiness index test apparatus	1
8.	Aggregate impact test apparatus as per IS 2386- Part IV- 1963	1
9.	Los Angles abrasion apparatus as per IS-2386-Part IV -1963	1
10.	Flow table as per IS 712-19731	1
11.	Equipment for slump test and compaction factor test	1
12.	Equipment for the determination of specific gravity of fine and coarse aggregate as per IS-2386 Part III- 1963	1
13.	Digital compression and flexural strength testing machine of 200 tonne capacity with additional dial for flexural testing.	1
14.	Core cutting machine with 15cm dia diamond cutting edge	1
<b><u>CONTROL OF PROFILE AND SURFACE EVENNESS</u></b>		
1	Survey level and staff	1Set
2	3 meter straight edge and measuring edge	1Set
3	Unevenness indicator(optional)	1
4	Camber templates single lane/Double lane	2 Each
5	Field CBR testing equipment	2 Sets
6	Water testing kit	1 Set
7	Riffle box	No
8	Atterberg Limits(liquid and plastics limits) determination apparatus	01 Set
9	Compaction test Equipment both 2.5kg and 4.5kg rammers(Lights and heavy compactive efforts)	01 Set
10	Dry Bulk density test apparatus (sand pouring cylinder, tray, can etc)complete	01 Set
11	Speedy Moisture Meter complete with chemicals	01 set
12	Post hole Auger with extensions	01 set
13	Unconfined compression test apparatus	01 set
14	Rifle Box small size	01 set
15	Miscellaneous sand scoop , spatula, straight Edge Gauged Trowel ,Steel foot rules ,Scales, Mortar Pans, Spade, shovels, Filter paper and Wax	As Reqd.
16	Other equipment for site test as outlined in BIS	
17	Dynamic Cone Penetrometer	01
<b><u>MISC</u></b>		
1.	Total Station	01



## Annx- III to Appx 'A' of NIT

**FORM OF SOLVENCY CERTIFICATE FROM A SCHEDULED BANK**

This is certified to the best of our knowledge and information that M/s \_\_\_\_\_  
\_\_\_\_\_ having  
address \_\_\_\_\_,  
a customer of our bank are / is respectable and can be considered solvent for any upto  
Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_). This certificate is  
issued without any guarantee or responsibility on the bank or any of the officers.

Place:

Signature of Bank Manager

Date:

Name, No. &amp; Seal of Bank

**WORKING CAPITAL CERTIFICATE**

This is Certified that M/s \_\_\_\_\_ having address  
\_\_\_\_\_ has/have been maintaining a saving bank account /current  
account / fixed deposit account with this branch of bank since \_\_\_\_\_ and an amount not less  
than Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_)  
has been available to the credit in his/her/their account Nos \_\_\_\_\_ for the last three months.  
The firm is enjoying overdraft/credit facility upto limit of Rs. \_\_\_\_\_.

Place:

Signature of Bank Manager

Date:

Name, No. &amp; Seal of Bank

**Annx- IV to Appx 'A' of NIT**

**(IAFW-2160 REVISED 1960) INDEMNITY BOND**

This bond of indemnity is executed on this \_\_\_\_\_ day \_\_\_\_\_ by M/s/ \_\_\_\_\_ having registered office at \_\_\_\_\_ to indemnify the Government of India of the following:-

1. We undertake to pay the Government of India any damages that may be found to be recoverable on order of our contracts.
2. We undertake that in case Government is put to pay any loss or disadvantage in monetary of contract by the firm which shall indemnify the Government for each loss or disadvantage.
3. This bond of indemnity is executed by M/s \_\_\_\_\_ and have signed before me.

Whatever stated above is true and correct to the best of my knowledge and belief.

Signature of Contractor

Notary

Annexure V to Notice of TenderINTEGRITY PACT

Between

CCE (NEP) (AF) Chabua (including its successors and their officers and staff associated with the project) hereinafter referred to as "The Principal",

and

.....(including their successors, executors, administrators assignee and legal representatives) hereinafter referred to as "The Bidder/Contractor".

Objectives

1. The Principal intends to award, under laid down organizational procedures, contract(s) for **"Resurfacing of runway and allied works at AF Station Purnea in Bihar"**. The Principal values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness / transparency, equity and competitiveness in its relations with its Bidder(s) and / or Contractor(s). It is an agreement between the bidders/contractors and the Principal, committing the persons /officials of both sides, not to resort to any corrupt practice in any aspect /stage of the contract.
2. In order to achieve these goals, Ministry of Defence, Govt of India has appointed or will appoint Independent External Monitors (IEMs) who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Commitments of the Principal

3. The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles :-
  - (a) No employee of the Principal, personally or through family members, will in connection with the tender or during the execution of a contract, seek or take a promise for or accept, for self or for third person, any material or immaterial benefit which the person is not legally entitled to.
  - (b) The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.
  - (c) The Principal will exclude from the process all known prejudiced Persons.
4. If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the IPC/PC Act, or if there be a substantive suspicion in, this regard, the Principal will inform the next higher authority and in addition will take suitable action against that employee.

Commitments of the Bidder(s)/ contractor(s)

5. The Bidder(s) / Contractor(s) commit himself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of his bids or during any pre contract or post contract stage. Bidders/Contractors commit to observe the following principles during their participation in the tender process and during the contract execution :-
  - (a) The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal's employees involved in the tender

process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

- (b) The Bidder(s)/ Contractor(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competition or to introduce cartelisation in the bidding process.
  - (c) The Bidder(s)/ Contractor(s) will not commit any offence under the relevant IPC/PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
  - (d) The Bidder(s)/Contractors(s) of foreign origin shall disclose the name and address of the Agents/representatives in India, if any. Similarly the Bidder(s)/Contractors(s) of Indian Nationality shall furnish the name and address of their foreign principals or associates, if any. Further, as mentioned in the Guidelines, all the payments made to the Indian agent/ representative have to be in Indian Rupees only.
  - (e) The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.
  - (f) The Bidder(s)/Contractor(s) will disclose any transgressions with any other company that may impinge on the anticorruption principle.
6. The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

#### **Disqualification from tender process and exclusion from future contracts**

7. If the Bidder(s)/Contractor(s), before award or during execution has committed a transgression through a violation of above or in any other form such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/Contractor(s) from the tender process or take action to ban further business dealings with him.

#### **Compensation for Damages**

8. If the Principal has disqualified the Bidder(s) from the tender process prior to the award of contract according to Para 7 hereinabove, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.
9. If the Principal has terminated the contract, or if the Principal is entitled to terminate the contract according to Para 7 hereinabove, the Principal shall be entitled to demand and recover from the Contractor liquidated damages of the Contract value or the amount equivalent to Performance Bank Guarantee.

#### **Previous Transgression**

10. The Bidder declares that no previous transgressions occurred in the last 3 years with any other Company in any country conforming to the anti corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.
11. If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or action can be taken to ban further business dealings with him".

**Equal Treatment of all Bidders / Contractors / Sub contractors**

12. The Bidder(s)/ Contractor(s) undertake(s) the responsibility to demand from all subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before signing contract /associating with them.
13. The Principal will enter into agreements with identical conditions as this one with all Bidders, Contractors and Sub contractors.
14. **All bidders who do not sign this Pact or violate its provisions will not be considered competent to participate in the bidding process.**

**Criminal charges against violating Bidder(s) / Contractor(s) / Sub contractor(s)**

15. If the Principal obtains knowledge of conduct of a Bidder, Contractor or Sub contractor, or of an employee or a representative or an associate of a Bidder, Contractor or Sub contractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the same to the Chief Vigilance Officer, Ministry of Defence through proper channel in addition to taking suitable action against the bidder(s)/contractor(s).

**Independent External Monitor / Monitors**

16. This pact would be implemented through a panel of Independent External Monitors (IEMs). Ministry of Defence, Government of India has appointed or will appoint Independent External Monitors for this Pact. The task of the Monitors is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.
17. The Monitors are not subject to instructions by the representatives of the parties. They will perform their functions neutrally and independently.
18. The Bidder(s)/Contractor(s) accept that the Monitor has the right to access without restriction to all Project documentation of the Principal including that provided by the Contractor(s). The Contractor will also grant the Monitors, upon their request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to sub contractors. The Monitors are under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s)/ Subcontractor(s) with confidentiality.
19. The Principal will provide to the Monitors sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitors the option to participate in such meetings.
20. As soon as the Monitors notice, or believe to notice, a violation of this agreement, he will so inform the Management' of the Principal and request the Management to discontinue or take corrective action, or to take other relevant action(s).
21. The role of IEMs is advisory, would not be legally binding and it is restricted to resolving issues raised by an intending bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some bidders.
22. The report of enquiry, if any, made by the Independent External Monitors shall be submitted to the Secretary, Ministry of Defence, Govt of India for a final and appropriate decision in the matter keeping in view the provision of this pact.

- 23. Person(s) signing Integrity Pact shall not approach the Courts while representing the matters to IEM, and he(they) will wait decision of IEMs in the matter.
- 24. The word 'Monitors' would include both singular and plural.

**Pact Duration**

- 25. This Pact begins when both parties have legally signed it. It expires for the Contractor till final completion of the contract and 10 months after the last payment under the contract, and for all bidders 6 months after the contract has been awarded.
- 26. If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above.

**Other provisions**

- 27. This agreement is subject to Indian Law. Place of performance and jurisdiction is the Registered Office of the Principal.
- 28. Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.
- 29. If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.
- 30. Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

CCE (NEP) (AF) Chabua  
(For & On behalf of the Principal)

(Office Seal)

Place \_\_\_\_\_  
Date\_\_\_\_\_

Witness 1 :  
(Name &Address)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Witness 2 :  
(Name &Address)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
(For & On behalf of Bidder/  
Contractor)  
(Office Seal)

27818/CCE(NEP)/75/E8

[www.defproc.gov.in](http://www.defproc.gov.in)

14 Aug 2018

M/s.....  
.....  
.....  
Tele: .....  
Fax : .....

CCE(NEP) (AF) CHABUA  
Po: Chabua Air Field  
Dist: Dibrugarh, Assam  
Pin:- 786102

**RESURFACING OF RUNWAY AND ALLIED WORKS AT AF STATION PURNEA IN BIHAR.**

Dear Sir,

1. Tender documents in respect of above work are uploaded on the site [www.defproc.gov.in](http://www.defproc.gov.in). The tender is on single stage two cover e-tendering system. The contents of Cover I & Cover II are specified in NOTICE OF TENDER.
2. Bids will be received online by **CCE (NEP) (AF) CHABUA (ACCEPTING OFFICER)** upto the date and time mentioned in the **NOTICE INVITING TENDER (NIT) as amended subsequently**. No tender / bid will be received in physical form and any tender / bid received in such manner will be treated as non bona fide tender / bid.
3. Bid will be opened on due date and time fixed for opening in the presence of tenderers / bidders or their authorized representatives, who have uploaded their quotation bid and who wish to be present at the time of opening the bids.
4. Your attention is also drawn to instruction on filing and submission of tender attached herewith. You may forward your points on tender documents and / or depute your technical representative for discussion on tender / drawings and to clarify doubts, if any, on or before **31 Aug 2018** You are requested not to write piecemeal points and forward your points duly consolidated before due date viz **31 Aug 2018**. Points may be forwarded on Email id: [dircontcenep2-mes@nic.in](mailto:dircontcenep2-mes@nic.in) .
5. Pre-bid meeting is tentatively scheduled on **05 Sep 2018** at GE(AF) Purnea. The points received from prospective bidders will be discussed in the meeting. The prospective bidders are requested to attend the pre-bid meeting.
6. Un-enlisted contractors are required to submit the scanned copies (in pdf file) of documents required as per eligibility criteria mentioned in instructions for filling the tender documents and Appendix 'A' to NIT along with EARNEST MONEY DEPOSIT (EMD) and tender fee on e-procurement portal and submit the physical documents in the office of CCE (NEP) (AF), Chabua within time limit specified in NIT. Inadequacy / deficiency of documents shall make the bid liable for rejection resulting in disqualification for opening of finance bid.
7. Contractor having not executed standing security bond and standing security deposit in any MES formation shall upload scanned copy of EARNEST MONEY DEPOSIT (EMD) mentioned in Notice of Tender and shall ensure receipt of hard copy of EMD in the office of tender issuing authority before date & time fixed for this purpose. In case of failure to abide by any of these two requirements, the finance bid will not be opened.

8. Enlisted contractors of MES shall submit the scanned copies (pdf file) of enlistment letter, tender fee and such other documents as mentioned in Appx 'A' to **NIT** on e-procurement portal and submit physical documents in the office of CCE(NEP) (AF) Chabua before date & time fixed for this purpose.
9. The contractor must ensure that the tender / bid on the proper form is uploaded in time as the Accepting Officer will take no cognizance of any quotations/ offer received in any other electronic or physical form like email/fax/by hand/ through post from tender / bidder even if they are received in time.
10. In view of delays due to system failure or other communication related failures, it is suggested that the tender /bid be uploaded, if necessary sufficiently in advance of the last due date and time fixed.
11. General Conditions of Contracts (IAFW-2249) (1989 Print) and errata and amendments thereto, Schedule of minimum fair wages and MES SSR (Part-I and Part-II) are not enclosed with these documents. These are available for perusal in the office of GE concerned and this office.

ANY TENDERER, WHO PROPOSES ALTERATIONS TO ANY OF THE CONDITIONS, SPECIFICATIONS LAID DOWN IN THE TENDER DOCUMENTS OR ANY NEW CONDITION, WHATSOEVER, IS LIABLE TO BE REJECTED.

Yours faithfully,

**SIGNATURE OF CONTRACTOR**  
**DATED :**

**DY DIRECTOR (CONTRACTS)**  
**FOR ACCEPTING OFFICER**



## **INSTRUCTIONS ON FILLING AND SUBMISSION OF TENDER**

### **1. EARNEST MONEY DEPOSIT (EMD)**

Contractor(s) who are not enlisted with MES / who are enlisted but have not executed the Standing Security Bond shall submit Earnest Money Deposit as detailed in Notice of Tender in one of the following forms, along with their tender / bid :-

- (a) Deposit at Call Receipt from a Scheduled Bank in favour of CCE (NEP) AF Chabua for Rs. 15,00,000.00(Rs.Fifteen Lakh only)
- (b) Receipted Treasury Challan, the amount being credited to the Revenue Deposit of CCE (NEP) AF Chabua.

It is advisable that Earnest Money is deposited in the form of deposit call receipt from an approved Scheduled Bank for easy refund. In case the tender / bidder wants to lodge 'EARNEST MONEY DEPOSIT' in any other form allowed by MES, a confirmation about its acceptability will be obtained from the Accepting Officer well in advance of the bid submission end date and time. Earnest Money Deposit shall be submitted in the name of concerned GE.

**NOTES: Earnest Money Deposit (EMD) in the form of Cheque / Bank Guarantee etc. will not be accepted. NON-SUBMISSION OF EARNEST MONEY DEPOSIT (EMD) (scanned copy along with Technical Bid & hard copy before the date & time fixed for opening of BOQ) WILL RENDER THE BID DISQUALIFIED FOR OPENING OF COVER II (FINANCE BID)**

### **2. PERFORMANCE SECURITY**

Performance Security deposit of 5% of contract amount as per BOQ shall be provided by successful bidder in favour of CE (AF) Shillong by way of Bank Guarantee within 30 days of acceptance of Tender/allotment of contract by CCE (NEP),The Bank Guarantee shall be returned as per Schedule 'A' Notes.

### **3. GENERAL INSTRUCTIONS FOR COMPLIANCE**

- 3.1 The bids received only in the electronic form will be considered. All bids shall be submitted on 'defproc.gov.in' portal. Documents should be scanned and forwarded in 'pdf' form and 'xls' form as indicated.
- 3.2 Bid shall be uploaded on 'defproc.gov.in' portal on or before the bid closing date mentioned in the tender. No tender/bid in any other electronic or physical form like email / fax / by hand/ through post will be considered.
- 3.3 Bid should be DIGITALLY signed using valid DSC. All pages of tender documents, corrections/ alterations shall be signed/ initialled by the authorised rep. of lowest bidder after acceptance, in the office of CCE(NEP) AF Chabua.
- 3.4 Drawings, if issued in physical form, must be returned duly initialled by the tenderer /bidder in separate envelope indicating his name and address.
- 3.5 The tender shall be signed, dated and witnessed at all places provided for in the documents after acceptance. All corrections shall be initialled. The Contractor shall initial every page of tender and shall sign all drawings forming part of the tender. Any tender/bid, which proposes alterations to any of the conditions whatsoever, is liable to be rejected. The contractor's authorized representative shall attend the office of CCE (NEP) AF Chabua immediately after acceptance for signing of original documents.

- 3.6 In the technical bid, a scanned copy of Power of Attorney in favour of the person uploading the bid using his/her DSC shall be uploaded. In case the digital signatory himself is the sole proprietor, scanned copy of an affidavit on stamp paper of appropriate value to this effect stating that he has authority to bind the firm in all matters pertaining to contract including the Arbitration Clause, shall be attached in '.pdf' form. In case of partnership concern or a limited company, digital signatory of the bid/tender shall ensure that he is competent to bind the contractor (through partnership deed, general power of attorney or Memorandum and Articles of Association of the Company) in all the matters pertaining to the contracts with Union of India including arbitration clause. A scanned copy of the documents confirming of such authority shall be attached with the tender/bid in '.pdf' form, if not submitted earlier. The person uploading the bid on behalf of another partner(s) or on behalf of a firm or company using his DSC shall upload with the tender/bid a scanned copy (in '.pdf' form) of Power of Attorney duly executed in his favour by such other or all of the Partner(s) or in accordance with constitution of the company in case of company, stating that he has authority to bind such other person of the firm or the Company, as the case may be, in all matters pertaining to the contract including the Arbitration Clause.
- 3.7 Even in case of Firms or Companies which have already given Power of Attorney to an individual authorizing him to sign tender in pursuance of which bids are being uploaded by such person as a routine, fresh Power of Attorney duly executed in his favour stating specifically that the said person has authority to bind such partners of the Firm, or the Company as the case may be, including the condition relating to Arbitration Clause, should be uploaded in '.pdf' form with the tender/bid; unless such authority has already been given to him by the Firm or the Company. It shall be ensured that power of attorney shall be executed in accordance with the constitution of the company as laid down in its Memorandum & Article of Association.
- 3.8 Hard copies of all above documents should be sent by the contractor to the Tender issuing authority well in advance to be received before the date & time fixed for the same.
- 3.9 Bid (Cover 1 & 2) shall be uploaded online well in time.
- 3.10 The contractor shall employ Indian Nationals after verifying their antecedents and loyalty. Attention is also drawn to special condition 3 referred hereinafter and also conditions 24 & 25 of IAFW 2249 (General conditions of contract).
- 3.11 Tenderers/bidders who uploaded their priced tenders/bids and are desirous of being present at the time of opening of the tenders/bids, may do so at the appointed time.
- 3.12 The tenderer/bidder shall quote his rate on the BOQ file only. No alteration to the format will be accepted, else the bid will be disqualified and summarily rejected.
- 3.13 In case the tenderer/bidder has to revise / modify the rates quoted in the BOQ (excel sheet) he can do so only in the BOQ, through [defproc.gov.in](http://defproc.gov.in) site only before the bid closing time and date.

**4. REVOCATION/REVISION OF OFFER UPWARD/ OFFERING VOLUNTARY REDUCTION, AFTER CLOSING OF BID SUBMISSION DATE & TIME**

In the event of lowest tenderer/bidder revoking his offer or revising his rates upward/ offering voluntary reduction, after closing of bid submission date & time, his offer will be treated as revoked and the Earnest Money deposited by him shall be forfeited. In case of MES enlisted Contractors, the amount equal to the Earnest Money stipulated in the Notice of tender, shall be notified to the tenderer/bidder for depositing the amount through MRO. Bids of such Contractors/bidders shall not be opened till the aforesaid amount equal to the earnest money is deposited by him in Govt Treasury. In addition, bids of such tenderer/bidder and his related firm shall not be opened in second call or subsequent calls. Reduction offered by the tenderer/bidder on the freak high rates referred for review shall not be treated as voluntary reduction.

**5. PROJECT PLANNING**

- 5.1 The project planning for work covered in the scope of tender is based on CPM (By using MS Project / Primavera software).
- 5.2 The tenderer/bidder is expected to be fully conversant with the scheduling technique and employ technical staff who can use the technique in sufficient details. Sufficient books and other literature on the subject are widely available in the market which the tenderer,/bidder may make use of.
- 5.3 The tenderer's/bidder's attention is drawn to special condition of the tender regarding preparation of the detailed network analysis and time schedule for the work and his liability for employing sufficient resources to adhere to this schedule. Any inability on the part of the tenderer/bidder in using the technique will be taken as his technical inefficiency and will affect his class of enlistment and future prospect/invitation to tenders for future works.
- 5.4 Department may issue amendments/errata in form of CORRIGENDUM to tender /revised BOQ to the tender documents. The tenderer/bidder is requested to read the tender documents in conjunction with all the errata/ amendments/corrigendum, if any, issued by the department.
6. These instructions shall form part of the contract documents.

**SIGNATURE OF CONTRACTOR**  
**DATED : \_\_\_\_\_**

**DY DIRECTOR (CONTRACTS)**  
**FOR ACCEPTING OFFICER**

**(IN LIEU OF IAFW-1779A) TO BE USED IN CONJUNCTION WITH GENERAL  
CONDITIONS OF CONTRACTS (IAFW 2249)**

Tele: .....  
Fax : .....

[www.defproc.gov.in](http://www.defproc.gov.in)  
CCE(NEP)(AF) CHABUA  
PO:- CHABUA AIR FIELD  
DIST:- DIBRUGARH(ASSAM)  
PIN :- 786102

27818/CCE(NEP)/E8

14 Aug 2018

**TENDER AND LUMP SUM CONTRACT FOR WORKS BY IN THE EXECUTION OF  
RESURFACING OF RUNWAY AND ALLIED WORKS AT AF STATION PURNEA IN BIHAR.**

1. Shri.....  
of..... is/ are hereby authorized to tender for the  
above work. The tender is to be uploaded in the e tendering portal [www.defproc.gov.in](http://www.defproc.gov.in).
2. THE PRESIDENT OF INDIA DOES NOT BIND HIMSELF TO ACCEPT THE LOWEST  
OR ANY TENDER.

**SIGNATURE OF OFFICER ISSUING THE DOCUMENTS  
APPOINTMENT: DY DIR (CONTRACTS)**

**SCHEDULE 'A'**  
**(RESURFACING OF RUNWAY AND ALLIED WORKS AT AF STATION PURNEA  
 IN BIHAR)**

1. These notes are applicable for all items in schedule 'A' for the work Resurfacing of Runway and Allied Works at AF Stn. Purnea in Bihar .
2. This Schedule covers for all items of works described in Schedule A Part-I to XV. The Building/ Structure and all services described under Schedule 'A' Part-I to XV shall be executed at location shown on site plan. The broad scope of work included in various parts of Schedule A is as under :

Sl. No.	Part	Description
(i)	Part –I	Buildings/Structures.
(ii)	Part-II	Internal Water Supply
(iii)	Part-III	Internal Electrification
(iv)	Part –IV	Pavement Works
(v)	Part –V	RCC Duct for HRS & Electrical cable works
(vi)	Part –VI	Road & Path Works
(vii)	Part –VII	Culvert Works
(viii)	Part – VIII	External Water Supply
(ix)	Part – IX	External Electrical Supply
(x)	Part – X	External Sewage Disposal Work
(xi)	Part – XI	Area Drainage Works
(xii)	Part – XII	Site Clearance Works
(xiii)	Part – XIII	Dismantling & Demolition Works
(xiv)	Part – XIV	Miscellaneous Works
(xv)	Part – XV	Schedule of Credit

**3. PERIOD OF COMPLETION**

- (a) The entire work as per part I to XV under this contract shall be completed within **548 days (18 months)** as per phasing given below from the date of commencement as mentioned by GE in the work order No 01 and in accordance with CPM/PERT network agreed to between the Respective GE's and contractor in terms of condition 11 of IAFW 2249 (General Conditions of Contracts) forming part of contract. The work schedule shall be planned by the contractor as under: -

Sl. No.	PHASE	PERIOD
<b>A</b>	<b><u>Mobilisation Phase (Phase-I)</u></b>	
	(i) Survey work and taking levels of the area under the scope of work at grid interval of 3m both ways jointly and plotting the same and working out quantities of profile correction work.	04 months from date of commencement as shown in work order No.1
	(ii) Construction of site office, Labour Camp, store shed.	

	<ul style="list-style-type: none"> <li>(iii) Lab establishment with Calibration of Lab equipment's as per Appendix 'D'</li> <li>(iv) Recording of existing pavement levels &amp; identification and stabilization of unstable slabs</li> <li>(v) Approved source of coarse aggregate is PAKUR(JH) after completion of all tests as per IS-2638 and chemical analysis to rule out presence of pyrite &amp; lignite.</li> <li>(vi) Sample Material Approval, submission and approval of Design Mix / Job Mix formula.</li> <li>(vii) Employment of Engineering/ supervising staff as given hereinafter.</li> <li>(viii) Preparation and finalization of Project Schedule through Primavera/ MS Project.</li> <li>(ix) Mobilization of equipment, T&amp;P, procurement of 20% quantity of material for all items of schedule (except PMB, Cement and other perishable material as decided by GE). T&amp;P involved only for bituminous works may be mobilized at a later date as per time schedule approved by GE.</li> <li>(x) Rolling over existing rigid pavements by 40MT heavy roller to identify weak/damaged slabs.</li> <li>(xi) Approval of Trial bay for GSB, WMM, DLC, DBM and PQC.</li> <li>(xii) Construction of five nos of water storage tank of capacity 10000 litres each in masonry /RCC construction for curing purpose and cube testing.</li> </ul>	
	<p><b>Note: - In case of the failure on the part of contractor to complete phase –I work within the stipulated period, compensation for phase–I shall be recovered from the contractor at the rate of 0.5% of total contract amount per week of delay subject to maximum of 10% of total Contract amount. When the delay is not a full week or in multiple of a week but involves a fraction of a week the compensation payable for the fraction shall be proportional to the number of days involved. Condition 50 of IAFW-2249 (General conditions of Contracts) shall be deemed to be amended accordingly for phase-I. The T &amp; P collected shall be entered in the MB as “NOT TO BE ABSTRACTED” and shall be dully signed by both the parties.</b></p>	
<b>B</b>	<p><b>Phase-II</b> :- Phase-II work comprises the construction of buildings, pavement and services as per Schedule 'A' complete all as specified and shown on drawing.</p>	14 Months from due date of completion of Phase 1 as shown in work order No.1

**(b) SITE FOR EXECUTION OF WORK**

Site for execution of work will be available as mentioned in Phases. In case it is not possible for the Department to make the entire site available on the award of work, the contractor will have to arrange his working programme accordingly. No claim whatsoever, for not giving the entire site of work on acceptance of tender & for giving the site gradually will be tenable.

**(c) DEFECT LIABILITY PERIOD**

The work shall be treated as completed within the provisions of condition 49 of IAFW-2249 only after the whole work as per work of different parts completed under the contract and taken over by the GE. The defects liability period mentioned in condition 46 of IAFW-2249 shall commence from the date of completion as mentioned in completion certificates issued by the GE which shall be issued only after the completion of the entire work under the contract. The Defect Liability shall be for three years, from the date of completion of all the Phases of completion as mentioned in completion certificates issued by the GE. The Defect liability period as given in condition 46 of IAFW-2249 will be amended as per DLP given hereunder except for the work of antitermite treatment and water proofing treatment for which the defective liability will be 10 years.

**(d) PERFORMANCE SECURITY**

Successful bidder will be required to lodge performance security of 5% of accepted amount in approved form valid for a period at least 2 months after the release of performance security is due. The performance security may be released in 2 parts. Half of the performance security will be released on expiry of one & half year of defect liability period & rectification of defects notified till date. Other half will be released only after payment of final bill, completion of defect liability (03 years) and submission of no demand certificate (IAFW- 451).

**4. NOTES APPLICABLE FOR SCHEDULE 'A' PART – I**

4.1 The unit rate of buildings to be inserted by the Deptt. and contractor, in Part 1 of Schedule 'A' shall include for all materials and Labour complete as specified in Particular Specifications and as shown on Drgs. including notes thereon except works as referred in note 4.3 here-in-below and interalia include the following :

- a. All earth work, refilling and disposal of surplus earth for the building.
- b. Toilet/Sanitary appliances, fittings / fixtures / accessories and connection including all traps as required.
- c. Plumbing and sewage disposal with CI soil pipe upto and including the 1<sup>st</sup> manhole (s). CI waste pipe with GT, SGSW piping upto first manholes, anti-syphonage pipes / vent pipes shall also be part of lump sum quote.
- d. RCC shelves of any number of tiers, RCC Jalli, RCC platform, rungs/ cat ladder and mirror etc. all as shown on drawings.
- e. Leaving/forming/cutting necessary chases, recesses, holes etc. wherever required in walls, floor / ceiling and making good in cement mortar (1:3) and finishing to match the adjoining surfaces for internal water supply, internal electrification works and plumbing etc.
- f. Fan hooks with box complete.
- g. Circular opening of required dia shall be provided in masonry for exhaust fan in locations as shown on drawings. The opening shall be uniform in size and shall be finished smooth.
- h. Colour shade for all painting works shall be got approved from the GE before execution.
- i. Clearing of site including and upto 10m beyond the periphery of the building before start of the work and on completion.
- j. Making good tarmac floor to match the adjoining surface of existing tarmac floor.
- k. Seismic Strengthening measures as applicable.
- l. Rainwater pipes including splash stones all as shown on drawings.
- m. Surplus soil shall be removed and disposed within MoD land, where directed.
- n. Rigid pavement as shown in drawing.

- o. Antitermite treatment.
- p. Any other civil work to accommodate various fittings/fitments all as shown on drawings.
- q. All Single skinned galvalume roof sheeting thickness shall be of 0.55mm.
- r. All brickwork shall be of Flyash.

**NOTE: Internal Water Supply and Internal Electrification work for GRP shall not be part of the lump sum and the same shall be measured and paid under Schedule 'A' Part-II and Part-III.**

- 4.2 Loose furniture shown in the drawing is not in the scope of present work. However built in furniture such as kitchen cabinet, etc, shall be within the scope of work and the cost shall be deemed to be included in the lump sum of Schedule 'A'.
- 4.3 The quoted unit rates of the buildings in Part I of Schedule 'A' do not include the following items/works unless specifically mentioned otherwise elsewhere in the contract and shall be measured and paid for separately under respective Part of Schedule 'A'.

Sl. No.	Part	Description
(i)	Part-II	Internal Water Supply
(ii)	Part-III	Internal Electrification
(iii)	Part -IV	Pavement Works
(iv)	Part -V	RCC Duct for HRS & Electrical cable works
(v)	Part -VI	Road & Path Works
(vi)	Part -VII Part -VIIA Part - VIIB	Culvert Works . Extension of Culvert New Culvert
(vii)	Part - VIII	External Water Supply
(viii)	Part - IX	External Electrical Supply
(ix)	Part - X	External Sewage Disposal Work
(x)	Part - XI	Area Drainage Works
(xi)	Part - XII	Site Clearance Works
(xii)	Part - XIII	Dismantling & Demolition Works
(xiii)	Part - XIV	Miscellaneous Works
(xiv)	Part - XV	Schedule of Credit

- 4.4 The description of building works given in Part I of Schedule 'A' is in brief. This shall be read in, conjunction with Special Conditions, Particular Specifications, contract drawings and MES Schedule 2009 Part-I, Specifications and 2010 Part-II rates and these documents are taken as mutually explanatory of one another.
- 4.5 Unless otherwise specified, unit rates of all items of Part I of of Schedule 'A' include for all materials and labour complete all as specified and/or shown in drawings. Contractor's special attention is drawn to the fact that all the provisions including use of materials or labour or both, specified in the particular specifications and/or shown on drgs but not specifically included in the description of the relevant items of Schedule 'A' shall be deemed to be included in the lump sum quoted by the contractor and nothing extra shall be admissible on this account.
- 4.6 (a) The lump sum quoted by the tenderer shall also include for any minor details of works and/or constructional details which are obviously and fairly intended and which may



not have been specifically referred to in the tender document and are essential for the execution and completion of the work in a workman like manner and sound construction.

- (b) If certain details are missing, in that case the details indicated elsewhere in the drawings which are similar or nearby to the missed out items of works shall be followed. In the absence of any other similar and near details, the minimum essential requirement for the completion of work from the structural and utility point of view shall be deemed to be included in the quoted lump sum.
  - (c) In case of difference of opinion between the contractor and the department as to whether or not a certain item of work is minor, extra or constructional details included in the lump sum amount quoted or not, the decision of the Accepting Officer shall be final, conclusive and binding.
  - (d) In case of any missing dimension, the GE shall ascertain the same considering the intent of the detail / drawing. In case of any difference between dimension arrived by adding the details and overall dimension, overall dimension shall be followed. The Lump Sum amount quoted shall include such eventualities.
- 4.7
- (a) For structural details, structural drawings shall only be referred. If there is any discrepancy between architectural and structural drawings with regard to structural details, details shown on structural drawings shall prevail. Similarly, if there is discrepancy between architectural and structural drawings with regards to architectural details, detail shown on architectural drawings shall prevail. The decision of the Accepting Officer as to what constitutes structural or architectural details shall be final, conclusive and binding.
  - (b) For missing reinforcement details, if any, of RCC work, minimum reinforcement as required as per IS shall be adopted.
  - (c) In case where type and size of beam, slabs and column etc are not indicated these shall be provided as decided by the Accepting Officer.
  - (d) If there is any discrepancy regarding general notes on RCC works, standard drawings and structural drawings, structural drawings shall be followed. Similarly, details in main drawing shall be followed in case of discrepancy between main drawing and standard drawings.

Nothing extra shall be admissible on account of work executed as stated above and the contractor shall be deemed to have taken into consideration the above provisions before quoting his lump sum and submitting the tender.

- 4.8 Unit rate of building listed in Schedule `A` Part-I shall also include for provision of two MS sheet 3mm thick board each of size 45cm X 30cm, duly fixed in location as directed by the GE. The following information shall be engraved and painted with black painting: -
- 4.8.1.1 CA No & Name of work.
  - 4.8.1.2 Name of contractor.
  - 4.8.1.3 Name of GE and Engineer-in-Charge.
  - 4.8.1.4 Date of commencement and completion.
  - 4.8.1.5 Date of expiry of defects liability period.

#### 4.9 YARD STICK PERCENTAGE FOR PAYMENT

- (i) Tenderer shall note that payment of RAR's under condition 64 of IAFW-2249 (General conditions of contracts) forming part for the contract shall be governed by the yard stick percentage for buildings of Schedule 'A' Part- I. The yardstick is attached as Appendix 'K'. No claim whatsoever shall be entertained for the yardstick percentage during execution of works. The payment shall be made only to the extent of work executed as the work proceeds and as assessed by Engineer-in-Charge/GE, subject to maximum percentage approved in yardstick percentage for different stages.
- (ii) In case payments for materials lying at site are claimed, the rate allowable for payment shall be lesser of paid vouchers and cost of materials given in break up

details. Any variation resulting in these estimates during scrutiny by the CWE will be final and binding. No claims what so ever will be entertained on account of the same.

- 4.10 **PSMB** : After completion of work and before payment of final bill, the consultant shall prepare the PSMB (Periodical Services Measurement Book) for complete painting work for the buildings covered under Schedule 'A', The contractor shall provide all necessary details in his possession for preparation of PSMB.
- 4.11 Unit rate of buildings (as listed in Schedule `A` Part-I) shall also include the cost of numbering on both sides as per details as directed by the GE.
- 4.12 If any Room or area is not covered under Schedule of finishes. The finish of the nearby area should be considered.
- 4.13 Contractor may use solid precast cement concrete blocks instead of Burnt clay/Fly ash bricks anywhere mentioned without any price adjustment.
- 4.14 In various drawings, contour levels and finished floor levels are given. The plinth height/floor height will be as per these levels mentioned in the drawings.

**5 NOTES: APPLICABLE TO ALL PARTS OF SCHEDULE 'A'**

- 5.1 The work to be carried out under the contract shall, except as otherwise provided in these schedules, include all labour, materials, tools, plants, equipment and transport which may be required in preparation of and for and in the full and entire execution and completion of the works. The descriptions given in the Schedule-'A' shall, unless otherwise stated, be held to include wastage on materials, carriage and cartage, hoisting, setting, fitting and fixing in position and all other labours necessary in and for the full and entire execution and completion of the work as aforesaid in accordance with good practice and recognized principles.
- 5.2 All the code of practice, standards and specifications applicable shall be the latest editions with up to date correction slip etc.
- 5.3 Tenderers are required to get fully acquainted with scope of work as catered for in the tender documents and also the site of work. No claim shall be entertained subsequently for any misunderstanding or any inaccuracy with regard to site conditions and provisions made in the tender documents.
- 5.4 During detailed layout, there may be minor changes in location/positioning of blocks/buildings for which no price adjustment will be made.
- 5.5 All material shall be got approved from the GE before incorporation in the work. Though contractor may use any type (from approved source) of sand but mixing of two types of sand in any situation shall not be permitted.
- 5.6 Tenderer's special attention is drawn to relevant Clause of Particular Specification regarding precautionary measures to be taken during the construction period as the proposed sites are located inside existing Airports. The price in Schedule 'A' shall include cost of taking such measures.
- 5.7 Pre-priced rates inserted under column 'Unit Rate' of schedule A are deemed to be at par with the rates contained in the MES standard schedule of rates or analogous rates thereto. Contactor's attention is invited to condition 6A (B) of IAFW-2249 wherein the lump sum price shall be worked out by him independently of the prices or rates inserted by MES in the tender and irrespective of any errors or inaccuracies therein. The percentage to be inserted by tenderer against a particular part of schedule 'A' shall be derived by him from the amount tendered by him against the particular part of Schedule 'A' as compared to the amount inserted by MES against each part of Schedule 'A'.
- 5.8 The contractor shall ensure that all the workers deployed during the execution of work are enrolled as members of provident fund and should be given the **Universal Account Number (UAN)**. The contractor shall submit relevant particulars to the GE.

5.9 While claiming any payment, the contractor shall submit the certificate that all workers employed directly or indirectly by him are registered for EPF and due contributions have been credited into their account.

**5.10 SAFETY MEASURES OF WORKMEN**

In addition to the safety precautions to be taken by the contractor as described in special conditions herein and IAFW-2249 General Conditions of Contract, the contractor shall take following additional safety precautions of his workmen without any extra cost to the Government

- (i) Use of Personal Protective Equipment (PPE) for safety is mandatory inside work area.
- (ii) Safety adjustable waist belt with proper arrangement
- (iii) Safety helmets with strap, jacket and safety shoe. These shall be provided to his workmen whenever workmen are in the working area.
- (iv) The contractor shall employ safety inspector qualified in construction of particular field of work.

5.11 The lump sum quoted by the tenderer against each part of Schedule 'A' will be deemed to allow for all minor extras and constructional details, which are not specifically shown on drawings and specified in particular specifications but are essential for execution of work/services in workman-like manner and sound construction. In case of difference of opinion as to whether or not a certain item of work constitutes minor extras and constructional details, the decision of the Accepting Officer in this regard shall be final, conclusive and binding.

5.12 It is made clear that cost of material for testing, all field apparatus required for sampling and testing as per MES Schedule/IS codes and manpower to such testing will be provided along with necessary transport arrangement to and fro to the approved testing agency or laboratory by the contractor during the construction of the work and defect liability period. Field laboratory with all the required apparatus as listed in Appendix-'D' to particular specification along with trained man power for conducting tests along with requisite furniture, computer with connected equipment and trained staff shall be established by the contractor at site of work at his cost for carrying out field test at stipulated frequency. Any test which is required to be carried out as per MES Schedule/IS code, but cannot be performed at field laboratory established by the contractor, expenditure of such test shall be borne by the contractor and nothing extra shall be payable on this account.

5.13 Description of buildings, works and services given in various parts of Schedule 'A' are brief. These shall be deemed to be amplified and read in conjunction with special conditions, particular specifications, specifications for materials and workmanship and special conditions in relevant trade sections of MES Standard Schedule of Rates SSR-2009 Part I and SSR-2010 (Part-II) and contract drawings including notes thereon.

5.14 Tenderers are requested to visit the sites of work to make themselves conversant with the nature and type of work involved before quoting his tender. Also to assure themselves regarding the approach roads & infrastructure for induction of materials.

5.15 Where consolidation or rolling is specified in the description of items under column 2 of schedule 'A', the "Unit" of measurement given under column 4, shall be deemed to be for the compacted/consolidated quantities of work done. The quantities given under column 3 of Schedule 'A' against these items are in solid contents i.e. after compaction/consolidation.

5.16 Please note that No foreign exchange or import license facility will be arranged by the department for any material included in the subject tender. Further form 'D' will not be issued by the department for interstate purchase or the like.

**5.17 SAND: -**

Wherever use of natural sand (fine aggregate) specified in the tender for concrete/masonry, the contractor may also be permitted to use crushed stone sand as permitted as per IS without extra cost to Government with prior approval from GE.

5.18 The hard rock obtained from excavation shall be properly stacked by the contractor at site of work. The method of measurement shall be as laid down in clause 3.1 on page 16 & 17 of SSR Part-II. The hard rock obtained from excavation shall become property of contractor for which he will be charged @ Rs. 300/- per cum. of stack measurements without any deduction for voids. The measurement shall be properly recorded in MB and shall be signed by DEPM Consultant, the GE and the contractor. Nothing extra shall be paid for stacking and removal of such material from the site of work.

5.19 The contractor shall clear the work site used for contractor's various purposes such as storage/accommodations/transportation of his men materials and T&P. Such site shall be cleared of all work materials/rubbish/debris and contractor's materials. The site shall be properly levelled so as to provide free flow of water logging rains without any stagnation, no additional payment shall be made for these activities.

5.20 Wherever the terms "Project Manager/PM" is mentioned in this tender documents, the same will be considered synonymous to Garrison Engineer/GE. The Concerned GE will be performing all the duties of PM.

**5.21 GST ON WORK CONTRACTS**

a. The rate quoted by the tenderer shall be inclusive of all types of taxes, levies including GST, labour welfare tax etc.as prevailing on the date of submission of tender.

b. Certain taxes such as central excise duty, service tax, additional custom duty, state level value added tax, octroy, and other levies which were applicable on interstate transportation of goods are subsumed by GST, thus special condition as here-in for Reimbursement/refund on variation in prices in taxes directly related to contract value of tender shall be deemed to be amended incorporating GST in lieu of taxes mentioned in the condition but subsumed by GST.

5.22 Fly ash Brick as per IS: 12894 may be used in lieu of bricks as per IS: 13757 without any price adjustment.

5.23 Design Mix for RCC, PQC, DLC and Job mix formula for SDAC shall be got approved by Chief Engineer(AF), shillong or any officer authorized by CE,(AF) shillong.

5.24 No damage shall be done to MES/Air-force property during execution of the work i.e. electric cables, road, water pipe line, telephone line, sewer line etc. Any damage done on the part of contractor/his workmen shall be made good by the contractor without any extra cost to the Govt. and no claim whatsoever shall be admissible on this account

5.25 All cases of approval/proposals of the contractor shall be routed through the DEPMC. The contractor shall submit cases for approvals to GE with copy to DEPMC.

**6 NOTES APPLICABLE TO PART-II TO PART-XV**

6.1 All items and quantities are 'Provisional'.

6.2 The item of work covered under Schedule 'A' Part-II to XIII, are pre-priced by MES. The tenderer is required to work out unit rate/price independently and to quote the same against this item of Schedule 'A' and total amount of Schedule 'A' Part shall be carried over to BOQ. The amounts inserted by the tenderer against Schedule 'A' Part-II to XIII, in the BOQ in the financial bid shall be deemed to have been calculated in the manner set out in condition 6A

(B) of IAFW-2249, (General Conditions of contracts) forming part of this contract. It is an express condition of the contract that the tendered amount shall be deemed to include for full and entire completion of work and the tenderer shall have no claim whatsoever on account of any errors in the unit rate/prices inserted by MES. The rates inserted by MES under Col 4 in respect of Schedule 'A' Part II to XIII, shall be deemed to be at par with the rates contained in the MES standard Schedule of rates 2010 together with errata/amendments as applicable or at the rates analogous there to and/or the supplementary rates as given in the particular specifications. The tenderer shall quote his unit rates item wise for Schedule 'A' Part XIV, in BOQ in the finance bid. Rates in schedule of 'A' part XV are fixed and the amount of the schedule of credit shall be deducted to arrive at Lump sum amount.

- 6.3 If rate quoted for similar / identical items in same part of schedule 'A' is at variance, the lowest rate quoted only be considered.
- 6.4 For all electrical works the rating of the ACB/MCCB/MCB/Bus bar shall be as under wherever not mentioned :-
- (a) All ACB shall be due type and have microprocessor based o/c, s/c & e/f release & breaking capacity 50 KA.
  - (b) All MCB & RCCB shall be 10KA 'C' Curve.
  - (c) All MCCB shall be ICS =100% ICU
  - (d) MCCB below 200 A -25 KA breaking capacity, thermal magnetic release adjustable type (min 70% to 100%)
  - (e) MCCB 200A to below 400 A – 35KA breaking capacity, electronic release adjustable type (min 70% to 100%)
  - (f) MCCB 400A and above -50KA breaking capacity, electronic release adjustable type (min 70% to 100%)
  - (g) Bus bar ratings upto 100 A-35KA.
  - (h) Bus bar ratings upto 100 A-50KA.
  - (j) All MCCB terminated with both side spreader links.
- 6.5 All the Electrical Pit Cover should be of RCC. Reinforcement and other detail shall be as per drawing or as directed by GE.
- 6.6 Probable distribution of various items of internal and external services is tentative and may be varied where necessary at the discretion of the GE. The contractor shall not be entitled for any claim on account of such varied alignment/quantities.
- 6.7 Unless otherwise specified, unit rate of each item of work is inclusive of "materials and labour" or 'supply and fix', connecting, jointing, testing and commissioning complete to the entire satisfaction of GE. The words M&L and S&F mentioned in the Sch 'A' item shall be read as 'Material and Labour' and 'Supply and Fixing.'
- 6.8 All provisions of MES Schedule including special conditions in MES Schedule Part-II 2010 and preambles to items given in MES Schedule Part-II 2010 under respective trades shall be applicable. If any provision in the description of item of Schedule 'A' and/or in particular specifications is at variance with the provision in special conditions in MES Schedule Part-II 2010 and preambles to MES Sch items, the provision in Schedule 'A' or particular specifications shall take precedence there over.
- 6.9 Unless otherwise specified, unit rate against each item of work shall be deemed to be inclusive of materials and labour, all plants, equipment and tools including testing for acceptance criteria complete.
- 6.10 All consumer Electrical equipment/appliances such as ceiling fan, Refrigerator, Distribution Transformer, industrial motor, Pumps, Heaters, Ballast, DG Sets, Led Lamps etc, to be provided under this contract will be minimum BEE star rating as specified in Schedule A or particular specification. In case no BEE star rating is specified, the contractor shall provide such consumer electrical equipment/appliances of minimum three star rating of BEE.

- 6.11 In the BOQ, the contractor shall quote rates against each item. Certain items are provided in the BOQ sheets which are not to be quoted by the contractor. Description of such items (which may be more than one) shall be considered included in the preceding item to be quoted. Hence the quoted rate of such item will be included scope of work of all such succeeding items not be quoted, unless specifically mentioned otherwise.

**7 NOTES APPLICABLE TO PAVEMENT WORKS.**

- 7.1 Mix design and job mix formulas from approved institution(s) i.e. any IIT/SEMT Pune/CRRRI New Delhi as specified shall be submitted by the contractor for approval within 90 days of commencement of phase-I work. The cost of testing will be borne by the contractor. Job mix formula/Design mix will be approved by Chief Engineer(AF), Shillong or any officer authorized by CE,(AF) Shillong.
- 7.2 Any test which is required to be carried out as per MES Schedule / IS code/ MORTH specifications but cannot be performed at field laboratory established by the contractor, all such tests shall be carried out by the contractor at IITs / SEMT Pune and cost of such tests shall be borne by the contractor and their quoted rates shall be deemed to include for the same. All the tests shall be carried out by qualified lab technicians employed by the contractor in the presence of Engineer-in-Charge or his representative and a third party i.e. either AGE(I) (Lab) or SO II(Lab) or runway coordinator as appointed by Accepting officer, who shall directly report to him on quality control issues / matters. In addition to above, minimum 5% of required tests as per frequency shall be got done from third party viz. IIT/SEMT Pune. Cost of materials, sampling, transporting and testing charges shall be borne by the contractor. The quoted rates shall be deemed to be included for this provision and nothing extra will be paid by the government in this regard. In case any field testing equipment is found deficient at site lab, the tests as required will be carried out at NABL/IITs & SEMT/CTL at the discretion of GE. The testing charges including transporting the testing materials to NABL/IITs/SEMT /CTL shall be borne by the contractor and no extra claim shall be admissible in this regard.
- 7.3 the absence of any definite provision in the specifications contained herein, reference may be made to the latest MORT & H (Ministry of Road Transport and Highways) (Govt of India) published by IRC (Indian Road Congress), IRC (Indian Road Congress) and MES Schedule, ICAO Specification, ASTM/CPWD and IS codes. Wherever these are silent, construction and completion of works shall conform to sound engineering practice, and in case of any dispute arising out of the interpretation of the above, the decision of Accepting Officer shall be final and binding on the Contractor.
- 7.4 PMG/RRMT:- Contractor shall extend all facilities to project monitoring group/ RRMT as constituted by concerned Air Force authorities to inspect, monitor and verify any item of work or material at no extra cost to the Government.
- 7.5 Prior to commencement of overlay work, proper and accurate survey of existing surface of the runway shall be jointly carried out by MES executives and contractors' representative to take and record existing levels of the runway, to identify and mark cracks and other defects and deteriorated/loose pockets on the runway. The initial levels shall be recorded at a grid interval of 3.0 metre both ways with the help of suitable equipment like Total Station survey equipment. Contractor will also identify and record the cracks and other defects and deteriorated/loose pockets on the runway. All the levels so taken shall be fed into the computer on MS Excel sheet. The L-Section and cross section will be got drawn by the contractor and signed jointly by the contractor, GE and CWE. Contractor using suitable software/Excel sheet shall submit initial and proposed correction layer levels to the GE for his approval. Contractor's quoted rate shall be deemed to include for these provisions and nothing extra shall be payable on this accounts.
- 7.6 Site for hot mix plant and concrete batching plant shall be shown to the contractor by GE with prior approval. The contractor will have to make partial approach road from concrete batching plant to actual place of delivery. Contractor's rates shall be deemed to include construction of

- suitable partial approach road from concrete batching plant to actual place of delivery / execution of work and around 600m approach road from main road to exit gate (this exit gate is to be provided for this work). The location of these plants may be changed within the limits of layout plan and the contractor shall have no extra claims on this account. Such approach roads shall be properly graded to avoid any accumulation of rain water prior to issue of completion certificate.
- 7.7 Hydraulic weigh bridge of capacity 100 tonnes shall be provided for measuring weight of aggregate, cement, sand, bitumen etc., shall be installed at locations as directed by GE and cost of the same is deemed to be included in the unit rates quoted.
- 7.8 Contractor has to provide basic model of mobile phone without media devices to all their staff for effective communication between plant site, storage yard, site, lab, MES and user. The permission for use of mobile phone at site shall be obtained from Air Force authority through GE.
- 7.9 Output of road roller shall be decided by GE after carrying out trials on trial bays for DLC, GSB, WMM, DBM and DAC.
- 7.10 Contractor shall provide adequate arrangements for protection of freshly laid concrete from high speed winds, temperature & sudden spells of rains etc. in the form of mobile tent. The contractors quoted rates shall be deemed to be inclusive of this aspect. Nothing extra shall be admissible on this account. Special attention of the tenderer is also invited to the fact that, recently completed runway resurfacing works have developed distress and hence utmost care shall be taken by contractor to deliver best quality work.
- 7.11 While laying Dense bituminous macadam transverse slope should be corrected as directed by the GE based on relevant IS/code. After laying dense bituminous macadam levels shall be taken at a grid interval 3.0 metre both way and recorded again which shall be jointly signed by the contractor and the GE. The quantity of dense bituminous macadam laid shall be computed based upon these levels only. Contractor's quoted rate shall be deemed to include for these provisions and nothing extra shall be payable on these accounts.
- 7.12 During execution of the work, the contractor has to interact with other agencies working on the runway and the progress of the work may be affected due to work of the other agencies. Contractor shall not claim any extra on this account.
- 7.13 Contractor will be required to carry out friction test after execution of work on runway through agency as approved by GE. The cost of testing shall be deemed to be included in the quoted rates.
- 7.14 After completion of work the contractor shall prepare and submit two copies of detailed drawings showing different types of joints provided in pavement with dimensions.
- 7.15 After completion of works, PCN evaluation of pavement at all places i.e. Runways, Links, PTT, LTT, dispersals, wherever resurfacing or new provision has been made will be evaluated by the Government (through SEMT) and the cost of the same shall also be borne by the Government.
- 7.16 Before issue of completion certificate and final taking over of the work, the checking of undulations by roughometer of the Runway/dispersal/taxi track/ORP shall be done in the presence of GE and authorized representative of contractor and Air Force for compliance as per required gradient & camber. Longitudinal profile of finished surface when checked with roughometre / profile meter shall not exceed 2000mm per kilometer. All the test results shall be duly signed by all concerned and copy shall be kept in record. If any portion of the work is found to be unacceptable based on the above tests, same shall be re-done/re-laid by

contractor without any extra cost. GE's decision with regard to method and manner of relaying or rectifying the undulations shall be final and binding.

- 7.17 The contractor shall take all precautions to ensure that the coarse aggregate incorporated in the works are strictly as per specifications and procured only from the approved quarry at PAKUR & ETHELBARI as mentioned in appendix-B to Particular Specifications. The contractor shall submit the particulars of sources, suppliers and sample of various sizes of aggregates prior to procurement. The samples shall be tested for physical & chemical tests before approval. The aggregate shall be procured only from the approved quarries supplier and the regular sample testing shall be carried out. The purchase vouchers for each lot should indicate the particulars of trucks/lorries for transportations which will be submitted to GE along with a computer generated gate pass issued by supplier showing the trucks & materials details including its weight for verification at the stage of unloading of materials from the truck/lorries at site. Crusher owner(s) should be able to supply a total of 550-600 cum coarse aggregate on daily basis for 14months continuously.

## **8. PREPARATORY / TEMPORARY / ANCILLARY WORKS**

The following items of works indicated shall be considered as preparatory/ temporary/ ancillary works under the subject contract. These provisions shall be provided by the contractor as specified herein below at his own expenses and the quoted rates shall deemed to include for these provisions and nothing extra will be paid by Government in this regard.

- (a) During mobilization phase the existing rigid pavement of the runway shall be rolled with 40MT heavy roller to identify the weak/damaged slabs for reconstruction.
- (b) **Temporary approach for contractor's men and materials:-** Contractor shall provide temporary approach as shown in site plan. Contractor is at liberty to use any specification for these provisions. The contractor shall bring this stretch of approach roads to its original status by using excavated earth which shall be properly compacted and rolled to the satisfaction of Engineer-in-Charge & Airforce (Users) before work is completed and certified so by GE. The existing approach road towards tools and plant location is 2.70m wide. The roads needs to be strengthened & widened and shall always be kept in serviceable condition for movement of T&P. The contractor shall access the length of approach road and shall be responsible without any extra cost to departments prior to issue of completion all temporary roads shall be properly graded so that there should not be any accumulation of water. **The rate quoted for the various items in BOQ is deemed to include for this cost element and nothing extra shall be paid on this account.**
- (c) **Temporary movable collapsible tent:-** Two collapsible tents of minimum 36m length and of required width which can be moved on rails shall be arranged and mobilized by the contractor so as to allow the concreting work during rains and hot summer at his own expense and the quoted rates shall deemed to include for the same and nothing will be paid by Govt. The design of collapsible mobile tent will be of suitable strength to protect newly laid surface from rain & wind and other extreme elements. The design of collapsible tent will be approved by GE. The tent should be good enough to cover.
- (d ) The materials i.e. aggregate for various flexible / rigid pavements / concrete shall be stacked on paved concrete surfaces in neat trapezoidal stacks which shall be measured and recorded in measurement as "Not to be abstracted". Platform shall be of PCC 1:5:10, type E2, using 40mm graded stone aggregate of thickness 75mm and the same shall be dismantled after the completion of work.
- (e) The contractor shall maintain the roads under his use for access to site and transportation of his men/materials/T&P during the execution of work. The roads shall be kept free from potholes/defects. The road will be remains under the custody of Air Force and will also



be used by the other users. The cost of maintenance of road shall be deemed to be included in the quoted rates of the contractor and nothing extra shall be payable.

- (f) The contractor shall maintain the temporary barricading of MS sheet 2.4m high for batching plant, labour hutment, material yard, site office, etc & 3.0m high for work site (Runway) inside Air Force area during the execution of work to prevent FOD and for security purposes. The cost shall be deemed to be included in the quoted rates of the contractor and nothing extra shall be payable.
- (g) Formation of temporary embankments (bund) spreading in layers and compacted, not exc. 30cm thick and 1.5m high up to width of the kuchha drain to be resurfaced from base including bailing out of water caused from springs, seepage, broken water main or drains complete all as directed by engineer-in-charge to facilitate the area drainage work. These also include the removal of temporary bund and making the site clear after completion of drainage work. These complete works shall be deemed to be included in the quoted rates of other scheduled items, Nothing extra will be paid on this account.
- (h) The contractor has the option to bring the water from outside or to dig borewell inside Purnea campus at the location approved by GE. In case the water is taken from the borewell, the contractor has to arrange the RO plant of sufficient capacity as the iron content of groundwater is high. In such an event the borewell along with pump, RO plant and other connected items shall become property of the MES after completion of works and nothing additional will be paid to the Contractor for these items. Contractor will also be liable to rectify the defects in the borewell, RO plant etc. during defect liability period of 3 years.

#### 8.1 **LAYING TRIALS (TRIAL BAYS) FOR GSB, WMM, DBM, DAC, PQC & DLC.**

The contractor shall carry out laying trial bays, to demonstrate that the proposed mix can be successfully laid and compacted all in accordance with contract provisions. The laying trials shall be carried out on a suitable area, which is not to be form part of the works and not to be measured and paid separately. The area of the laying trials (Trial bays) shall be as specified in particular specifications under respective items and it shall be in all respect similar, particularly compaction shall be same as required in proposed work. Once the laying trials have been approved, the same plant and methodology shall be applied to the mixing, laying, consolidation and compaction of the material on the project. Contractor's quoted rate under respective item shall be deemed to include for these provisions of trial bays and nothing extra shall be payable on these accounts.

- (a) Curing tanks 05 Nos. minimum capacity of 10,000 litres each for curing of cube/beams and construction purpose shall be constructed by the Contractor without any cost to the department.
- (b) Any other work specifically mentioned to be carried out elsewhere in this tender document
- (c) Cost of these works shall be deemed to be included in the quoted rates of various connect items of Schedule 'A'.

#### 9 **PROJECT MANAGEMENT**

- 9.1 In amplification of Condition 25 of IAFW-2249, at least two graduate engineers in Civil Engineering with requisite experience shall be employed by the contractor at site for work, who will be well conversant and qualified to the satisfaction of Garrison Engineer on utilization of project management tools and techniques using Primavera/ MS Project. The Engineers so employed shall be approved by GE and shall not be changed during the currency of the project without his prior permission. The requirements of engineer for the Project Management will be addition to the requirements of engineers given elsewhere for execution of work. The contractor's site office will have necessary software, hardware and one qualified operator (in addition to above graduates in Civil Engineering) to monitor the project on day to day basis using above Primavera/ MS Project tools. The total project duration considered

from start to completion will also include likely time delays specific to the area of execution of the work and shall be within the accepted time of completion mentioned in the contract.

- 9.2 The details in the Project Schedule Network will include: -
- (a) All activities in detail work break down structure (WBS) for each activity with assigned T&P labour and duration with facility to follow progress.
  - (b) Material Procurement planning and utilization (qty and time of availability) details to ensure actual availability prior to the commencement of the activity/task.
  - (c) Plant deployment details (activity wise).
  - (d) Activity Vs Labour employment details.
- 9.3 Dated Project Time Schedule will be jointly prepared by contractor and Garrison Engineer using MS Project/Primavera within two weeks of acceptance of the contract and shall be kept on record of Garrison Engineer for further reference.
- 9.4 The Project Time Schedule will be updated daily with all necessary details and the "Work Done Report" will be signed by the contractor and included as part of the "Works Diary" by the JE and checked by the Engineer-in-Charge. A weekly review of the work progress will be done between the Engineer-in-Charge and the contractor to monitor the progress made during the week vis-à-vis total progress. The weekly report will also include forecast of resources to include plant, stores, labour, etc. for the next week. A detailed monthly report will be prepared and submitted to the GE by the contractor and review done jointly to examine increasing resources to ensure completion within the laid down time period. The outcome of the monthly meeting shall be submitted as detailed report submitted to office of at Chief Engineer (AF) Shillong. However, if the work is hampered or runs behind Schedule, then joint meeting shall be held and issues discussed, participated by director of the firm or one senior management member and Project Manager of Contractor with Accepting Officer/Director (Contracts)/ Officers detailed by Accepting Officer at Chief Engineer (AF) Shillong.
- 9.5 Use of existing taxi track, PTT, link and runway will not be permitted except during execution of work. Daily cleaning of road used for transportation of material is to be carried out for foreign material fallen on road as required by users.
- 9.6 **METHODOLOGY AND SEQUENCE OF WORK**  
Apart from CPM/PERT technique chart, within 25 days after the date of the letter of acceptance, the contractor shall submit to the GE for approval, the detailed construction methodology including mechanical equipment proposed to be used, sequence of various activities and schedule from start to end of the project. Programme should be such as to work on pavement, shoulder construction and other items to be done simultaneously in a coordinated manner. The methodology and sequence shall be so planned as to provide proper safety, drainage and free flow of traffic.
- 9.7 **PERFORMANCE EVALUATION**
- 9.7.1 Performance evaluation of the work shall be carried out at site on quarterly basis from the date of commencement of work till the completion of work as decided by the Accepting Officer depending upon the ground requirement. Contractor shall give a detailed presentation covering all aspects related with the work and also highlight factors/ bottle necks responsible for delay if any visualized in achieving planned progress at site as per agreed CPM or PERT.
- 9.7.2 The issues put forth by the contractor during performance evaluation shall be deliberated at ground and decisions so taken by the Accepting Officer shall be implemented by the contractor without delay and also render confirmation report to all concerned.
- 9.7.3 The minutes of Performance Evaluation shall be recorded and signed by the Accepting Officer, GE, rep of users (PMG), DEPMC and the contractor and shall be kept on record.

- 9.7.4 The Contractor shall also submit Quality Control Plan as per format in MES Quality Assurance Manual as per periodicity laid down therein.

## 10 LIST OF MAJOR PLANT AND EQUIPMENT (MINIMUM ESSENTIAL) FOR RUNWAY RESURFACING WORK

Sl. No.	T & P items	Minimum Quantity
As per Appendix "F" to particular specification		

### Notes :-

- 10.1.1.1 The list is only minimum requirement. Additional requirement based on volume of work, time available and scheduling may be decided in consultation with executives during execution of work. However the minimum requirement mentioned in Appendix-"F" as lay down will not be diluted.
- 10.1.1.2 Plants and equipment applicable to type of construction shall be deployed.
- (a) Contractor shall also arrange any additional T & P and any other machinery required during execution of work without any extra cost to the Govt so as to ensure smooth and quality work including timely completion of work. The contractor shall also make suitable arrangement to ensure uninterrupted execution of work in case of failure /break down of any T & P. The contractor shall keep sufficient spare parts for each T & P & machinery and ensure immediate repair of the T & P and machinery in case of any breakdown.
- The contractor shall make his own arrangement for safety and security of T & P and materials brought at site.
- (b) The following is to be ensured :-
- (i) The plant has fitness certificate from authorized service centre of original manufacture/OEM.
- (ii) The plant has been calibrated by the OEM/authorized service centre, as per recommended periodicity.
- (iii) The original manufacturer's AMC is current and valid.
- (iv) The operation of plant to be certified by the OEM.
- (c) GE shall ensure that, all T&P brought at site in proper working condition. Calibration of all T & P and lab equipment/machine to be carried out quarterly or as per manufacturer's instructions. The calibration shall be carried out quarterly in absence of manufacturer's instructions. Two technicians are to be employed one from electrical side and another from mechanical side for maintenance of T & P.
- (d) The defect liability period shall commence only after completion of work against whole contract as certified by GE in final completion certificate.
- (e) If any machine listed under Note here in before found not working for more than 03 days then compensation at the rate of Rs. 5000.00 per machinery per day will be recovered from Contractor's payment.

## 11 ENGINEERING ESTABLISHMENT

The Contractor shall ensure that all engineering establishments as specified below shall be given the duties on site in consultation with Engineer-in-Charge/GE. All testing documents and other contact related documents shall be prepared daily in consultation with Engineer-in-

Charge/GE during the currency of work in progress, failing which, no claim whatsoever in this regard in RAR shall be entertained.

The contractor shall have the following Engineering Establishment:

**LIST OF STAFF**

Sl. No.	Appointment	Nos	Qualification	Experience
1.	Project Director	01	B Tech (Civil)	10 year with Road Pavement including minimum 03 years of runway pavement execution.
2.	Executive Engineer / Assistant Engineer	01	B Tech (Civil)	05 year including 02 years of runway pavement execution
3.	Executive Engineer / Assistant Engineer	02	B Tech (Civil)	05 year including 02 years of pavement execution.
4.	JEs	01	Diploma (Electrical Engineering)	05 Years
5.	JEs	02	Diploma (Civil Engineering)	05 year including 02 years of runway pavement execution
6.	JEs	02	Diploma (Civil Engineering)	05 year including 02 years of pavement execution.
7.	Lab Assistant	02	Diploma	05 years including 02 years of runway pavement work & site lab.
8.	Surveyor	02	Diploma / ITI	05 years' experience in field survey.

**Note:**

Recovery for Non Employment of Engineer with reference to PQC shall be effected as specified here-in-below :

1. Graduate Engineer/Post Graduate engineer : Rs. 3000/- per day if absent more than 05 days in a month.
2. Diploma Engineer : Rs. 1500/- per day if absent more than 05 days in a month
3. Surveyor : Rs. 1000/- per day if absent more than 05 days in a month
4. Notwithstanding above, Garrison Engineer is empowered to stop part/ entire work in case of absence of any site engineer employed by the contractor.

**12. MODE OF PAYMENT OF WAGES TO THE WORKERS**

- (a) Wages will be paid to each employee through e-payment/account payable cheque by the contractor and transaction details shall be provided to the department on the monthly basis.
- (b) The payment will be made into AADHAR linked bank account of employees /workman by the contractor. No payment of contractor will be made, unless proof of payment of wages through AADHAR linked bank account is submitted by the contractor.
- (c) In case payments are made in current coin or currency notes, certificate will be submitted by the contractor alongwith undertaking by the concerned workmen asking for payment other than by cheque or by crediting in the bank account of the employee/workman.
- (d) Submission of proof of crediting the wages in the bank account/payment made to the employees by the contractors, shall be a pre-requisite to enable the contract executing authority to release subsequent payments to contractors. The registered contractor shall also provide the details of employees EPF and ESI account number to claim the payment and the contract executing authority will ensure verification of the same from time to time.

**13. ACCESS TO SITE & ACCOMODATION :-**

13.1 The works lies in restricted areas. The conditions applicable for restricted areas given in the Special Conditions shall only be applicable to this tender.

**13.2 SECURITY REQUIREMENT OF LOCAL AREA AUTHORITY OF AF CAMPUSES:-**

(a) Contractors are advised that as far as possible NOT to carry laptops or any other type of secondary data storage devices at site of work. If it is inescapable, permission from local area security authority (Air Force) shall be obtained through GE in advance.

(b) Contractors are also advised not to carry mobile phones of any type inside the Air Force campuses, if the same is inescapable then the case may be taken up well in advance through GE for obtaining necessary security clearance from competent Air Force Authority. If any such electronic devices are found in possession of contractor or his workmen without security clearance from Air Force authorities, during check at main gate or at any surprise check by security staff, the same shall be treated as willful act and the gadget will be confiscated and action against defaulter will be taken as per rules. No claim and compensation whatsoever on this account will be entertained. GE's decision in this regard shall be final and binding.

(c) The contractor must have the details of all the employees /labours with him employed inside the AF campus a list of these employees with their local and permanent address with photograph shall be submitted to Engineer-in-Charge.

(d) No child labour to be employed to work inside the AF campus area.

The contractor, if he so desires may be allowed to work beyond normal working hours except on Sundays and Gazetted holidays with prior written permission of GE. The contractor may also be permitted to work on Sunday and Gazetted holidays if so desired by him within normal working hours with prior written permission as in terms of relevant condition of special condition.

13.3 Tentative site plan showing locations of labour camp, material dumping yard & routes to be followed for entry & exit of truck/loader/ lorry etc & labours has been included in the list of drawings & the same is available in the offices of CCE(NEP)AF, CWE (AF) Panagarh, & GE(AF) Purnea. Bidders may visit either of these offices & collect the site plan for their reference & quoting. Though the site plan will form part of tender documents it has not been uploaded on e-procurement site due to security reasons.

**SIGNATURE OF CONTRACTOR**  
**DATED : \_\_\_\_\_**

**DY DIRECTOR (CONTRACTS)**  
**FOR ACCEPTING OFFICER**

**SCHEDULE 'A' Part-I****(List of Works & Prices for Building Works including Steel Structure )**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	Construction of GRP Hangar (Ground Run Point) in Steel Structure alongwith attached single storied Annexe Building with blast deflector panel and anchor block. Roof for GRP Hangar & attached corridor shall be with single skinned galvalume sheet roofing, including Hangar flooring, Annexe flooring,pavement/flooring in between the buildings ,hard standing area attached to building , drain,ducts and sheeting for roof and wall, etc complete all as specified and shown on drawings.	Refer List of Drawings for all Items .	2,05,00,000.00 / Each Block	1.00	2,05,00,000.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items.
<b>Page Total Carried Over to Collection of Schedule 'A' Part-I</b>					<b>2,05,00,000.00</b>		

**COLLECTION OF SCHEDULE 'A' Part-I**  
**(List of Works & Prices for Building Works including Steel Structure)**

SI. No.	Reference of Pages	Amount (RS )
1	2	3
1	Total amount brought forwarded from Page No.46	2,05,00,000.00
	<b>Total of Schedule 'A' Part-I Carried Over to BOQ</b>	<b>2,05,00,000.00</b>

**SCHEDULE 'A' Part-II**  
**(List of Works & Prices for Internal Water Supply Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
<b>1.0)</b>	<b>INTERNAL WATER SUPPLY</b>						
1	Supplying and laying of CPVC pipes SDR 11 & plain CPVC SDR 11 fittings in trenches complete all as specified. (a) 25mm outer diameter	Refer List of Drawings for all Items .	130.1 /RM	130.00	16,913.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items.
2	Supplying and laying of CPVC pipes SDR 11& plain CPVC SDR 11 fittings on walls/ ceiling or laying in floors complete all as specified. (a) 16mm outer diameter (b) 20mm outer diameter (c) 25mm outer diameter		92.5 /RM 111.4 /RM 144.1 /RM	12.00 2.00 2.00	1,110.00 222.80 288.20		
3	Supply & Fixing 16mm outer diameter Brass Elbow for CPVC pipes complete all as specified & directed.		36.8 /Each	3.00	110.40		
4	Supply & Fixing 16mm outer diameter Brass Tee for CPVC pipes complete all as specified & directed.		46.7 /Each	6.00	280.20		
5	Supply & fixing gun metal globe or gate valve with iron wheel head, screwed both ends for iron pipe complete all as specified & directed. (a) 25mm dia		413.8 /Each	1.00	413.80		
6	Supply & fixing 15mm dia bib taps, fancy type ,cast copper alloy, chromium plated with crutch or butterfly handles, screwed down, screwed for iron pipe or for brass ferrule complete all as specified & directed		180.30 /Each	1.00	180.30		
7	Supply & fixing 15mm dia Stop valves, fancy type cast copper alloy chromium plated., screwed down, high pressure, with crutch or butterfly handle, screwed both ends for iron pipe or for unions and fixed complete all as specified & directed.		169.00 /Each	5.00	845.00		
8	Supply & Fixing PVC connections 15mm size with PTMT nuts at both ends of 450mm long complete all as specified & directed.		73.90 /Each	3.00	221.70		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-II</b>					<b>20,585.40</b>		



SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
9	Excavation in trenches not exc. 1.5m wide and not exc. 1.5 m depth as in soft / loose soil; for foundation etc. or for shafts, wells, cesspits, manholes, pier holes, etc. not exc. 10 sq.m on plan and not exceeding 1.5m in depth and getting out complete all as specified & directed.	Refer List of Drawings for all items.	115.20 /Cum	6.56	755.71	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all items .
10	Returning, filling in, including spreading, levelling, watering and well ramming in layers not exc. 25 cm complete all as specified & directed.		41.70 /Cum	6.31	263.13		
11	Removing excavated material exc. 250m but n exc. 500m. and depositing where directed at a level not exceeding 1.5 m above the starting point complete all as specified & directed.		149.40 /Cum	0.25	37.35		
12	M & L PCC (1:2:4) Type B2 (using 40 mm graded stone aggregate) as in foundation, filling & mass concrete complete all as specified & directed.		3062.50 /Cum	0.02	58.19		
13	M&L plain cement concrete 1:4:8 Type D2 ( using 40mm graded stone aggregate) as in foundation,filling & mass concrete complete all as specified and directed		2303.30 /Cum	0.04	92.13		
14	M&L Brick work with old size fly ash bricks, straight or curved on plan exc 6m mean radius built in CM (1:6) complete all as specified and as directed. (For valve chamber/ reqd as per drg ).		2249.50 /Cum	0.10	224.95		
15	M&L for rendering 10mm thick on fair faces of brick work or concrete surface in cement mortar (1:4) finished even and smooth without using extra cement complete all as specified & directed.		103.10 /Sqm	0.68	70.11		
16	Supply, installation and placing in position inside the building rectangular loft tank made of virgin LLDPE (Linear Low Density Polyethylene) material having 500 litres capacity including inlet, outlet, overflow & drains connection complete all as specified & directed.		2312.50 /Each	1.00	2,312.50		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-II</b>					<b>3,814.07</b>		

**COLLECTION OF SCHEDULE 'A' Part-II**  
**(List of Works & Prices for Internal Water Supply Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.48	20,585.40
2	Total amount brought forwarded from Page No.49	3,814.07
	<b>Total of Schedule 'A' Part-II Carried Over to BOQ</b>	<b>24,399.47</b>

**SCHEDULE 'A' Part-III**  
**(List of Works & Prices for Internal Electrification Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
<b>1.0</b>	<b>WIRING</b>						
1.1	M& L for point wiring with 1.5 sqmm FRLS PVC insulated multi stranded copper conductor cable (red for phase & black for neutral) & 1.5 sqmm green in colour PVC insulated multistranded copper conductor cable for earth continuity connected to common earth dolly drawn through & including PVC concealed conduit medium grade (1.2mm thick) of dia not less than 20mm, including chase cutting, necessary fixing arrangement & making good to walls, floor,etc & all fixing accessories, all as specified for the following:- (a) One light / fan point controlled by one switch, one way, 230 V	Refer List of Drawings for all Items .	509.10 /Per Point	40	20,364.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items.
1.2	S & F Wiring for circuit/submain wiring alongwith earth wire with 2x2.5 sq. mm + 1x2.5 sq. mm earth wire of FRLS PVC insulated copper conductor, single core cable in surface/ recessed 25mm dia PVC conduit as required <b>(SDB to Lighting Switch Board )</b>		116.00 /RM	120	13,920.00		
1.3	S&F Wiring for circuit/submain wiring along with earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/recessed Steel conduit as required. a.) 4 x 10 sqmm + 2 x 10 sq.mm earth wire		679.00 /RM	40	27,160.00		
1.4	Ditto all as per item No 1.1 above but using 4 Sq mm Copper cable and 4 Sqmm Copper earth wire for one power point 15 Amps on independent board complete all as specified & directed.		990.00 /Per Point	9	8,910.00		
1.5	S&F Modular <b>switch 1 way 6A</b> , 1 module complete all as specified & directed.		130.10 /Each	40	5,204.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-III</b>					<b>75,558.00</b>		

**SCHEDULE 'A' Part-III**  
**(List of Works & Prices for Internal Electrification Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1.6	S&F Modular Multi Switch socket Combination 6/16A, 6 pin, 3 module complete all as specified & directed.	Refer List of Drawings for all Items .	674.10 /Each	9	6,066.90	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
1.7	S&F electronic step type 120 watt modular fan regulator two module complete all as specified & directed.		637.10 /Each	3	1,911.30		
1.8	S&F Modular White cover plate with metal frame, 3 module complete all as specified & directed.		112.80 /Each	9	1,015.20		
1.9	S&F Modular White cover plate with metal frame, 4 module complete all as specified & directed.		121.00 /Each	2	242.00		
1.10	S&F Modular White cover plate with metal frame, 6 module complete all as specified & directed.		207.30 /Each	2	414.60		
1.11	S&F Modular White cover plate with metal frame, 8 module complete all as specified & directed.		226.80 /Each	2	453.60		
1.12	S&F Modular metal flush box 3 module complete all as specified & directed.		76.60 /Each	9	689.40		
1.13	S&F Modular metal flush box 4 module complete all as specified & directed.		96.00 /Each	2	192.00		
1.14	S&F Modular metal flush box 6 module complete all as specified & directed.		156.50 /Each	2	313.00		
1.15	M&L ceiling rose surface bakelite three terminal 65 x 50 mm polycarbonate , complete all as specified & directed.		22.80 /Each	40	912.00		
1.16	S&F of 25 mm dia. Medium grade PVC conduits exclusive of boxes (junction /terminal) but inclusive of all tees, bends, elbows, reducers, bell mouth tube ends and all fixing accessories such as couplers, lock nuts, saddles, pipe hook, etc. (TV & Telephone).		46.00 /RM	20	920.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-III</b>					<b>13,130.00</b>		

**SCHEDULE 'A' Part-III**  
**(List of Works & Prices for Internal Electrification Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
2	<b>SUB DISTRIBUTION BOARDS</b>	Refer List of Drawings for all Items .					
2.1	S&F of vertical type double door Distribution Board (DB) for MCBs, 6 way VTPN having IP-43, Ik-09 with 125 Amps rated bus bar, 415V fixed flushed to wall.		3147.30 /Each	2	6,294.60	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
2.2	S&F 40A, 4P RCCB (100 mA) 10KA		2614.60 /Each	2	5,229.20		
3	<b>EARTHING AND LIGHTNING PROTECTION</b>						
3.1	Earth continuity conductor or main earthing lead of size 8 SWG (4 mm dia) GI wire fixed to wall or recess or chases or buried in ground or drawn in conduit / pipe or fixed to poles or any other indicated situation for loop earthing etc. as required.		18.30 /RM	20	366.00		
3.2	Earthing complete with galvanised steel earth plate electrode 600x600x6mm thick buried directly in ground not less than 2.25 mtrs deep below ground level with top edge of the plate not less than 1.5 mtr below ground level connected to 4 mm dia GI wire as earthing lead by means of bolts, check nuts & washers of galvanised iron or steel all as shown in plate No. 3 of SSR part-1, including testing on completion, excavation of earth work, RCC pit cover with lifting hook ,funnel with watering pipe of 20mm dia medium grade and earth lead protection pipe 15mm dia light grade, wire mesh, charcoal & salt etc. including testing on completion complete all as specified & directed.	2536.80 /Each set	2	5,073.60			
<b>Page Total Carried Over to Collection of Schedule 'A' Part-III</b>					<b>16,963.40</b>		

**SCHEDULE 'A' Part-III****(List of Works & Prices for Internal Electrification Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
3.3	Supply and fixing GI strip 32mm x 6mm complete, including Porcelain saddle at an interval not more than 500mm c/c and fixing (for lightning protection) complete all as specified & directed.	Refer List of Drawings for all Items .	132.10 /RM	200	26,420.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items.
3.4	Earthing complete with galvanised steel earth plate electrode 600x600x6mm thick buried directly in ground not less than 2.25 mtrs deep below ground level with top edge of the plate not less than 1.5 mtr below ground level connected to galvanised iron strip 32mm x 6mm as earthing lead by means of bolts, check nuts & washers of galvanised iron or steel all as shown in plate no. 3 of SSR part-1, including testing on completion, excavation of earth work, RCC pit cover with lifting hook, funnel with watering pipe of 20mm dia medium grade and earth lead protection pipe 40mm dia light grade, wire mesh, charcoal & salt etc. including testing on completion complete all as specified & directed.		3277.50 /Each set	14	45,885.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-III</b>					<b>72,305.00</b>		

**COLLECTION OF SCHEDULE 'A' Part-III**  
**(List of Works & Prices for Internal Electricification Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.51	75,558.00
2	Total amount brought forwarded from Page No.52	13,130.00
3	Total amount brought forwarded from Page No.53	16,963.40
4	Total amount brought forwarded from Page No.54	72,305.00
	<b>Total of Schedule 'A' Part-III Carried Over to BOQ</b>	<b>1,77,956.40</b>

**SCHEDULE 'A' Part-IV**  
**(List of Works & Prices for Pavement Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	Excavation over area not exc. 1.5 m depth and getting out as in soft/loose soil complete all as specified & directed.	Refer List of Drawings for all Items .	77.40 /Cum	1,96,500.00	1,52,09,100.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
2	Removing excavated material (soil) not exceeding 50 m and depositing where directed at a level n exc. 1.5m above the starting point complete all as specified & directed.		96.10 /Cum	1,96,300.00	1,88,64,430.00		
3	Removing excavated material (soil) exceeding 50 m and not exceeding 100m and depositing where directed at a level n exc. 1.5m above the starting point complete all as specified & directed.		109.20 /Cum	100.00	10,920.00		
4	Removing excavated material (soil) exc. 1.5km but n.exc 5.0 km and depositing where directed at a level n exc. 1.5m above the starting point complete all as specified & directed.		208.30 /Cum	100.00	20,830.00		
5	Rolling and consolidating formation surfaces in cutting with roller exceeding 8 tonne and not exceeding 12 tonne to achieve dry density min. 90% of Modified Maximum Proctor Density as per IS 2720 Part VIII complete all as specified & directed.		8.00 /10 Sqm	49,150.00	3,93,200.00		
6	Forming embankments from available earth including raising (or lowering) earth spreading in layers n exc. 30 cm thick, levelling, watering and well ramming. Each layer to be compacted to achieve dry density to 90% of Modified Maximum Proctor Density as per IS 2720 Part VIII complete all as specified & directed.		50.70 /Cum	5,200.00	2,63,640.00		
7	Forming embankments from available earth including raising (or lowering) earth spreading in layers n exc. 30 cm thick, levelling, watering and well ramming. Each layer to be compacted to achieve dry density not less than 95% of Modified Maximum Proctor Density as per IS 2720 Part VIII complete all as specified & directed.		55.77 /Cum	1,91,529.00	1,06,81,572.33		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-IV</b>					<b>4,54,43,692.33</b>		



SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
8	M&L Sand filling under floors or in foundation,etc including watering and consolidated to gradient and camber in required thickness as shown on drg complete all as specified and directed.	Refer List of Drawings for all Items .	678.20 /Cum	3,958.00	26,84,315.60	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items.
9	Supply and fixing Fe 500D TMT steel bars 6 to 8 mm dia., cut to length, bent to shape required, hooking ends and binding with and including mild steel wire (annealed) not less than 0.9 mm dia and securing in place with chairs, in odd shape concrete slabs, as shown in the drawings.		49.10 /Kg	26,205.00	12,86,665.50		
10	M&L for Painting lines, dashes, arrows, letters etc. on roads, pavements and the like exc 10cm wide with road marking paint, white or golden yellow all complete as directed.		37.10 /Sqm	42,000.00	15,58,200.00		
11	Demolition of cement concrete(unreinforced) of any description and in any position not specifically provided for complete all as specified & directed.		494.00 /Cum	5,782.00	28,56,308.00		
12	Dismantling of bricks or brick tiles in floors, channels, kerbs, aprons etc. (each layer), laid, bedded & pointed in any mortar complete all as specified and directed.		380.70 /10 Sqm	248.00	94,413.60		
13	Removing building materials etc, to a distance of 100m or under, beyond the lead included in the rates, including loading, unloading and stacking at the destination or as directed.		32.40 /Load	1,671.00	54,140.40		
14	Add to item No. 13 for upto 1.0km total distance, complete all as specified and directed.		36.90 /Load	1,671.00	61,659.90		
15	Add to item No. 13 and 14 for exc 1.0 km total distance but not exceeding 5.0 km, complete all as specified and directed.		12.00 /Load	1,671.00	20,052.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-IV</b>					<b>86,15,755.00</b>		

**COLLECTION OF SCHEDULE 'A' Part-IV**  
**(List of Works & Prices for Pavement Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.56	4,54,43,692.33
2	Total amount brought forwarded from Page No.57	86,15,755.00
	<b>Total of Schedule 'A' Part-IV Carried Over to BOQ</b>	<b>5,40,59,447.33</b>

**SCHEDULE 'A' Part-V****(List of Works & Prices for RCC Duct for HRS & Electrical Cable Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	Excavating in trenches n. exc 1.5 m wide and n. exc 1.5 m in depth; for foundation etc. or for shafts, wells, cesspits, manholes, pier holes, n exc 10sqm on plan and n exc 1.5m in depth and getting out as in hard / dense soil complete all as specified and directed.	Refer List of Drawings for all items.	202.50 /Cum	1125.90	2,27,994.75	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all items .
2	Removing excavated material (soil) n. exc 50 m and depositing where directed at a level n exc. 1.5m above the starting point complete all as specified and directed.		96.10 /Cum	562.90	54,094.69		
3	Removing excavated material (soil) exc 50m but n. exc 250 m and depositing where directed at a level n exc. 1.5m above the starting point complete all as specified and directed.		109.20 /Cum	563.00	61,479.60		
4	M&L Sand filling under floors or in foundation,etc including watering and consolidated to gradient and camber in required thickness as shown on drg complete all as specified and directed		678.20 /Cum	26.40	17,904.48		
5	Returning, filling in including spreading, levelling, watering and well ramming in layers not exc 25 cm. as in soft / loose soil .Each layer to be compacted to 90% of Modified Maximum Proctor Density complete all as specified and directed.		41.70 /Cum	55.20	2,301.84		
6	M&L 600mm dia reinforced concrete pipes, class NP-3, laid and jointed with collars complete all as specified and directed.		1974.80 /Rm	617.00	12,18,451.60		
7	Material & labour for mass concrete in cenent concrete (1:2:4), Type B2 (using 40 mm graded stone aggregate) for header and pipe etc. complete all as specified and directed.		3062.50 /Cum	541.40	16,58,037.50		
8	M&L plain cement concrete 1:4:8, Type D2 ( using 40mm graded stone aggregate) as in foundation,filling & mass concrete complete all as specified and directed		2303.30 /Cum	6.90	15,899.68		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-V</b>					<b>32,56,164.14</b>		

**SCHEDULE 'A' Part-V****(List of Works & Prices for RCC Duct for HRS & Electrical Cable Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
9	M&L reinforced cement concrete (Design Mix), M-30 (using 20 mm graded stone aggregate) as in foundation including raft, footings, foundations beams, plinth beams,bases for columns etc;basement slab,under reemed piles and mass concrete, complete all as specified and directed.	Refer List of Drawings for all Items.	3649.20 /Cum	33.00	1,20,423.60	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
10	M&L reinforced cement concrete (Design Mix), M-30 (using 20 mm graded stone aggregate) as in walls, retaining walls, basement walls, ballast walls and the like; any thickness; above top of footings; including attached pilasters and buttresses, complete all as specified and directed.		4133.50 /Cum	17.75	73,369.63		
11	M&L reinforced cement concrete (Design Mix), M-30 (using 20 mm graded stone aggregate) as in slabs supported on walls, beams and columns in floors, roofs, landings, balconies, canopies, deck slabs and in shelves and the like, complete all as specified and directed.		3935.00 /Cum	8.21	32,306.35		
12	M&L formwork to sides of concrete foundations, footings, bases of columns, raft and raft beams, sides and soffits (if any) of foundation and plinth beams; and similar work; vertical or to batter for rough finished surfaces of concrete (flat), complete all as specified and directed.		134.20 /Sqm	51.00	6,844.20		
13	M&L formwork for rough finished surfaces of concrete (flat) to faces of walls, retaining walls, abutments, parapets and staircase railings and similar work including attached pilasters, buttresses, etc.; vertical or to batter, complete all as specified and directed.		200.00 /Sqm	229.00	45,800.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-V</b>					<b>2,78,743.78</b>		

**SCHEDULE 'A' Part-V****(List of Works & Prices for RCC Duct for HRS & Electrical Cable Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
14	M&L formwork for rough finished surfaces of concrete (flat) to soffits of suspended slabs such as roof slabs, floor slabs, landings and similar work; not exceeding 200 mm thick (Horizontal or sloping) , complete all as specified & directed.	Refer List of Drawings for all Items.	211.50 /Sqm	25	5,287.50	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
15	Supply and fixing Fe 500 D TMT steel bars 10mm dia and above, cut to length, bent to shape required, hooking ends and binding with and including mild steel wire (annealed) not less than 0.9 mm dia and securing in place with chairs, in odd shape concrete slabs, as shown in the drawings.		48.60 /Kg	31530	15,32,358.00		
16	Ditto, but 6mm to 8mm dia complete all as specified and directed.		49.10 /Kg	7883	3,87,055.30		
17	S & F cast iron work grade FG 150 (articles exc. 5 Kg each) unmachined, in brackets, gully traps, gratings, railing, frames, manhole covers, fire and soot doors, dampers, stop valve boxes, gate stops, parts of ranges, balusters and similar articles complete all as specified and directed.		68.30 /Kg	1800	1,22,940.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-V</b>					<b>20,47,640.80</b>		

**COLLECTION OF SCHEDULE 'A' Part-V**  
**(List of Works & Prices for RCC Duct for HRS & Electrical Cable Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.59	32,56,164.14
2	Total amount brought forwarded from Page No.60	2,78,743.78
3	Total amount brought forwarded from Page No.61	20,47,640.80
	<b>Total of Schedule 'A' Part-V Carried Over to BOQ</b>	<b>55,82,548.71</b>

**SCHEDULE 'A' Part-VI**  
**(List of Works & Prices for Road & Path Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	Excavating over areas, n. exc 1.5 m deep and getting out as in Soft / loose soil complete all as specified and directed.	Refer List of Drawings for all items .	77.40 /Cum	11160	8,63,784.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all items .
2	Removing excavated material (soil) not exceeding 50 m and depositing where directed at a level n exc. 1.5m above the starting point complete all as specified and directed.		96.10 /Cum	11160	10,72,476.00		
3	Removing excavated material (soil) exc. 1.5km but n. exc 5.0 km and depositing where directed at a level n exc. 1.5m above the starting point complete all as specified and directed.		208.30 /Cum	100	20,830.00		
4	Forming embankments from available earth obtained from excavation within MOD land free of cost, including raising (or lowering) earth spreading in layers n exc. 30 cm thick, levelling, watering and well ramming. Each layer to be compacted to achieve dry density not less than 95% of Modified Maximum Proctor Density as per IS 2720 Part VIII complete all as specified and directed.		55.77 /Cum	6650	3,70,870.50		
5	Scarifying existing ground to 250mm depth, bring scarified soil to optimum moisture content (OMC) and rolling & consolidating formation surfaces in cutting & filling with roller exceeding 8 tonne and not exceeding 12 tonne to achieve dry density min. 95% of Modified Maximum Proctor Density as per IS 2720 Part VIII.		8.00 /10 Sqm	2220	17,760.00		
6	M&L continuous old size Fly ash brick edging; with width equal to the width of the brick, laid on end vertically complete all as specified & directed.		45.30 /Rm	7140	3,23,442.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-VI</b>					<b>26,69,162.50</b>		

**SCHEDULE 'A' Part-VI**  
**(List of Works & Prices for Road & Path Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
7	Preparing aggregate base course surfaces by brushing with wire brushes for removing caked mud etc. sweeping with brooms and finally fanning the cleaned surface with gunny bags to remove all loose dirt etc complete all as specified and as directed.	Refer List of Drawings for all Items .	109.20 /10 Sqm	1101	1,20,229.20	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
8	M & L applying evenly bituminous prime coat with bituminous primer (paving bitumen) at 10 Kg per 10 square metre complete all as specified and directed.		429.50 /10 Sqm	1101	4,72,879.50		
9	M & L 40 mm thick (consolidated thickness) Semi dense asphaltic concrete with binder (paving bitumen) content as per approved job mix formula (JMF) (minimum 5.5% by weight of mix), mixed in hot mix plant as per approved mix design, rolled and compacted to required camber and gradient complete as per the Specification. <b>Notes: (i) At site the binder content will be as per approved job mix of 5.5%.</b> <b>(ii) No price adjustment shall be applicable if excess quantity of binder content above 5.5% bitument (VG30) is used/approved in execution of work.</b> <b>(iii) Minus price adjustment shall be made for quantity of binder paving bitumen (VG30) less than 5.5% as per approved design mix separately as per rate of Rs 40/- per kilogram.</b> <b>(iv) Trial bay as specified herein after shall be prepared but no pavement shall be made for the same</b>		2361.40 /10 Sqm	1101	25,99,901.40		
Page Total Carried Over to Collection of Schedule 'A' Part-VI					<b>31,93,010.10</b>		



**SCHEDULE 'A' Part-VI**  
**(List of Works & Prices for Road & Path Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
10	Forming 12 mm thick expansion joints filled with pre-formed bituminous filler and top 30 mm primed and sealed with sealing compound, Grade 'B' conforming to the Specifications.	Refer List of Drawings for all Items .	1358.40 /10Rm	15.60	21,191.04	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items.
11	Provide 38mm dia mild steel dowel bars 50cm long (25cm in each slab) with ferrules including boring formwork and preformed filler for dowels complete all as specified and as directed.		63.46 /Rm	355	22,529.65		
12	Forming Contraction (Dummy) joints 65mm deep X 10mm wide, filled with sealing compound grade 'B' conforming to the Specifications.		496.90 /10Rm	156	77,516.40		
13	Forming Construction joint 30mm deep X 10mm wide filled with sealing compound grade-B conforming to the Specifications.		248.80 /10Rm	10	2,488.00		
14	Surface dressing, renewal coat, by spraying evenly paving bitumen at 12 kg per 10 sq. metre, blinding with 10 mm stone chipping @ 0.10 cum per 10 sq. metres and rolling to required gradient and camber complete all as specified and as directed.		607.40 /10 Sqm	20	12,148.00		
15	Mild steel Framed work such as grills, gratings, etc.. With ends of bars shouldered and / or riveted, or forged into spikes; framed guard bars; barred iron door; ladders; framed balusters; walk ways; railings; framework of water tanks and similar work conforming to Fe-290, Gde-E 165 complete all as specified and as directed.		87.10 /kg	4680	4,07,628.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-VI</b>					<b>5,43,501.09</b>		

**COLLECTION OF SCHEDULE 'A' Part-VI**  
**(List of Works & Prices for Road & Path Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.63	26,69,162.50
2	Total amount brought forwarded from Page No.64	31,93,010.10
3	Total amount brought forwarded from Page No.65	5,43,501.09
	<b>Total of Schedule 'A' Part-VI Carried Over to BOQ</b>	<b>64,05,673.69</b>

**SCHEDULE 'A' Part-VIIA**  
**(List of Works & Prices for Extension of Culvert Works)**

SL. NO.	Description of Items	Drg.No	Rate (in /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	Excavating over areas, n. exc 1.5 m deep and getting out as in Soft / loose soil complete all as specified and directed.	Refer List of Drawings for all Items .	77.40 /Cum	2659	2,05,806.60	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items.
2	Excavating over areas exc 1.5 m but n exc 3.0m deep and getting out as in soft/loose soil complete all as specified and directed.		125.10 /Cum	1140	1,42,614.00		
3	Returning, filling in including spreading, levelling, watering and well ramming in layers not exc 25 cm. complete all as specified and directed.		41.70 /Cum	383	15,971.10		
4	Removing excavated material (soil) exc. 250 m but n. exc 500 m and depositing where directed at a level n exc. 1.5m above the starting point complete all as specified and directed.		149.40 /Cum	3416	5,10,350.40		
5	M&L reinforced cement concrete (Design Mix), M-25 (using 20 mm graded stone aggregate) as in foundation, including raft, footings, foundations beams, plinth beams, bases for columns etc; basement slab, under reamed piles and mass concrete complete all as specified and directed.		3482.20 /Cum	774	26,95,222.80		
6	M&L reinforced cement concrete (Design Mix), M-25 (using 20 mm graded stone aggregate) as in walls, retaining walls, basement walls, ballast walls and the like; any thickness; above top of footings; including attached pilasters and buttresses complete all as specified and directed.		3966.50 /Cum	171	6,78,271.50		
7	M&L reinforced cement concrete (Design Mix), M-25 (using 20 mm graded stone aggregate) as in slabs supported on walls, beams and columns in floors, roofs, landings, balconies, canopies, deck slabs and in shelves and the like complete all as specified and directed.		3770.00 /Cum	99	3,73,230.00		
8	M&L plain cement concrete 1:4:8, Type B1 ( using 40mm graded stone aggregate) as in foundation, filling & mass concrete complete all as specified and directed.		1945.10 /Cum	645	12,54,589.50		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-VIIA</b>					<b>58,76,055.90</b>		

**SCHEDULE 'A' Part-VIIA**  
**(List of Works & Prices for Extension of Culvert Works)**

SL. NO.	Description of Items	Drg.No	Rate (in /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
9	M&L formwork to sides of concrete foundations, footings, bases of columns, raft and raft beams, sides and soffits (if any) of foundation and plinth beams; and similar work; vertical or to batter, for rough finished surfaces of concrete (flat) complete all as specified and directed.	Refer List of Drawings for all Items .	134.20 /Sqm	843	1,13,130.60	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
10	M&L formwork to faces of walls, retaining walls, abutments, parapets and staircase railings and similar work including attached pilasters, buttresses, etc; vertical or to batter, for fair finished surfaces of concrete (flat) all as specified and directed.		225.00 /Sqm	475	1,06,875.00		
11	M&L formwork to soffits of suspended slabs such as roof slabs, floor slabs, landings and similar work; not exceeding 200 mm thick (Horizontal or sloping) for fair finished concrete surface(flat) complete all as specified & directed.		236.50 /Sqm	240	56,760.00		
12	M&L formwork to edges of rough finished surfaces of concrete flats, treads, breaks, in floors, window cills, concrete railings, openings in concrete walls, floor and roofs exc 5 cm but n exc. 10cm wide and sides of RCC / PCC bands in walls, horizontal or sloping and similar work complete all as specified and directed.		19.50 /Rm	3735	72,832.50		
13	M&L Fe-500D TMT steel bars 10mm dia and over, cut to length, bent to shape required, including cranking, bending spirally for hooping for columns, hooking ends and binding with and including mild steel wire (annealed) not less than 0.9 mm dia or securing with clips complete all as specified & directed.		48.60 /Kg	148770	72,30,222.00		
14	All as per Item no 13 above, but 6mm to 8mm dia. complete all as specified and directed.		49.10 /Kg	7830	3,84,453.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-VIIA</b>					<b>79,64,273.10</b>		

**SCHEDULE 'A' Part-VIIA**  
**(List of Works & Prices for Extension of Culvert Works)**

SL. NO.	Description of Items	Drg.No	Rate (in /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
15	M&L boulder pitching, laid dry, hand packed tightly as per drawing complete all as specified and directed.	Refer List of Drawings for all Items .	767.40 /Cum	490	3,76,026.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
16	M&L flush pointing to stone sett paving any description with cement mortar (1:3) complete all as specified & directed.		280.50 / 10 sqm	49	13,744.50		
17	Demolition of reinforced cement concrete (reinforced cut as required to facilitate demolition) of any description and in any position not otherwise specifically provided for complete all as specified and directed.		570.40 /Cum	175	99,820.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-VIIA</b>					<b>4,89,590.50</b>		

**COLLECTION OF SCHEDULE 'A' Part-VII A**  
**(List of Works & Prices for Extension of Culvert Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.67	58,76,055.90
2	Total amount brought forwarded from Page No.68	79,64,273.10
3	Total amount brought forwarded from Page No.69	4,89,590.50
	<b>Total of Schedule 'A' Part-VIIA Carried Over to BOQ</b>	<b>1,43,29,919.50</b>

**SCHEDULE 'A' Part-VII B**  
**(List of Works & Prices for New Culvert Works)**

SL. NO.	Description of Items	Drg.No	Rate (in /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	Excavating over areas, n. exc 1.5 m deep and getting out as in Soft / loose soil complete all as specified and directed.	Refer List of Drawings for all Items .	77.40 /Cum	1886.00	1,45,976.40	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
2	Excavating over areas exc 1.5 m but n exc 3.0m deep and getting out as in soft/loose soil complete all as specified and directed.		125.10 /Cum	810.00	1,01,331.00		
3	Returning, filling in including spreading, levelling, watering and well ramming in layers not exc 25 cm complete all as specified and directed.		41.70 /Cum	670.00	27,939.00		
4	Removing excavated material(soil) exc. 250 m but n. exc 500 m and depositing where directed at a level n exc. 1.5m above the starting point complete all as specified and directed.		149.40 /Cum	1216.00	1,81,670.40		
5	M&L reinforced cement concrete (Design Mix), M-25 (using 20 mm graded stone aggregate) as in foundation, including raft, footings, foundations beams, plinth beams, bases for columns etc; basement slab, under reemed piles and mass concrete complete all as specified and directed.		3482.20 /Cum	415.00	14,45,113.00		
6	M&L reinforced cement concrete (Design Mix), M-25 (using 20 mm graded stone aggregate) as in walls, retaining walls, basement walls, ballast walls and the like; any thickness; above top of footings; including attached pilasters and buttresses complete all as specified and directed.		3966.50 /Cum	214.00	8,48,831.00		
7	M&L reinforced cement concrete (Design Mix), M-25 (using 20 mm graded stone aggregate) as in slabs supported on walls, beams and columns in floors, roofs, landings, balconies, canopies, deck slabs and in shelves and the like complete all as specified and directed.		3770.00 /Cum	133.00	5,01,410.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-VII B</b>					<b>32,52,270.80</b>		

**SCHEDULE 'A' Part-VII B**  
**(List of Works & Prices for New Culvert Works)**

SL. NO.	Description of Items	Drg.No	Rate (in /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
8	M&L plain cement concrete 1:4:8, Type D2 ( using 40mm graded stone aggregate) as in foundation, filling & mass concrete, complete all as specified and directed.	Refer List of Drawings for all Items .	2303.30 /Cum	229.00	5,27,455.70	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
9	M&L formwork to sides of concrete foundations, footings, bases of columns, raft and raft beams, sides and soffits (if any) of foundation and plinth beams; and similar work; vertical or to batter, for rough finished surfaces of concrete (flat) complete all as specified and directed.		134.20 /Sqm	332.00	44,554.40		
10	M&L formwork to faces of walls, retaining walls, abutments, parapets and staircase railings and similar work including attached pilasters, buttresses, etc; vertical or to batter, for fair finished surfaces of concrete (flat) all as specified and directed.		225.00 /Sqm	899.00	2,02,275.00		
11	M&L formwork to soffits of suspended slabs such as roof slabs, floor slabs, landings and similar work; not exceeding 200 mm thick (Horizontal or sloping) for fair finished concrete surface(flat) complete all as specified & directed.		236.50 /Sqm	298.00	70,477.00		
12	Formwork to edges of concrete flats, treads, breaks, in floors, window cills, concrete railings, openings in concrete walls, floor and roofs exc 5 cm but n exc. 10cm wide and sides of RCC / PCC bands in walls, horizontal or sloping and similar work complete all as specified & directed.		19.50 /Rm	1135.00	22,132.50		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-VII B</b>					<b>8,66,894.60</b>		



**SCHEDULE 'A' Part-VII B**  
**(List of Works & Prices for New Culvert Works)**

SL. NO.	Description of Items	Drg.No	Rate (in /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
13	M&L Fe-500D TMT steel bars 10mm dia and over, cut to length, bent to shape required, including cranking, bending spirally for hooping for columns, hooking ends and binding with and including mild steel wire (annealed) not less than 0.9 mm dia or securing with clips complete all as specified & directed.	Refer List of Drawings for all Items .	48.60 /Kg	108585.00	52,77,231.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items
14	All as per Item No. 13 above, but 6mm to 8mm dia. complete all as specified & directed.		49.10 /Kg	5715.00	2,80,606.50		
15	M&L flush pointing to stone sett paving any description with cement mortar (1:3) complete all as specified & directed.		280.50 /10Sqm	20.00	5,610.00		
16	M&L boulder pitching, laid dry, hand packed tightly as per drawing complete all as specified & directed.		767.40 /Cum	196.00	1,50,410.40		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-VII B</b>					<b>57,13,857.90</b>		

**COLLECTION OF SCHEDULE 'A' Part-VII B**  
**(List of Works & Prices for New Culvert Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.71	32,52,270.80
2	Total amount brought forwarded from Page No.72	8,66,894.60
3	Total amount brought forwarded from Page No.73	57,13,857.90
	<b>Total of Schedule 'A' Part-VII B Carried Over to BOQ</b>	<b>98,33,023.30</b>

**SCHEDULE 'A' Part-VIII**  
**(List of Works & Prices for External Water Supply Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	Excavation in trenches not exceeding 1.5 meters wide and not exceeding 1.5 meters in depth for foundation, etc. or for shaft, wells, cesspits, manholes, pier holes, etc. not exceeding 10 sqm on plan and not exceeding 1.5 m in depth and getting out soft/loose soil as specified and directed.	Refer List of Drawings for all items .	115.20 /Cum	95.00	10,944.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all items .
2	Returning, filling in, including spreading, levelling, watering and well ramming in layers not exceeding 25 cm thick all as specified and directed.		41.70 /Cum	80.00	3,336.00		
3	Removing excavated material (soil) from site to a distance not exceeding 50 meters away and depositing where directed at a level not exceeding 1.5 meter above the starting point all as directed.		96.10 /Cum	15.00	1,441.50		
4	Material & labour for mass concrete in CC (1:2:4), Type B1 (using 20 mm graded stone aggregate) for header and pipe etc. complete all as specified & directed.		2751.00 /Cum	4.60	12,654.60		
5	M&L plain cement concrete (1:4:8), Type D2 ( using 40mm graded stone aggregate) as in foundation, filling & mass concrete ,complete all as specified and directed.		2303.30 /Cum	4.00	9,213.20		
6	M&L for Fly ash brick work with old size brick, straight or curved on plan exceeding 6 m mean radius built in cement mortar (1:4) complete all as specified. (For valve chamber).		2421.20 /Cum	4.00	9,684.80		
7	M&L for 10mm thick rendering on fair faces of brick work or concrete surfaces in cement mortar (1:3) and finishing the surface fair & even complete all as specified and directed.		103.10 /Sqm	25.00	2,577.50		
8	M & L 32mm steel water tubing "medium grade", galvanised with all fittings and fixtures laid in trenches complete all as specified & directed.		285.30 /Rm	380.00	1,08,414.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-VIII</b>					<b>1,58,265.60</b>		

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
9	M & L 25mm steel water tubing "medium grade", galvanised with all fittings and fixed to walls and ceiling or laid in floor complete all as specified & directed.	Refer List of Drawings for all Items.	227.50 /RM	10.00	2,275.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
10	M&L Gun-metal globe or gate valves, with iron wheel head, screwed both ends for iron pipe and fixed to following size of pipes complete all as specified and directed (a ) 25mm dia ( b ) 32mm dia		413.80 /Each	2.00	827.60		
11	M&L Straight plain brass ferrules (or connecting screws) of 25 mm dia screwed both ends and fixed complete all as specified and directed.		471.40 /Each	2.00	942.80		
12	M&L Straight plain brass ferrules (or connecting screws) of 25 mm dia screwed both ends and fixed complete all as specified and directed.		554.50 /Each	1.00	554.50		
13	Drilling and tapping Galvanised water mains (in position) for branch connections of internal diameter 20 mm complete all as specified and directed.		162.00 /Each	1.00	162.00		
14	M&L reinforced concrete pipes, class NP3, laid in trenches and jointed complete with Collar's all complete as required. (a) 100mm dia pipe		271.30 /RM	50.00	13,565.00		
14	M & L concrete bed for 100mm dia drain pipes including packing under and haunching against the sides of pipes with concrete after they are laid and tested in cement concrete 1:4:8, type D-2 (using 40mm graded stone aggregate) complete all as specified and directed.		162.40 /RM	50.00	8,120.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-VIII</b>					<b>26,446.90</b>		

**COLLECTION OF SCHEDULE 'A' Part-VIII**  
**(List of Works & Prices for External Water Supply Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.75	1,58,265.60
2	Total amount brought forwarded from Page No.76	26,446.90
	<b>Total of Schedule 'A' Part-VIII Carried Over to BOQ</b>	<b>1,84,712.50</b>

## SCHEDULE 'A' Part-IX

(List of Works &amp; Prices for External Electrical Supply Works)

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	<b>LT CABLES &amp; CABLE TRAYS</b>	Refer List of Drawings for all Items .					
1.1	Supply and Laying in trenches / pipe / duct / floor cable, heavy duty armoured XLPE insulated and sheathed, as per ISI mark, 1100 volts grade aluminium stranded conductor cable of size 25 sqmm, 4core all as specified (earth work sand cushioning & cable cover shall be measured & paid separately under respective item of Sch 'A')		207.00 /Rm	60	12,420.00		See All Notes of Schedule 'A' for all Items.
2	<b>EXCAVATION AND EARTH WORK</b>						
2.1	Excavation in trenches for laying of cables in soft / loose soil not exceeding 1.5 mtr in width and 1.5 mtrs in depth and getting out including forming bottom surfaces to required level or slope as directed.		115.20 /Cum	12	1,382.40	Refer Schedule 'A' Notes	
2.2	Returning and filling including spreading levelling, watering and well ramming in layer not exceeding 25cm complete all as specified and directed.		41.70 /Cum	9	375.30		
2.3	Removal of surplus soil to a distance not exceeding 50 mtr and depositing where directed at a level not exceeding 1.5 mtr above the starting point complete all as specified and directed.	96.10 /Cum	3	288.30			
2.4	Supply and spread sand in trenches as Sand cushioning to under ground cable for protection with river sand and provide required cover after punning down complete all as specified and directed. <b>NOTE</b> Thickness of sand cushion after punning down will be measured and paid.	678.20 /Cum	3	2,034.60			
<b>Page Total Carried Over to Collection of Schedule 'A' Part-IX</b>					<b>16,500.60</b>		

## SCHEDULE 'A' Part-IX

## (List of Works &amp; Prices for External Electrical Supply Works)

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
3	<b>EARTHING</b>						
3.1	M&L Earthing complete with copper earth plate electrode 600x600x3.15mm thick buried directly in ground not less than 2.25 mtrs deep below ground level with top edge of the plate not less than 1.5 mtr below ground level connected to galvanised iron strip 20mm x 3mm as earthing lead by means of bolts, check nuts & washers of galvanised iron or steel all as shown in plate no. 3 of SSR part-1, including testing on completion, excavation of earth work, RCC pit cover with lifting hook, funnel with watering pipe of 20mm dia medium grade and earth lead protection pipe 40mm dia light grade, wire mesh, charcoal & salt and etc., including testing on completion complete all as specified complete all as specified and directed.	Refer List of Drawings for all Items .	7642.00 /Each Set	39	2,98,038.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
3.2	Supply and fixing Copper strip 32mm x 6mm buried in ground complete all as specified and directed.		896.60 /Rm	195	1,74,837.00		
3.3	Supplying & laying unreinforced precast concrete cable cover LV type 03 flat size 450x180mmx40mm laid in trenches for LT cable for protection complete as directed.		48.00 /Nos.	135	6,480.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-IX</b>					<b>4,79,355.00</b>		

**COLLECTION OF SCHEDULE 'A' Part-IX**  
**(List of Works & Prices for External Electrical Supply Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.78	16,500.60
2	Total amount brought forwarded from Page No.79	4,79,355.00
	<b>Total of Schedule 'A' Part-IX Carried Over to BOQ</b>	<b>4,95,855.60</b>



**SCHEDULE 'A' Part-X**  
**(List of Works & Prices for External Sewage Disposal Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	M & L 150mm dia Salt-glazed stoneware drain pipes laid in trenches and jointed as specified.	Refer List of Drawings for all Items .	209.00 /RM	25.00	5,225.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
2	M & L concrete bed for 150mm dia drain pipes including packing under and completely surrounding pipes with concrete after they are laid and tested in cement concrete 1:3:6 type C-2 (using 40mm graded stone aggregate) complete all as specified and directed.		250.00 /RM	25.00	6,250.00		
3	Supplied and fixed cast iron soil, waste and vent pipe (spun pipes) of 100 mm bore, in any length with or without ears with cement joints fixed to walls.		752.20 /RM	3.00	2,256.60		
4	Supplied and fixed cast iron cowls for cast iron soil, waste and vent pipes of 100 mm bore.		272.00 /Each	1.00	272.00		
5	M & L 150mm dia double Y junctions for salt-glazed stoneware drain pipes complete all as specified and directed.		243.50 /Each	2.00	487.00		
6	Excavation in trenches not exceeding 1.5 meters wide and not exceeding 1.5 meters in depth for foundation, etc. or for shaft, wells, cesspits, manholes, pier holes, etc. not exceeding 10 sqm on plan and not exceeding 1.5 m in depth and getting out as in soft/loose soil complete all as specified and directed.		115.20 /Cum	57.00	6,566.40		
7	Returning, filling in, including spreading, levelling, watering and well ramming in layers not exceeding 25 cm thick all as specified and directed.		41.70 /Cum	53.00	2,210.10		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-X</b>					<b>23,267.10</b>		

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
8	Removing excavated material (soil) from site to a distance not exceeding 50 meters away and depositing where directed at a level not exceeding 1.5 meter above the starting point all as directed.	Refer List of Drawings for all Items.	96.1 /Cum	2.00	192.20	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
9	Removing excavated material (soil) exceeding 250m but not exceeding 500m and depositing where directed at a level not exceeding 1.5 meter above the starting point all as directed.		149.4 /Cum	2.00	298.80		
10	Extra for forming fair finished drain or channel 30 cm inner girth in cement concrete, using extra cement, including forms, moulds, mitred/stopped ends etc. <b>Note- Inner girth of drain only to be measured.</b>		14.9 /RM	20.00	298.00		
11	Testing drains as specified by filling the pipes with water to a head of 1.5m at the highest point including temporarily fixing of bends, etc as required for pipe drain upto (a) 250 mm dia. (internal) ( b) 150 mm dia. (internal)		12.1 /RM	2.00	24.20		
			8.4 /RM	25.00	210.00		
12	Testing manholes as specified by filling with water complete all as specified and directed.		53.4 /Each	4.00	213.60		
13	M&L 250mm dia reinforced concrete pipes, class NP3, laid in trenches and jointed complete with Collar's all complete as required.		568.7 /RM	2.00	1,137.40		
14	M & L concrete bed for 150mm dia drain pipes including packing under and haunching against the sides of pipes with concrete after they are laid and tested in cement concrete 1:3:6 type C-2., complete all as specified & directed.	194.4 /RM	2.00	388.80			
<b>Page Total Carried Over to Collection of Schedule 'A' Part-X</b>					<b>2,763.00</b>		

**COLLECTION OF SCHEDULE 'A' Part-X**  
**(List of Works & Prices for External Sewage Disposal Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.81	23,267.10
2	Total amount brought forwarded from Page No.82	2,763.00
	<b>Total of Schedule 'A' Part-X Carried Over to BOQ</b>	<b>26,030.10</b>

**SCHEDULE 'A' Part-XI**  
**(List of Works & Prices for Area Drainage Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	Surface excavation not exceeding 30 cm deep and averaging 15 cm deep and getting out as in (a) Soft / loose soil	Refer List of Drawings for all Items .	15.90 /Sqm	45800	7,28,220.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
2	Returning, filling in including spreading, levelling, watering and well ramming in layers not exc 25 cm. complete all as specified and directed.		41.70 /Cum	500	20,850.00		
3	Providing and laying type B2 1:2:4 (40mm graded stone aggregate) Cement concrete in surface channels and drains complete all as specified and directed.		3087.20 /Cum	5727	1,76,80,394.40		
4	M&L for Fly ash brick work with old size brick, straight or curved on plan exceeding 6 m mean radius built in cement mortar (1:6) complete all as specified and directed.		2249.50 /Cum	15	33,742.50		
5	Extra for forming fair finished to drain or channel 30 cm inner girth in cement concrete, using extra cement, including forms, moulds, mitred/stopped ends etc. <b>Note- Inner girth of drain only to be measured.</b>		14.90 /Sqm	350	5,215.00		
6	M & L 75mm thick plain cement concrete (1:3:6), type C-2 (using 40mm graded stone aggregate) complete all as specified and directed.		196.50 /Sqm	197	38,710.50		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-XI</b>					<b>1,85,07,132.40</b>		

**COLLECTION OF SCHEDULE 'A' Part-XI**  
**(List of Works & Prices for Area Drainage Works)**

Sl. No.	Reference of Pages	Amount (RS )
1	2	3
1	Total amount brought forwarded from Page No.84	1,85,07,132.40
	<b>Total of Schedule 'A' Part-XI Carried Over to BOQ</b>	<b>1,85,07,132.40</b>

**SCHEDULE 'A' Part-XII**  
**(List of Works & Prices for Site Clearance Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
1	Site Clearance.						
	a) Ground Run Point		5.30 /Sqm	2,811.00	14,898.30		
	b) Pavement and Shoulders		5.30 /Sqm	4,69,500.00	24,88,350.00		
2	Removing excavated material (soil) n. exc 50 m and depositing where directed at a level n exc. 1.5m above the starting point complete all as specified and directed.	Refer List of Drawings for all Items .	96.10 /Cum	30,635.00	29,44,023.50	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .
3	Removing excavated material (soil) exc. 1.5km but n. exc 5.0 km and depositing where directed complete all as specified.		208.30 /Cum	39790.00	82,88,257.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-XII</b>					<b>1,37,35,528.80</b>		

**COLLECTION OF SCHEDULE 'A' Part-XII**  
**(List of Works & Prices for Site Clearance Works)**

<b>Sl. No.</b>	<b>Reference of Pages</b>	<b>Amount (RS )</b>
<b>1</b>	<b>2</b>	<b>3</b>
1	Total amount brought forwarded from Page No.86	1,37,35,528.80
	<b>Total of Schedule 'A' Part-XII Carried Over to BOQ</b>	<b>1,37,35,528.80</b>

**SCHEDULE 'A' Part-XIII****(List of Works & Prices for Dismantling & Demolishing Works)**

SL. NO.	Description of Items	Drg.No	Rate (in Rs.) /Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	3	6	7	8
1	Demolition of cement concrete (unreinforced) of any description exceeding 15cm thickness above ground level complete all as specified and directed.	Refer List of Drawings for all Items .	648.90 /Cum	70.00	45,423.00	Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items.
2	Demolition of Cement Concrete (reinforced) in roof, floor, beam, landing, chajja and similar suspended work (other than ground floor) complete all as specified and directed.		874.10 /Cum	5.00	4,370.50		
3	Demolition of brickwork or stone / boulder masonry built in cement mortar including all quoins, arches, pillars, etc. but excluding ashlar facings, dressed stonework and precast concrete articles complete all as specified and directed.		417.80 /Cum	124.00	51,807.20		
4	Taking down Chowhats or frames of area not. exc. 1.50 Sq.m. each with shutters (without taking off the shutters from the frame) and removal to store complete all as specified and directed.		80.20 /Each	3.00	240.60		
5	Ditto as above but area exc. 1.5 sqm but not exc. 4 sqm. complete all as specified and directed.		101.10 /Each	4.00	404.40		
6	Dismantling asbestos cement (corrugated, semicorrugated etc.) sheets in roof covering complete all as specified and directed.		10.9 /sqm	43.80	477.42		
7	Dismantling wall and ceiling boards (fibre, pulp, insulation etc.) or insulation boards / slabs / blankets any thickness including cover fillets complete all as specified and directed.		12.7 /sqm	29.00	368.30		
8	Dismantling wrought iron or mild steel work of any description not otherwise provided complete all as specified and directed.		155.40 /Qtl.	7.00	1,087.80		
9	Removing demolished unused building materials etc. (other than spoil payable under items 03028 to 03031 in section 3- Earthwork) to a distance of 5km beyond the lead included in the rates, including loading, unloading and stacking at the destination complete all as specified and directed.		78.90 /Per load	280.00	22,092.00		
<b>Page Total Carried Over to Collection of Schedule 'A' Part-XIII</b>					<b>1,26,271.22</b>		



**COLLECTION OF SCHEDULE 'A' Part-XIII**  
**(List of Works & Prices for Dismantaling & Demolishing Works)**

SI. No.	Reference of Pages	Amount (RS )
1	2	3
1	Total amount brought forwarded from Page No.88	1,26,271.22
	<b>Total of Schedule 'A' Part-XIII Carried Over to BOQ</b>	<b>1,26,271.22</b>

**SCHEDULE 'A' Part-XIV**  
**(List of Works & Prices for Miscellaneous Works)**

SL. NO.	Description of Items	Drg.No	Rate (in I/Unit	No. of Unit Required.	Amount ( In Rs.)	Period of Completion of individual Item after date of Handling over of Site.	Remarks
1	2	3	4	5	6	7	8
	Refer Serial No 3 to 9.06 listed in BOQ to be quoted by the tenderer.	Refer List of Drawings for all Items .	As Per BOQ			Refer Schedule 'A' Notes	See All Notes of Schedule 'A' for all Items .

**SCHEDULE 'A' (CONTD ...)**  
**SCHEDULE OF CREDIT PART-XV**

SL No	Description of item	Unit	Qty	Rate (Rs.)	Amount (Rs)	Remarks
1	2	3	4	5	6	7
1	Credit for the value of salvage mtrls from demolition or dismantling works					
1.1	Old Unserviceable bricks or brick bats.	Cum	86.80	200.00	17,360.00	
1.2	Old Unserviceable Scrap Iron or bars	Kg	18000.00	20.00	3,60,000.00	
1.3	Old Unserviceable Chowkat or frame not exc. 1.50 Sqm each with Shutter(s) including builders hardware of any description.	Each	2.00	150.00	300.00	
1.4	Old unserviceable chowkat or frame of area exc. 1.50 Sqm but not exc. 4 sqm each with shutter(s) including builders hardware of any description.	Each	2.00	250.00	500.00	
1.5	Old un-serviceable AC Sheets of any description.	Sqm	43.80	40.00	1,752.00	
1.6	Old un-serviceable ceiling boards with all fittings and fixtures.	Sqm	29.00	5.00	145.00	
				<b>Total:-</b>	<b>3,80,057.00</b>	

**Notes:-**

- (a) The materials obtained from demolition/dismantling will become the property of the contractor and accordingly necessary credit for the same shall be deducted from contractor's payment. The contractor shall not remove any material from the site until credit amount for such items are recovered from the interim/ final payments due to the contractor. The amount of credit shall be recovered progressively as the work proceeds. The materials obtained from credit shall be kept in safe custody by contractor till amount for credit is recovered from contractor's payment.
- (b) The rate inserted under Col. 5 is firm and the contractor shall have no claim what so ever against the department if the actual value of dismantled materials turns out to be different from the cost given by the department.
- (c) The quantity inserted against Col. 4 are approximate. The quantity may vary as per actual at site. The amount under this schedule will be worked out for the quantities, which will be measured as per actual quantities at site. The contractor shall have no claim what so ever for variation of quantities.
- (d) If any item is obtained from dismantling/demolition/taking down, it is not included in this schedule. Such items shall become the property of the department and same be removed and handed over to MES Store without any cost to state.
- (e) Material considered in this schedule shall not be re-issued in the subject work unless otherwise specified in description of item.
- (f) Overall contract sum as well as BOQ wise amount shall be arrived after deduction of schedule of credit amount.

**SIGNATURE OF CONTRACTOR**

DATED : \_\_\_\_\_

**DY DIRECTOR (CONTRACTS)****FOR ACCEPTING OFFICER**

(IN LIEU OF IAFW-2159 (REVISED-1947))

**SCHEDULE 'B'**  
**ISSUE OF MATERIAL ETC TO THE CONTRACTOR**  
**(See Condition 10 of the IAFW-2249)**

SI No.	Particulars	Rate at which materials will be issued to the Contractor		Place of issue by name for all items	Remark
1	2	3	4	5	6
-----NIL-----					

SIGNATURE OF CONTRACTOR  
 DATED : \_\_\_\_\_

DY DIRECTOR (CONTRACTS)  
 FOR ACCEPTING OFFICER

**SCHEDULE 'C'**  
**LIST OF TOOLS AND PLANTS (OTHER THAN TRANSPORT) WHICH WILL BE HIRED TO THE CONTRACTOR**  
**(See condition 15, 34 and 35 of IAFW-2249)**

SI No.	Qty particulars	Details of MES Crew Supplied	Hire charges Unit/per working day	Stand by charges per Unit/off day	Place of issue(by name)	Remarks
1	2	3	4	5	6	7
.....NIL.....						

SIGNATURE OF CONTRACTOR  
 DATED : \_\_\_\_\_

DY DIRECTOR (CONTRACTS)  
 FOR ACCEPTING OFFICER

**SCHEDULE 'D'**  
**(TRANSPORT TO BE HIRED TO THE CONTRACTORS)**  
**(See condition 16, 34 and 35 of IAFW-2249)**

SI No.	Qty particulars	Details of MES Crew Supplied	Hire charges Unit/per working day	Stand by charges per Unit/off day	Place of issue(by name)	Remarks
1	2	3	4	5	6	7
.....NIL.....						

SIGNATURE OF CONTRACTOR  
 DATED : \_\_\_\_\_

DY DIRECTOR (CONTRACTS)  
 FOR ACCEPTING OFFICER

(IN LIEU OF IAFW-2159 (REVISED-1947))

**TENDER**

To,  
The President of India

Having examined and perused following documents:-

1. Specifications signed by Dy Director (Contracts).
2. Drawings detailed in specifications.
3. Schedules 'A', 'B', 'C' and 'D' attached hereto.
4. MES Standard Schedule of Rates 2009 Part-I (Specifications) and Part-II 2010 (Rates) together with Amendments 1 to 3 for Part-I and 1 to 59 for Part-II hereinafter referred to as the MES Schedule.
5. General conditions of Contracts IAFW-2249 (1989 Print) together with Errata 1 to 20 and amendments 1 to 40 and Schedule of Minimum Fair wages as applicable.
6. **Water.** Refer condition 31 of IAFW-2249 (General condition of Contracts) **Water will not be supplied by the MES** (Ref condition 8 of Special conditions).
7. Should this tender be accepted.

I/We Agree,

- \* (A) That the sum of Rs. \_\_\_\_\_ forwarded as earnest money shall either be retained on account of Security Deposit or be refunded by the Govt on receipt of an equal amount as Security Deposit within the time specified in condition 22 of IAFW-2249.

(B) To execute all the works referred to in the said documents upon the terms and conditions contained or referred to therein and as detailed in the General Summary and to carry out such deviations as may be ordered vide condition 7 of IAFW-2249 upto a **maximum of 10% (TEN PERCENT)** and further agree/refer all disputes as required by condition 70 and 71 of IAFW-2249 to the sole Arbitration of a Serving Officer having Degree in Engineering or equivalent or having passed final/direct final examination of sub division II of Institution of Surveyors (India) recognised by the Govt. of India, to be appointed by the Engineer-in-Chief, Army Headquarter, New Delhi or in his absence, the officer officiating as Engineer-in-Chief or Director General of Works, if specifically delegated in writing by Engineer-in-Chief, Army HQ New Delhi whose decision shall be final, conclusive and binding.

- \* To be deleted where not applicable.

(IN LIEU OF IAFW-2159 (REVISED-1947)

Brought forward from BOQ page (Sum of BoQ minus Schedule of credit) for the Lump sum of Rs \_\_\_\_\_

(Rupees \_\_\_\_\_

\_\_\_\_\_ )

Signature \_\_\_\_\_ (With Name in Block letters)

in the capacity of \_\_\_\_\_ duly signed the tender for and on behalf of

(In block letters)

Witness

Date

Address

Postal Address

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Telegraphic Address

\_\_\_\_\_

Telephone Number

\_\_\_\_\_

**ACCEPTANCE**

\_\_\_\_\_ alterations have been made in this document and as evidence that these alterations were made before the execution of the contract agreement they have been initialled by the contractor and Shri \_\_\_\_\_

The said officer is hereby authorised to sign and initial on my behalf the documents forming part of this contract.

The above tender was accepted by me on behalf of the President of India for the lump sum of

Rs \_\_\_\_\_ (Rupees \_\_\_\_\_

\_\_\_\_\_ )

on the \_\_\_\_\_ day of \_\_\_\_\_ 2018.

Signature \_\_\_\_\_ on the \_\_\_\_\_ day of \_\_\_\_\_ 2018.

**Appointment:(GURDYAL SINGH)**

**BRIG**

**CCE (NEP) AF CHABUA**

**ACCEPTING OFFICER**

**(FOR AND ON BEHALF OF THE PRESIDENT OF INDIA)**

**GENERAL CONDITIONS OF CONTRACTS**  
**(IAFW-2249 PRINT 1989) FOR LUMP SUM CONTRACTS (IAFW-2159)**

1. A copy of the MES GENERAL CONDITIONS OF CONTRACT (IAFW-2249 Print-1989) with errata and amendments has been supplied to me/us and is in my/our possession. I/We have read and understood the provisions contained in the aforesaid GENERAL CONDITIONS OF CONTRACTS before submission of this tender and I/We agree that I/We shall abide by the terms and conditions thereof.
2. It is hereby further agreed and declared by me/us that the MES General Conditions of Contracts (IAFW-2249 of Print 1989) including condition 70 thereof pertaining to settlement of disputes by Arbitration containing 33 pages (Serial Page Nos. 96 to 128 with errata 1 to 20 and Amendment Nos. 1 to 40 containing 17 pages (Srl Page Nos. 129 to 145) form part of these tender documents.
3. It is hereby agreed that the "Schedule of minimum Fair wages" (SMFW) as published vide Government of India Notification up to the last date of receipt of tender documents forms part of these tender document. My/Our signature hereunder amounts to my/our having read and understood the provisions contained therein and I/We agree that I/We shall abide by the same and that aforesaid documents form part of this tender.
4. My / Our signature hereunder amounts to my / our having read and understood the provisions contained therein and I / We agree that aforesaid documents form part of tender.

**NOTE: -**

- (i) The documents mentioned above can be seen in the office of the CCE (NEP) (AF), Chabua, Airforce Station Chabua or in any other MES (CWE/GE) office during working hours.
- (ii) In case of difference in interpretation due to wordings of English and Hindi versions, the English version will prevail as per Article 348 of constitution of India.

\_\_\_\_\_  
**DY DIRECTOR (CONTRACTS)**  
**FOR ACCEPTING OFFICER**

\_\_\_\_\_  
**SIGNATURE OF CONTRACTOR**  
**DATED :**

**SCHEDULE OF MINIMUM FAIR WAGES**

1. Schedule of Minimum Fair Wages is not enclosed alongwith the tender but the contractor is deemed to have full knowledge regarding the minimum wages payable to labourers as legally effective on date of submission of tender and his tendered rates shall be deemed to have been based on the same. For the purpose of reimbursement of price variation (PV) clause for wage escalation of labour, the minimum wages legally effective on the date of receipt of tender shall be the basis.
2. The minimum wage legally effective referred to above are the minimum wages notified in Gazette / Governed by any local regulations or by Central Govt., whichever is higher.
3. My / Our signature hereunder amounts to my / our having read and understood the provisions contained therein and I / We agree that aforesaid documents form part of tender.

**NOTE: -**

- (i) The documents mentioned above can be seen in the office of the CCE (NEP) (AF), Chabua, Airforce Station Chabua or in any other MES (CWE/GE) office during working hours.
- (ii) In case of difference in interpretation due to wordings of English and Hindi versions, the English version will prevail as per Article 348 of constitution of India.

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**DY DIRECTOR (CONTRACTS)  
FOR ACCEPTING OFFICER**

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**SIGNATURE OF CONTRACTOR  
DATED :**



**SPECIAL CONDITIONS OF CONTRACT****1. GENERAL**

These special conditions shall be read in conjunction with the General conditions of Contracts, IAFW-2249 (1989 Print) and IAFW-2159 A including Errata/amendments thereto. Any provision in these special conditions if at variance with the provision in the abovementioned documents, the provision in these special condition shall be deemed to take precedence there over.

**2. ADMISSION TO SITE BY CONTRACTOR AND RESPONSIBILITY TO ASCERTAIN HIS OWN INFORMATION**

2.1 The tenderer shall contact the Garrison Engineer for the purpose of inspection of site(s) and relevant documents other than those sent herewith, who will give reasonable facilities for this purpose. The tenderers shall also make themselves familiar with working conditions, accessibility to site(s), availability of materials and other cogent conditions, which may affect the completion of work under this contract.

2.2 The tenderers shall be deemed to have visited the site(s) and made themselves familiar with the working conditions irrespective of the fact whether they actually inspect the site(s) or not.

**3. SECURITY AND PASSES**

3.1 Refer condition 25 of IAFW-2249. The contractor shall employ only Indian Nationals as his representatives, agents, servants and workmen and verify their antecedents and loyalty before employing them for the works. He shall ensure that no person of doubtful antecedents and nationality is in any way associated with the work. If for reasons of technical collaboration or other consideration, the employment of any foreign national is unavoidable, the contractor shall furnish full particulars to this effect to the Accepting Officer at the time of submission of his tender. The contractor shall, on demand by the Engineer-in-Charge, submit list of his agents, employees and work people concerned and shall satisfy the Engineer-in-Charge as to the bonafides of such people.

3.2 The Engineer-in-Charge shall at his discretion have the right to issue passes as per rules and regulations of the installation/area in force to control the admission of the contractor, his agents, employees and work people to the site of the work or any part thereof. Passes should be returned at any time on demand by the Engineer-in-Charge or the authorities concerned and in any case on completion of work.

3.3 The contractor and his agents, employees and work people shall observe all the rules promulgated by the authority controlling the installation/area in which the work is to be carried out e.g. prohibition of smoking and lighting, fire precautions, search of persons on entry and exit, keeping to specific routes, observing specified timing etc. Nothing extra shall be admissible for any hours etc, lost on this account.

**4. CONDITIONS OF WORKING**

The work lies in RESTRICTED AREA.

**4.1 VISIT TO SITE WITHIN THE RESTRICTED AREA**

4.1.1 Permission to enter the Restricted Area at the time of submission of tender can be obtained through the Garrison Engineer. Tenderers are advised to send prior intimation of their agents, representatives etc., if any, dates and time of their proposed visit so that necessary arrangements may be made by GE to secure admission. Whether a tenderer visits the site or not he shall be deemed to have full knowledge of the restrictions of entering into exit from site and working within the Restricted Area.

**4.2 ENTRY / EXIT**

4.2.1 The contractor, his agent(s)/representatives, workmen etc. and his materials, carts, trucks or other means of transports etc. will be allowed to enter through and leave only from such gate and at such times as the GE or authorities incharge of the Restricted Areas may at their sole discretion permit to be used. The contractors' authorised representative is required to be present at the place of entry and exit for the purpose of identifying his carts, trucks etc. to the personnel incharge of the security of Restricted Area.

**4.3 IDENTITY CARDS OR PASSES**

4.3.1 The contractor, his agents and representatives are required individually to be in possession of any identity card or pass duly verified by the Garrison Engineer. The Identity Card or pass will be examined by the security staff at the time of entry into, exit from the Restricted Area and also at any time or number of times inside the Restricted Area.

**4.4 IDENTITY OF WORKMEN**

4.4.1 Every workmen shall be in possession of an Identity Card. The Identity Card will be issued after thorough investigation of the antecedents of the labourers by the contractors and attested by the Officer Incharge of the Unit concerned in accordance with the standing rules and regulations of the Units.

4.4.2 Contractor shall be responsible for the conduct and action of his workmen, agents or representatives.

**4.5 SEARCH**

4.5.1 Thorough search of all persons and transport shall be carried out at each gate and for as many times as gate is used for entry or exit and may also be carried out at any time or any number of times at the work site within the Restricted Area.

**4.6 FEMALE SEARCHER**

4.6.1 If the contractor desires to employ female labour on works to be carried out inside the area of a Factory, Depot, Park etc. and a female searcher is not borne on the

authorised strength of the Factory, Depot, Park etc. at the time of submission of the tender, he shall be deemed to have allowed in his tender for pay and allowance etc. for a Female Searcher (Class IV servant/Gp 'D' servant) calculated for the period, female labour is employed by him inside the area if more than one contractor has/have to employ female searcher in addition to the authorised strength of Factory, Depot, Park etc. the salary and allowances paid to the additional female searcher(s) shall be distributed on an equitable basis between the contractors employing female labour taking into consideration the value and period of completion of their contract. The GE's decision in regard to the amount recoverable on this account from contractor shall be final and binding.

#### 4.7 **WORKING HOURS**

4.7.1 The Units controlling Restricted Area, usually, work during six days in the week and remain closed on the 7<sup>th</sup> day. The working hours available to contractor's labour and staff, however, accordingly get reduced because of the time taken in security checking observed at the of entry, exit and during working hours.

4.7.2 The exact working hours, days and non-working days observed or the Restricted Area, where works are to be carried out shall be deemed to have been ascertained by the contractor before submitting his tender. The tenderer's attention is invited to the fact that total number of working hours for a Unit area prescribed in regulations and they cannot be increased by the Garrison Engineer.

4.7.3 Contractor's materials, transport etc. shall normally be permitted to come in/go out of the area between 9.00 AM to 5.00 PM.

4.7.4 Contractor may also be allowed to carry out the work beyond 5.00 PM and upto 6.00 AM (day and night) with prior approval of GE. No movements of materials and transport to/out of site of work shall be permitted during night unless special permission is obtained from the factory/Unit authorities.

#### 4.8 **WORK ON HOLIDAYS**

4.8.1 The contractor shall not carry out any work on gazetted holidays, weekly holidays and other non-working days except when he is specially authorised in writing to do so by the GE. The GE may at his sole discretion declare any day as holiday or non-working day without assigning any reason for such declaration.

#### 4.9 **ACCESS TO RESTRICTED AREA AFTER COMPLETION OF WORKS**

4.9.1 After the works are completed and surplus stores etc. removed, the contractor, his agents, representatives or workmen etc. may not be allowed to have access to the Restricted Area except for attending any rectification of defects pointed out to him by the GE.

#### 4.10 **FIRE PRECAUTIONS**

4.10.1 The contractor, his agents, representatives, workmen etc. shall strictly observed the orders pertaining to fire precautions prevailing within the Restricted Area.

- 4.10.2 Motor transport vehicles, if any, allowed by authorities to enter the Restricted Area, must be fitted with serviceable fire extinguishers.

## 5. MINIMUM WAGES PAYABLE

- 5.1 Refer condition 58 of IAFW-2249. The Schedule of Minimum fair wages as published vide Govt of India Notification upto the date of receipt of tender documents forms part of the tender documents and given at pages of the tender documents. The contractor shall not pay wages lower than minimum wages for labour as fixed by the Govt of India/ State Govt/Union Territory under Minimum Wages Act or Contract Labour (Abolition and Regulation Act), whichever is higher.
- 5.2 The fair wages referred to in condition 58 of IAFW-2249 will be deemed to be the same as the minimum Wages payable as referred to above.
- 5.3 The contractor shall have no claim whatsoever, if on account of local factors and or regulations, he is required to pay the wages in excess of minimum wages as described above during the execution of work.

## 6. QUARRIES

Reference Condition 14 of General Conditions of Contracts (IAFW-2249) No quarries on defence land are available.

## 7. LAND FOR TEMPORARY WORKSHOP, STORES ETC.

Delete the following from lines 5 to 9 of sub Para 1 of condition 24 of IAFW-2249 reading "In the event of area of land \_\_\_\_\_ and allotted to him" and insert as under:-

"The contractor shall be allotted free of charge, the areas marked on the layout plan for the purpose of erection of temporary workshop, stores etc. No Ministry of Defence land is available for accommodation of labour and canteen in Restricted Area.

## 8. WATER

- 8.1 **Water will not be supplied by MES.** The Contractor shall at his own cost arrange water for construction purpose and for his workmen from the source as approved by GE. However, the Contractor if he desire, will be permitted to drill bore well(s) in the area at his own cost. In case of digging of borewell the contractor shall take up the case with concerned Govt. authorities/CGWB and obtain prior approval. The well(s) dug/drilled by the Contractor shall become the property of the Govt without any cost. The contractor may install water treatment plant at site. In such case the treated water will be allowed to use only after meeting the required quality.
- 8.2 It will be the responsibility of the contractor to ensure that the water brought to site meets the requirement of clause 5.4 of IS 456. Each source of water shall be got approved from the GE, well in advance of the requirement of water for construction purpose. GE will first approve each source of water before commencement of any concreting/masonry/plaster work. Thereafter, the water from each source will be tested at least at an interval of every three months. The

sample of water from the sites will be got collected by the GE and sealed by him. All the testing charges including the arrangement for forwarding the sample to the Recognized/Approved Laboratory will be borne by the contractor.

- 8.3 Work done with water arranged by the contractor and not meeting the requirement of IS 456 is liable for rejection.

## **9. CO-OPERATION WITH OTHER AGENCIES**

The contractor shall permit free access and generally afford reasonable facilities to other agencies or departmental workmen engaged by the Govt to carry out their part of the work, if any, under separate arrangements.

## **10. ELECTRIC SUPPLY**

- 10.1 Electric Supply required for the work upto a maximum of 10 KW three phase 440 volts shall be made available by the MES for works pertaining to each sections of schedule 'A'. Exact location of the electric points will be shown by the GE. KWH meters to register the electric energy supplied and main switch shall be provided and installed by the MES. Contractor shall provide all necessary cables, fittings etc. from the tapping point in order to ensure a proper and suitable supply of electricity for execution of work.

- 10.2 In case contractor desires to buy electricity from MES, he shall be charged for the electric energy consumed at Rs. 8.30 per Kilowatt-hour for lighting and power.

- 10.3 MES do not guarantee continuity of supply and no compensation whatsoever shall be allowed for supply becoming intermittent or for breakdown in the system.

- 10.4 GE or his representative shall be free to inspect all the power consuming devices or any electric lines provided by the contractor. Any devices or electric lines provided by the contractor, which is not to the satisfaction of the GE shall be disconnected from the supply, if so directed by him.

## **11. NET WORK ANALYSIS**

- 11.1 The time and progress chart to be prepared as per condition 11 of General Conditions of Contracts (IAFW-2249) shall consist of detailed network analysis and a time schedule. The critical path network will be drawn jointly by the GE and the contractor soon after acceptance of tender. The time scheduling of the activities will be done by the contractor so as to finish the work within the stipulated time. On completion of the time schedule a firm calendar date schedule will be prepared and submitted by the contractor to the GE who will approve it after due scrutiny. The schedule will be submitted in four copies within two weeks from the date of handing over the site.

- 11.2 During the currency of the work, the contractor is expected to adhere to the time schedule and this adherence will be a part of his/their performance under the contract. During the execution of the work, the contractor is expected to participate in the reviews and updating of the network undertaken by the GE. These reviews may be undertaken at the discretion of the GE, either as a periodical appraisal measure or when the quantum of work ordered on the contractor is substantially changed through deviation orders or amendments. Any revision of the time schedule as a result of the review will be submitted by the contractor to the GE within a week for his approval after due scrutiny.

11.3 The contractor shall adhere to the revised time schedule thereafter. In case of contractor disagreeing with revised schedule, the same will be referred to the Accepting Officer, whose decision shall be final and binding. GE's approval to the revised schedule resulting in a completion date beyond the stipulated date of completion shall not automatically amount to a grant of extension of time. Extension of time shall be considered and decided by the appropriate authority mentioned in condition 11 of IAFW-2249 and separately regulated.

11.4 Contractor shall mobilize and employ sufficient resources to achieve the detailed schedule within the broad frame work of the accepted method of working and safety. No additional payment will be made to contractor for any multiple shift work or other intensive methods contemplated by him in his schedule, even though the time schedule is approved by the department.

## **12. SAMPLE OF MATERIALS AND INDIAN STANDARDS**

12.1 Refer condition 10 of IAFW-2249 and Clause 1.6 & 1.7 of MES Schedule.

12.2 Contractor shall provide items/articles from the sources/firms mentioned in particular specification i.e. Appendix 'A','B' & 'E' where a firm listed in particular specification is manufacturing both ISI/Non ISI marked material, only ISI marked items/articles shall be provided.

12.3 The tenderer is advised to inspect other materials, which are displayed in the office of GE, before submitting his tender. The tenderer shall be deemed to have inspected the samples and satisfied himself as to the nature and quantity of materials, he is required to incorporate in the work irrespective of whether he has actually inspected them or not. The materials to be incorporated in the work by the contractor shall conform to or shall be superior in quality to the sample displayed and shall comply the specifications given hereinafter.

12.4 The contractor shall not procure materials unless the samples are first got approved by the Garrison Engineer.

12.5 Where IS number is mentioned in the tender documents the year of IS shall be the latest upto and including the date of receipt of tender.

## **13. RECORD OF CONSUMPTION OF CEMENT**

13.1 Refer Clause 4.1 of particulars specifications hereinafter.

## **14. PERIOD FOR KEEPING THE TENDER OPEN**

14.1 The tender shall remain open for acceptance for period of 90 (Ninty) days from the last date of submission of tender.

## **15. SECURITY OF CLASSIFIED DOCUMENTS**

15.1 Contractor's special attention is drawn to condition 2-A and 3 of IAFW-2249 (General Conditions of Contracts). The contractors shall not communicate any classified information regarding the work either to subcontractors or others without prior approval of the Engineer-in-Charge. The contractor shall also not make copies of the design/drawings and other documents furnished to him in respect of the work and shall return all documents on completion of the works or

earlier on determination of the contract. The contractor shall alongwith the final bill, attach a receipt of his having returned the classified documents as per condition 3 of IAFW-2249 (General Conditions of Contracts).

#### **16. OFFICIAL SECRETS ACT**

The contractor shall be bound by the official secret Act 1923.

#### **17. RECORD OF MATERIALS**

17.1 The quantity of materials such as paints, water proofing compound, chemicals for antitermite treatment and the like as directed by the Engineer-in-Charge (the quantity of which cannot be checked after incorporation in the works), shall be recorded in measurement books and signed by the contractor and the Engineer-in-Charge as a check to ensure that the required quantity has been brought to site for incorporation in the work.

17.2 Materials brought to site shall be stored as directed by the Engineer-in-Charge and those already recorded in measurement book shall be suitably marked for identification.

17.3 The contractor shall on demand, produce to the GE, original receipted Vouchers/ invoices in respect of the supplies. The Vouchers/invoices shall be defaced and stamped by Engineer-in-Charge indicating contract number, name of work, under his dated signature. The contractor shall ensure that the materials are brought to site in original sealed containers/packing, bearing manufacturer's marking except in the case of the requirement of material(s) being less than the smallest packing.

17.4 In addition to documents as mentioned elsewhere the contractor shall produce /invoice form the manufacturer (and/or their authorised agents where allowed by GE) for the full quantity of the following materials, as applicable as a prerequisite before submitting claims for payment for advances on account of the work done and/or materials collected in accordance with condition 64 of General conditions of contracts IAFW-2249.

- (a) Steel
- (b) Cement
- (c) And any other materials as directed by GE.

#### **18. ACCEPTANCE QUALITY OF WORK AND FINISHES**

18.1 To determine the acceptance standard of materials and workmanship/final finishes and layout fittings etc. the contractor shall execute stages of work viz excavation, foundation concrete walling upto plinth/lintel/roof levels, roofing, flooring, joinery built-in items finishes and the like and services i.e. Internal Electrification, Water supply, plumbing sanitary fitting of work under the close Supervision of Engineer-in-Charge and shall get it approved by the GE. The workmanship of various trades and finishes as such shall serve as guiding samples for the remaining work.

#### **19. CONTRACTOR'S PLANT/EQUIPMENT AT SITE**

19.1 The contractor shall furnish to the Engineer-in-Charge every morning a distribution return of his plant/equipment on the site of work, stating the following particulars: -

- 19.2 Particulars of plant/equipment, its make, manufacture No, model No if any, registration No, if any, capacity, year of manufacture, year of purchase etc.
- 19.3 Total No (Quantity) on site of work.
- 19.4 Location, indicating No (quantity) at each location of site of work.
- 19.5 Purchase value on the date of purchase. For the purpose of this condition, plant/equipment shall include vehicles i.e. trucks and lorries but neither the workmen's tools nor any manually operated tools/equipments.
- 19.6 The Engineer-in-Charge shall record the particulars, supplied by the contractor in the work diary and send the return to the GE for record in his office.

## **20. RELEASE OF PERFORMANCE SECURITY DEPOSIT**

- 20.1 A performance security of 5% will be required to be deposited by the contractor. This deposit is applicable for both enlisted & unlisted contractors.
- 20.2 The contractor is advised to deposit the performance security in two equal parts so as to facilitate its release in accordance with para 3(d) on page 26 of this tender document.

## **21. CLEANING DOWN**

- 21.1 Refer Condition 49 of IAFW-2249.
- 21.2 The contractor shall be responsible for cleaning all floors, walls, remove cement/lime/paint marks/drops, etc. clean the joinery glass panes etc. touch up all painters work and carryout all other necessary items of work in connection there with and leave the whole premises clean and tidy before handing over the building.

## **22. OCTROI, SALES TAX AND OTHER DUTIES**

- 22.1 (a) The rates quoted by the Contractor shall be deemed to be inclusive of all taxes (including Sales Taxes /VAT on materials, Sales Tax/VAT on Works Contracts, Turnover Tax, Labour Welfare cess/tax, service tax etc.), duties, Royalties, Octroi & other levies payable under the respective Statutes. No reimbursement /refund for variation in rates of taxes, duties, royalties, octroi and other levies, and/or imposition/abolition of any new/existing taxes, duties, royalties, octroi and other levies shall be made except as provided in sub Para (b) herein below.
- b) (i) The taxes which are levied by Govt at certain percentage rates of Contract Sum/Amount shall be termed as "taxes directly related to Contract value" such as Sales Tax/VAT on Works Contracts, Turnover Tax, Labour Welfare Cess / tax and like but excluding Income Tax. The tendered rates shall be deemed to be inclusive of all "taxes directly related to Contract value" with existing percentage rates as prevailing on last due date for receipt of tenders. Any increase in percentage rates of "taxes directly related to Contract value" with reference to prevailing rates on last due date for receipt of tenders shall be reimbursed to the Contractor and any decrease in percentage rates of "taxes directly related to Contract value" with reference to prevailing rates on last due date for receipt of tenders shall



be refunded by the Contractor to the Govt / deducted by the Govt. from any payments due to the Contractor. Similarly imposition of any new "taxes directly related to contract value" after the last due date for receipt of tenders shall be reimbursed to the Contractor and abolition of any "taxes directly related to Contract value" after the prevailing on last due date for receipt of tenders shall be reimbursed to the Contractor and abolition of any "taxes directly related to Contract value" prevailing on last due date for receipt of tenders shall be refunded by the Contractor to the Govt. /deducted by the Govt. from the payments due to the Contractor.

ii) The contractor shall, within a reasonable time of his becoming aware of variation in percentage rates and / or imposition of any further "taxes directly related to Contract value" give written notice thereof to the GE stating that the same is given pursuant to this Special Condition, together with all information relating thereto which he may be in a position to supply. The Contractors shall submit the other documentary proof / information as the GE may require.

iii) The Contractor shall, for the purpose of this condition keep such books of account and other documents as are necessary and shall allow inspection of the same by a duly authorized representative of Govt, and shall further, at the request of the GE furnish, verified in such a manner as the GE may require, any documents so kept and such other information as the GE may require.

iv) Reimbursement for increase in percentage rates / imposition of "taxes directly related to Contract value" shall be made only if the Contractor necessarily and properly pays additional "taxes directly related to Contract value" to the Govt. without getting the same adjusted against any other tax liability or without getting the same refunded from the concerned Govt. Authority and submits documentary proof for the same as the GE may require."

22.2 Any other condition stipulated by the tenderer regarding sales tax on works contracts will not be considered and such tender shall be liable for rejection.

### **23. QUALIFIED TRADESMEN (APPLICABLE FOR WORKS COSTING RUPEES ONE CRORE OR MORE)**

23.1 In compliance with condition 26 of IAFW-2249 (General Conditions of Contracts), the contractor shall employ skilled / semi-skilled tradesmen who are qualified and possessing certificate in particular trade from Industrial Training Institute (ITI) / National Institute of Construction Management and Research (NICMAR) / National Academy of Construction (NAC) Hyderabad/ similar reputed and recognized Institutes by State / Central Govt., to execute the works of their respective trade. The number of such qualified tradesmen shall not be less than 25% of total skilled / semi skilled tradesmen required in each trade. The contractor shall submit the list of such tradesmen along with requisite certificate to Garrison Engineer for verification and approval. Notwithstanding the approval of such tradesmen by GE, if tradesmen are found to have inadequate skill to execute the work of their trades, leading to un-satisfactory workmanship the contractor shall remove such tradesmen within a week after written notice to this effect by the GE and shall engage other qualified tradesmen after prior approval of GE. GE's decision whether a particular tradesmen posses requisite qualification, skill and expertise commensurate with nature of work shall be final and binding. No compensation what so ever on this account shall be admissible.

**24. CONCILIATION****24.1 SCOPE OF CONCILIATION**

24.1.1 The scope of conciliation shall be restricted to the following types of disputes with financial limits as indicated therein: -

- a) Disputes relating to levy of compensation for delay in completion - actual amount of compensation.
- b) Disputes relating to technical examination of works.
- c) Disputes relating to interpretation of the provisions of the contract with reference to their application to parties.
- d) Disputes relating to non-return of Schedule 'B' stores over issued to the contractor.
- e) Any other dispute having fair chances of being resolved by conciliation and considered fit to be referred to conciliation by the parties.
- f) For (b), (c), (d) and (e) above, the financial limit shall be Rupees two Lakhs or one percent of the contract amount whichever is less.

**24.2 COMMENCEMENT OF CONCILIATION PROCEEDINGS**

24.2.1 The party initiating conciliation shall send to the other party a written invitation to conciliate, briefly identifying the subject of dispute.

24.2.2 Conciliation proceedings shall commence when the other party accepts in writing the invitation to conciliate.

24.2.3 If other party rejects the invitation, there will be no conciliation proceedings. If other party initiating conciliation does not receive a reply within thirty days from the date on which he sends or within such other periods of time as specified in invitation, he may elect to treat this as a rejection of invitation to conciliate and if he so elects, he shall inform in writing the other party accordingly.

**24.3 NUMBER OF CONCILIATORS**

There shall be a sole conciliator

**24.4 APPOINTMENT OF CONCILIATOR**

All disputes brought out in Para 25.1.1(a) to (e) hereinbefore above shall be referred to the sole conciliator viz Serving Officer not below the rank of Superintending Engineer / Superintending Engineer (Q/S & C) having degree in Engineering or equivalent or having passed final / direct final examination of sub division II of Institution of Surveyors (India) New Delhi, to be appointed by the Engineer-in-Chief, Army headquarters, New Delhi or in his absence the officer officiating as Engineer-in-Chief or Director General of Works if specifically delegated by the Engineer-in-Chief in writing.

**24.5 STATUS OF EFFECT OF SETTLEMENT AGREEMENT**

The settlement Agreement signed by the parties as a result of conciliation proceedings shall have same status and effect as it is in an arbitral award on agreed terms.

**25. RETENTION MONEY/COMPENSATION FOR DELAY**

25.1 Refer condition 64 and 50 of IAFW-2249.

25.2 For the purpose of calculating retention money under condition 64 of IAFW-2249, and compensation for delay under condition 50 of IAFW-2249, the value of contract as revised by price variation in terms of condition 26 and 27 herein before under modified condition 63 of IAFW-2249 shall be taken in to account.

## 26. TESTING OF MATERIALS

26.1 Refer condition 10(A) of IAFW-2249. The materials listed at Appendix 'C' shall be tested as per the frequency indicated therein.

26.2 The contractor shall at his own cost and arrangement set up a field laboratory at the site with all requisite equipment required for testing for the contracts costing more than Rs. ONE Crore of accepted amount. The contractor shall be responsible for such test to be carried out and for that they shall employ a competent technical representative having minimum qualification of Diploma in Civil Engineering as approved by GE. This will be in addition to Engineer (s) required to be employed for the supervision of works as required under condition 25 of IAFW-2249. The tests shall be carried out in presence of Engineer-in-Charge. The charges for the tests carried out in site laboratory of the contractor will not be recovered.

26.3 Site lab shall be set up for works costing more than Rs. One Crore. Contractor at his option may set up a field laboratory at the site at his own cost for the work costing less than Rs. One Crore. The charges for the tests carried out in site laboratory of the contractor will not be recovered. The charges for tests will be recovered from the contractor only if he does not carry out the tests catered for in the contract.

26.4 A percentage or selected testes as decided by the Garrison Engineer with the approval of Accepting Officer shall be got done independently in Zonal/Govt approved lab. The expenditure of such tests will be borne by the department. However, if the test fails, expenditure thereof shall be borne by the contractor.

26.5 Level of testing shown in Legend as A, B & C are defined as under:

### **Level 'A' :**

(a) "Site Lab" means own lab established by contractor at the work site. This lab shall have all the facilities including T&P. Machinery, equipment, Manpower, etc. required for conducting tests. This lab shall be operative for the entire duration of the contract till its completion. Test shall be carried out in the presence of Engineer-in-Charge to be nominated by GE or any other departmental Officer to be nominated by the GE. Random check of compliance of frequency of testing shall be done by GE.

(b) Records shall be maintained at work site. These test results shall be signed by contractor or his authorised representative and aforesaid departmental official.

(c) Within 15 days of placement of work order No. 1 site lab shall be established and fact reported by the contractor to GE in writing who will verify the fact and satisfy himself of the facilities provided. Thereafter GE shall issue a certificate to this effect in writing listing out equipment particulars etc. of each material test. Only after issue of this certificate by GE the tests shall be carried out in site lab and materials so approved shall be incorporated in the work.

- (d) Manpower, material and infrastructure like Electricity, Water etc. required for conducting these tests shall be provided by the contractor.
- (e) Tenderer is deemed to cater for above provisions in his quoted rates.
- (f) Remedial measures, if any required achieving / obtaining desired results for each test shall be taken promptly by contractor.
- (g) In case contractor fails to establish site lab for any reasons whatsoever or the facilities provided in site lab are considered inadequate by GE the contractor shall get the tests done from any other lab as per Level 'C' here-in-after or Govt approved lab whose name shall be approved by GE in writing. The testing charges payable to such labs including materials and transportation etc. shall be paid by the contractor. Contractor's quoted rates are deemed to include for this eventuality and nothing extra shall be payable to the contractor. No extension of time shall be admissible on this account.
- (h) However, in case GE in his opinion considers that contractor is purposely not adhering to the laid down frequencies of the tests, he shall reserve the right to deduct penal recovery which shall be double the rates of tests indicated in Appendix 'C'. GE's decision on recoveries shall be final and binding.

**Level 'B' :**

- (a) "Zonal Lab" means lab of nearest CE Office as approved by Garrison Engineer.
- (b) The tests shall be conducted as per frequencies laid down for these tests in these labs for which contractor shall provide all requisite facilities like samples, cubes, materials etc and transportation to these labs for testing purpose. It will be contractor's responsibility to adhere to the laid down frequency of testing. Test results shall be sent by Lab to the GE whose copies can be made by contractor at his own expense. Testing charges for the tests so conducted shall be recovered at the rate indicated in Appendix 'C' from the running payments. The contractor's quoted rates are deemed to include for above provision.

Where the facilities are not existing in Zonal laboratory, the contractor shall get these tests carried out as per level 'C' here in after under his own arrangement and cost.

- (c) Provision of Para (h) above of Level 'A' shall be applicable to level 'B' also.

**Level 'C' :**

- (a) Level 'C' Lab stands for National Test House/SEMT Wing Pune located in CME Pune – 31/Local Engineering College or any other Government approved laboratory as approved by GE.
- (b) Rest provisions contained in Para (b) of level 'B' above shall be applicable here except that contractor shall obtain test results from these labs and hand over to GE. The testing charges payable to these labs for conducting these tests shall be borne by the contractor and his quoted rates are deemed to include this provision.
- (c) In case contractor purposely does not adhere to laid down frequency, then besides effecting penal recovery as in Para (h) of level 'A', GE will

get them tested from any other sources and necessary testing charges paid by GE shall be debited from the running payments.

26.6 List of equipment which should be available in the lab for testing both in lab and at site are attached as Appendix 'D'.

26.7 At last 20% of samples during construction should be got tested by third party i.e. reputed laboratory/agency as approved by GE."

## **27. PRE CONSTRUCTION ANTITERMITE TREATMENT**

27.1 Please refer clause of particular specifications. The contractor's particular attention is invited to 'Guarantee' and Security Deposit provisions.

## **28. ADVANCE ON ACCOUNT OF MATERIALS WHICH DO NOT LOOSE IDENTITY (APPLICABLE ONLY FOR THE WORKS COSTING MORE THAN Rs. 50.00 LAKHS)**

28.1 The contractor may be paid advance on account of the full value of the under mentioned materials only, brought on the site, on his furnishing guarantee Bonds from a Schedule Bank for the amount of retention money which should otherwise be recoverable from him under the contract.

- (a) Aluminium/PVC door shutters & frame.
- (b) Aluminium windows/ventilators.
- (c) Sanitary fittings.
- (d) Electrical cables, wires/fittings /fixtures.
- (e) Water supply pipes, fittings/fixtures.
- (f) All other non- perishable materials as decided by GE.

28.2 The Bank Guarantee Bonds shall be executed for a period and on a form as directed by the Accepting Officer. The contractor shall further arrange to extend the period of Guarantee Bond if and when necessary, as directed by the Accepting Officer or shall furnish fresh guarantee bond of similar value.

28.3 It will be noted that advance on account to the full value of materials brought on the site is permissible only in respect of fittings and fixtures and other manufactured items which do not loose their identity. Materials like bricks, aggregate, pre-cast concrete and similar items shall not be taken in the list.

## **29. FAIR WAGES**

The contractor shall have no claim what so ever if, for any reason other than those mentioned in condition 63 of IAFW-2249 and condition 5 herein before, he is required to pay wages in excess of minimum wages as laid down by Govt of India (shown in the schedule of minimum rate of wages or the minimum wages as fixed by the State Govt whichever is higher.

## **30. SCHEDULE OF FINISHES**

In the event of a discrepancy / difference in provision between schedule of finishes and other drawings forming part of the tender, the provisions in the schedule of finishes shall take precedence over the provisions in the other drawings.

**31. DAMAGE TO EXISTING STRUCTURE**

During execution of work, if any damage to existing structure, roads, drain sewage lines etc. takes place then it shall be made good by the contractor at his own cost without any claim. Rectifications, replacement, making good and touching up etc shall be carried out conforming to the materials & workman ship originally provided to the satisfaction of Engineer-in-Charge. In case of dispute on this account, the decision of the GE shall be final & binding.

**32. OUTPUT OF ROAD ROLLER**

32.1 Refer Condition 15 of IAFW-2249.

32.2 Where road rollers are hired by the Department to contractor a log book for each road roller shall be maintained by the Department for recording hours of working of the road roller. In case, however, when the contractor procures road rollers from sources other than the department, a logbook for each road roller shall be maintained by him for recording hours of working of the road roller. Entries in the log book shall be signed by the Contractor or his authorised representative and by the Engineer-in- Charge.

32.3 To ensure proper consolidation, roller must work for at least the number of days assessed, on the basis of output given hereinafter. If the roller has not worked for the number of days so assessed, recovery shall be effected from the contractor for the number of days falling short of the days assessed the output stipulated. The recovery shall be effected as under: -

32.3.1 Where the road roller is hired out only by the deptt. to the contractor, at rates given in Sch 'C'.

32.3.2 Where road roller is hired by the contractor only from sources other than the deptt, Rupees 1,500/- (One thousand five hundred) per working day of eight hours for 8 to 12 tone roller.

32.3.3 Where road roller is hired by the contractor from the Department and also from sources other than the deptt. at higher of the two rates given in Sch 'C' of contract and Para (b) above.

32.4 The above provision shall not, however, absolve the contractor of his responsibility of properly consolidating surfaces as required under the provisions of the contract. inadequate skill to execute the work of their trades, leading to unsatisfactory workmanship the contractor shall remove such tradesmen within a week after written notice to this effect by the GE and shall engage other qualified tradesmen after prior approval of GE. GE's decision whether a particular tradesmen possess requisite qualification, skill and expertise commensurate with nature of work shall be final and binding. No compensation what so ever on this account shall be admissible.

## 32.5 Output of road roller per day of Eight hours: -

(i)	Consolidation of formation surfaces/sub grade	-	1850 Sq Metres
(ii)	Consolidation of stone soling/ hardcore 23/20cm spread thickness	-	518 Sq Metres
(iii)	do -, but 15 cm thick (spread thickness)	-	800 Sq Metres
(iv)	-do-, but 10 cm thick (Spread thickness)	-	1000 Sq Metres
(v)	Consolidation of water bound macadam stone metal 7.5 cm (consolidated thickness) including spreading and consolidation with binding material	-	248 Sq Metres
(vi)	-do- but 10 cm (consolidated thickness)	-	175 Sq Metres
(vii)	Consolidation of single coat Surface dressing	-	774 Sq Metres
(viii)	- do - two coat surface dressing	-	558 Sq Metres
(ix)	Consolidation of 2.50 cm thick premixed carpet including seal coat (compacted thickness)	-	600 Sq Metres
(x)	-do- but 2.0 cm (compacted thickness)	-	744 Sq Metres
(xi)	-do- but 4 cm (compacted thickness)	-	500 Sq Metres
(xii)	-do- but 5 cm (compacted thickness)	-	400 Sq Metres
(xiii)	-do- but semi dense asphaltic concrete	-	375 Sq Metres
(xiv)	Pre Mix bituminous macadam	-	400 Sqm Metres
(xv)	Laying and compacting of GSB, WMM, DBM, DAC, PQC & DLC etc.		Output of road roller shall be decided by GE after carrying out trials on trials bays for PQC, DLC, WMM, DBM and DAC.

**33. Mobilisation advance non-revocable bank guarantee**

33.1 Interest bearing mobilisation advance of up to maximum of 10% of contract value shall be given to the contractor if he so desires and on his specific written request, in two instalments, on production of a non-revocable Bank Guarantee (s), for the amount at least 110% of the advance on an approved form from a Nationalized/Scheduled Bank. The Bank Guarantee (s) shall indemnify the Government against non-refund of mobilisation advance and also against default on Contractor's part in performance of the contract. The rate of interest shall be 10% (Ten) per annum, simple interest.

33.2 The first instalment of mobilisation advance shall be Rs 50lakhs and shall be paid to the contractor within 30 days of acceptance of Bank Guarantee (s) of 110% of the same amount furnished by him, by accepting Officer. The second instalment of the balance amount shall be paid to the contractor after 6 months of payment of the first instalment provided Bank Guarantee (s) for corresponding amount increased by 10%

has/have been furnished by the contractor, at least one month in advance and accepted by the Accepting Officer.

33.3 The total amount of mobilisation advance, together with interest shall be recovered from the payment made to the contractor against "Advance on Account", under condition 64 of IAFW-2249, MES General Conditions of contracts.

33.4 The amount of mobilization advance shall be recovered in fortnightly instalments as stipulated hereinafter.

33.5 Against the first instalment of mobilisation advance, the first instalment of recovery shall be effected from the 1st 'Advance on Account' payment made after commencement of Phase – II and the last instalment of recovery shall be effected during the fourth month preceding the month in which the due date of completion of entire work stipulated in first Work Order falls. The various instalments of recovery shall be of equal amounts.

33.6 Against the second instalment of mobilisation advance of Rs 1150 Lakh(maximum) the first instalment of recovery shall be effected from the "advance on Account" payment made immediately following the payment of mobilisation advance of Rs 1150 Lakh (Maximum) and the last instalment of recovery shall be effected during the third month preceding the month in which the due date of completion stipulated in first work order falls. The various instalments of recovery shall be of equal amounts. The recovery in instalments of this mobilisation advance of Rs 1150 Lakh (maximum) shall be in addition to the recovery in instalments of the mobilisation advance (first instalment) vide sub para 33.5 above.

33.7 The contractor may furnish one Bank Guarantee or a number of Bank Guarantee equal to number of instalment for recovery, each to match the quantum of recovery to be effected from the 'Advance on Account'. In case recovery is not possible to be effected from any particular 'Advance on Account' for reasons of non-submission of claim for payment of 'Advance on Account' or for any other reasons whatsoever, the recovery due shall be made by encashing the Bank Guarantee.

**34. Dispute Resolution Board (DRB) (Condition 71 of IAFW 2249 General Condition of Contract Refers)**

a) During execution of this works or after completion or after determination / cancellation / termination of the contract all disputes between the parties to contract arising out of the contract (except those for which decision of Accepting officer or any other officer (CWE and / or GE) is expressed to be final and binding), including any disagreement by either party with any action, inaction, opinion, instruction, certificate or valuation by the Accepting Officer or his nominee, the matter in dispute shall, in the first place be referred to the Dispute Resolution Board (DRB). In case of disagreement with the decision of such DRB, any party may invoke arbitration clause.

b) The Constitution of the DRB shall be a three member body as under: -

a. **Chairman**: Joint DG (Contracts) of the concerned Command Chief Engineer. Where Jt. DG (C) is not posted in the Comd, any other Chief Engineer / Brig level Offr posted in CE Comd shall be nominated by Comd CE at his sole discretion

b. **Member 1** }  
c. **Member 2** } Col / Director rank Officers of Comd CE or of any other Zonal CE be nominated by Comd CE.



- c) The name of Chairman and members shall be notified by the Accepting Officer within one month of the date of acceptance of Contract.
- d) Once the DRB is constituted the members and Chairman shall disclose in writing their neutrality and impartiality about any personal interest in the work.
- e) The dispute shall be referred to the Chairman of the DRB by the concerned party after giving notice to the other party for invoking of this clause.
- f) The DRB shall decide the dispute in accordance with the terms of the Contract, principle of natural justice, equity and fair play.
- g) The DRB may fix oral hearing at a place, date and time as decided by the Chairman.
- h) The requisite administrative support to the DRB shall be provided by the Accepting Officer.
- i) All the contract documents pertaining to the case shall be provided by the Accepting Officer for reference by the DRB.
- j) DRB shall give its decision on the disputes within three months of notice from any party invoking the DRB clause. This period can be extended by one month with the consent of the parties.
- k) All the decisions given by the DRB shall be by majority and such decisions shall be communicated in writing by Chairman to the parties.
- l) If the decision of the DRB is not to the satisfaction of either party or if the DRB fails to give decision within the laid down time either party shall indicate his reservations on the decision to Accepting Officer within 30 days of such decision and to refer that dispute for arbitration within the provisions of Condition 70 of IAFW 2249 General Conditions of Contract.
- m) It shall be mandatory for the party invoking arbitration on any particular dispute to have first exhausted the remedy provided under the DRB clause for that particular dispute.
- n) The mandate of the DRB shall terminate on completion of one year from the date of completion / determination / cancellation / termination of the contract.
- o) If any member or Chairman of the DRB is unable to function due to any reason whatsoever, or he resigns his appointment, Chief Engineer Command as the case may be, shall fill the vacancy so caused within 15 days of happening of such vacancy.
- p) Any dispute referred to the DRB and having been decided by the DRB and not objected to by either party within 30 days shall attain finality and shall not be referable to arbitration.
- q) Accepting Officer shall ensure implementation of the decisions of the DRB which attain finality, i.e. except those which are objected by him or by contractor within 30 days as per Para 12 above.
- r) Findings and decision of DRB shall be admissible as evidence, to the extent permissible as per law, in the subsequent Arbitration and / or litigation.

- s) DRB Chairman / member shall not in any case, be liable to be called as witness or to produce any evidence in any Arbitration or departmental proceedings of any kind.
  
- t) During execution of work the disputes may be referred to the DRB as per the requirement of each party after having exhausted the decision making process provided in the contracts. In case of completion of work or after determination / cancellation / termination of the contract all the disputes including payment / non-payment / delay in final bill shall be simultaneously referred to the DRB within six months of completion / determination / cancellation / termination of the contract.
  
- u) The department case before the DRB shall be presented by Accepting Officer himself and / or Dir (Contract) of CE Zone assisted by CWE and his DCWE (Contract), GE and his AGE (Contracts) and any other officer and legal counsel nominated by Accepting Officer. The Contractor may present his case by himself and / or by his nominated reps & authorized legal / technical counsel.
  
- v) ADG (NEI) Guwahati will perform the role of Command CE in this work.

**SIGNATURE OF CONTRACTOR**  
**DATE**

**DY DIRECTOR (CONTRACTS)**  
**FOR ACCEPTING OFFICER**

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**PARTICULAR SPECIFICATIONS****A. GENERAL**

1. The works under this contract shall be carried out in accordance with Schedule 'A' the general specification, particular specifications, MORTH specification (fifth Revision), drawings and other provisions in MES Schedule of Rates (2009) Part I -Specifications and (2010) Part II -Rates.

The supervision of the work shall be done by the Garrison Engineer (GE) through DEPMC (Detailed Engineering and Project management Consultancy). Any clarification at site regarding the work under this contract shall be done with either GE or with DEPMC.

The Government may engage some other agency / agencies to execute some work in the same site. The contractor is expected to work in close coordination with other agencies engaged by the Government including making / allowing connection of services lines, matching / coordinating in site grading / road works etc.

The term "General specification" referred to in Para 1.1 above shall mean specifications contained in MES Schedule 2009 Part-I (specifications) and MES Schedule of Rates Part-II 2010 print, including errata and amendments thereto are issued along with Tender documents.

General Rules, Specifications, Special Conditions and all preambles in the MES Schedule shall be deemed to apply to works under this contract, unless mentioned otherwise in this tender documents, in which case specifications in these tender documents shall take precedence over the aforesaid provisions in the MES schedule.

**1.1 Soil Investigation report**

A soil investigation has been carried out at site by the Accepting Officer / DEPMC through some specialist agency. To have a general idea of the soil condition at site, Soil Investigation Report can be seen by interested Tenderers with prior appointment from the GE / Accepting Officer. However, it should be clearly understood that the data given in the report is for general guideline only and no claim / payment shall be based on this data.

The notes on the drawings (if any) to the effect that foundations are based on specified Safe Bearing Capacity of the soil are for guidance of GE only.

All works as shown in the drawings, specifications, conditions of contract and Schedule 'A' shall be deemed to have been covered in the prices quoted and nothing extra shall be payable to the contractor for any reason whatsoever unless specifically stated otherwise in the contract.

If specifications for any item of work or material are not available either in MES schedule or in this Particular Specifications, relevant IS specification or National Building Code shall be followed.

Any drawing which is mentioned / referred on a drawing forming part of the contract but not specifically mentioned in the list of drawing shall be deemed to be forming part of the contract. The tenderer shall see such drawings / details in the office of Accepting Officer / GE.

## **1.2 Samples of Materials**

All materials to be provided shall be ISI marked. In cases where ISI marked materials are not available, materials superior or conforming to BIS standards and approved by the GE shall be used.

Approval of samples of all materials which shall be used in the project is mandatory. No order for materials shall be placed by the contractor prior to approval of samples. The Contractor shall maintain the sample / material approval register for all the items required for this project.

A consolidated list of approved makes of various materials is appended in this document. The tenderer shall quote his rates on the basis of the price of best quality of the make stipulated in the item of works as described in specification, the list of approved makes and as approved by the GE.

## **1.3 Making Good**

The contractor shall cut, leave or form holes, recesses, chases etc. in concrete, brick work, walls, ceilings, floors and in any other situations as required or as directed by the GE and make good in cement and sand mortar (1:3)/PCC (1:3:6) as directed by GE and Finish to match the adjoining surfaces.

## **1.4 Shop Drawings**

Shop/fabrication drawings shall be prepared by the contractor for all specialist items of work as indicated in the specifications. These shall be carefully prepared in accordance with the specifications and drawings and best trade practices and shall contain all the relevant information required.

Unless and otherwise mentioned the Contractor shall submit the shop drawings at least 6 weeks before the commencement of works for the prior approval of the GE. Before submission, the Contractor shall check the shop drawings and ensure that these are correct and complete and drawn in required scale and fully coordinated with all relevant disciplines.

The Contractor shall also ensure that any amendments to drawings and other information are made in accordance with comments of the GE, and shall re-submit these drawings and other information for formal approval by the GE. The Contractor shall submit three sets of the finally approved shop drawings to the GE. The shop drawings are to be updated / revised if there is any change in the scope of work as instructed by the GE.

Care shall be taken to ensure that all subsequent works are carried out as per the approved shop drawings only.

Shop drawing shall be prepared by the contractor for the specialized jobs. Nothing extra shall be paid to the contractor for the preparation of shop drawings.

### **1.5 Site Details**

The site is located in the existing functional Airport area. The contractor shall take almost care not to create inconvenience to the existing functional facilities. Rate quoted by the contractor in Schedule 'A', shall include the cost of above and no separate payment shall be made for the same.

- a) The plots of land on which construction activities will be carried out, shall be barricaded with 2.4 M high GI sheet with reasonable framing with prior approval of the GE.
- b) No labour camp shall be permitted at site. It is the responsibility of the contractor to provide accommodation for Labourer / his staff, elsewhere and transportation to site as per Instruction of Engineer-in-charge.

### **1.6 Safety:**

The contractor shall comply necessary safety and adhere to safe work and guard against hazardous as well as unsafe working conditions during all stages of work.

No workmen/Staff from Contractor, consultant, client, Visitors or other agencies shall be allowed to take entry at construction site without proper PPE.

Minimum PPE requirement is – Helmet, Safety Shoe & Safety Jacket. In addition job wise PPE requirement shall be use by the specific workmen engaged for that particular work.

Special attention to be given for the "Work at Height".

Contractor should submit Safety manual before starting of work and take approval from Client/Consultant.

Contractor to submit weekly & Monthly Safety report regularly.

### **1.7 SCOPE OF WORK**

The contract includes for the full, final and entire completion of the items of work described in Schedule 'A' and in General summary all as shown in drawings including notes thereon and/or as specified in these particular specifications.

### **1.8 Completion drawing / record drawing**

After completion of work Contractor shall mark any approve changes on the drawing duly signed by GE for submission. Incase where Contractor has submitted shop drawing / fabrication drawing the releted completion drawing also shall be submitted by the contractor.

**B. CIVIL WORKS****1 BUILDING WORKS (EARTH WORK)****1.1 Levelling of Site around Buildings and for Buildings**

The site around the plinth protection of the building including building portion shall be dressed and leveled upto 5.0 metre or as directed by GE and the cost of the same shall be deemed to be included in Lump Sum.

**1.2 Setting out and Making Profile**

Masonry or concrete pillars (460mm x 460mm) will be erected at suitable points in the area to serve as benchmarks for the execution of the work. These benchmarks shall be connected with G.T.S. or any other permanent benchmark approved by the GE. Necessary profiles with pegs, bamboos and strings or Burjis shall be made to show the correct formation levels before the work is started. The contractor shall supply labour and materials for setting out and making profiles and Burjis for the work at his own cost and the same shall be maintained during the excavation work. The Accepting Officer / GE will show grid co-ordinate or other reference points. It shall be the responsibility of the contractor to set out center lines correctly with reference to the drawings and install substantial reference marks. Checking of such alignment by the GE / Accepting Officer will not absolve the contractor from his responsibility to execute the work strictly in accordance with the drawings.

**1.3 Excavation and Earthwork**

Before commencing the construction, the contractor shall carry out the preparatory work, such as removal of grass, vegetation etc, of the area to the entire satisfaction of Engineer-in-Charge. The area referred to implies the entire building plot extending up to 5m all round the outer periphery of the building block. All the rubbish obtained from site clearance and all soil obtained from surface dressing shall be removed, spread and levelled as directed by Engineer-in-Charge and the cost of the same shall be deemed to be included in Lump Sum and the cost beyond 5 mtr shall be measured & paid separately under respective item of schedule 'A'.

**1.3.1 Excavation in General**

Soft/loose soil, hard/dense soil and mud shall be classified as "any type of soil" without the use of timbering for measurement and pricing under Sch 'A'. The rate of any type soil for the purpose of deviations shall be taken as average rate for soft/loose and hard/dense soil of SSR adjusted by contractor's percentage as applicable. In case of soft/hard rock is met with during excavation, the rock portion of foundation shall be ordered through deviation.

1.3.2 If rock (soft/disintegrated) is met at site, contractor shall immediately notify the fact to the GE in writing, who will after due verification, regularize the change through a proper deviation order.

1.3.3 In case hard rock is met with, the contractor shall immediately notify the same to GE under intimation to Accepting Officer and prior approval of

Accepting Officer shall be obtained by the GE before ordering work of excavation in hard rock on the contractor. Where hard rock is met with during the excavation, foundation design is likely to be changed which may entail delay in finalisation of drawings. The contractor shall mobilise his resources accordingly in consultation with GE and have no claims of what so ever nature for delay in finalisation of revised details shall be entertained. CE's decision in this regard shall be final and binding.

- 1.3.4 Hard rock met with during excavation shall be entered in the measurement Book duly signed by the GE and contractor and the same shall become the property of the contractor for which recovery at the rate of supply only rate for hand packing (irrespective of actual size of boulder/aggregate obtained) shall be made subject to applicable contractor's percentage of respective part of Schedule 'A' over SSR (item 06123 of MES SSR Part-II) from contractor's advance on account payment.
- 1.3.5 The hard rock so obtained may be allowed to be used in the work by the GE provided it meets the specified requirements; Locations etc where it is to be used (and allowed to be used) shall also be as decided by the GE whose decision shall be final and binding. The cost of transportation, stacking and breaking of stone shall be borne by the contractor. If hard rock obtained from excavation is not fit for use in the work the contractor shall remove the same outside the MD land without any extra cost to the Government.
- 1.3.6 Soft/disintegrated rock obtained from excavation can be used in filling under floors, returning and filling in, if approved by GE after crushing and adding fine materials all as directed by Engineer-in-Charge.
- 1.3.7 In case timbering to excavation is required and specifically ordered by the GE in writing, it shall be paid as deviation.
- 1.3.8 **Site clearance and surface dressing**  
Site clearance and surface dressing shall be carried out as per clause 3.6 and 3.10 of MES SSR Part-I. All rubbish obtained from site clearance and surplus soil obtained from surface dressing shall be removed, spread and levelled as directed by Engineer-in-Charge and the cost of the same shall be deemed to be included in Lump Sum and the cost beyond 5 mtr shall be measured & paid separately under respective item of schedule 'A'.
- 1.3.9 **Filling in Trenches/Under Floors**  
The earth used for filling shall conform to Para 3.19.1 of MES Schedule Part-I and shall be approved by GE. For the purpose of lump sum the entire soil (except soil obtained from surface dressing) obtained from excavation of Schedule 'A' Part-I shall be considered suitable for filling. No charges shall be levied against contractor for use of soil/obtained from excavation for filling.
- 1.3.10 Filling to sides of trenches shall be in layer n.exc 25 cm thick and each layer shall be watered, compacted and rammed as approved by Engineer-in-Charge.
- 1.3.11 Surplus soil shall be removed and spread at places as directed by the Engineer-in-Charge, at a distance exc 250m and n.exc 500m from the periphery of the buildings.

- 
- 1.3.12 If soil obtained from excavation is not adequate/sufficient or suitable for filling in trenches, plinth, under floor etc additional earth required shall be obtained from outside MD land without any extra cost to Govt.
- 1.3.13 In the event of any deviation the soil obtained from outside MD land shall be priced at the rate applicable for rough excavation in soft/loose soil to a depth not exceeding 1.5 mtr and getting out and removed to a distance exc. 1.5 km but n.exc 5 km adjusted by the contractor percentage as applicable irrespective of the actual cost to the contractor.
- 1.3.14 After construction and before handing over buildings, the area around the building up to 3 metre shall be cleaned, dressed to level and sloping out ward from the buildings and the spoil if any obtained from surface dressing shall be removed to a distance exc 250m but not exc. 500 m from the periphery of building.
- 1.3.15 Before commencement of excavation or earth filling, the representative of the GE and the contractor shall take the levels jointly, of the existing ground surfaces at intervals as decided by the GE (the decision of the GE will be final and binding) and cross sections to be prepared by the Engineer-in-Charge.
- 1.3.16 Existing levels of the area will be taken using total station survey equipment jointly by the contractor and the department. Desired profile after completion of survey work shall be provided by the GE to the contractor accordingly all excavation shall be carried out in the conformity with the directions laid hereunder and in a manner approved by GE. The work shall be so done that suitable materials available from excavation are satisfactorily utilized as decided by GE beforehand. While planning or executing excavations, the contractor shall take all adequate precautions against soil erosion, water pollutions etc as directed by GE. The excavation shall conform to the lines grades, sides slopes and levels as directed by GE. The contractor shall not excavate outside the slopes or below the established grades or loosen any material outside the limits of excavation subject to the permitted tolerance. Any excess depth excavated below the specified levels shall be made good at the cost and arrangement of the contractor with suitable material of similar characteristics and compacted to the requirements as decided and directed by GE. All debris and loose material on the slopes of cuttings shall be removed all as directed. No back filling shall be allowed to obtain required slopes excepting that when boulders or soft materials are encountered in cut slopes these shall be excavated to the approved depth as directed and the resulting cavities filled with suitable material andthoroughly compacted as directed.
- 1.3.17 Where the excavated materials is directed to be used in the construction of embankment, it shall be directly deposited at the required location complying with the requirements of embankment and sub grade so that the capacity of cutting,haulage and compaction equipment is nearly the same.



**1.3.18 Measurement for Payment:**

Earthwork in excavation shall be measured by taking cross sections at intervals as decided by GE in writing in the original position before the work starts and after its completion and computing the volumes in cubic metres by method of Prismoidal rule. Where it is not feasible to compute volumes by this method because of erratic location of isolated deposits, the volumes shall be computed by other accepted methods as approved by GE. The contractor shall leave depth indicators during excavations of such shape and size and in such positions as directed so as to indicate the original ground level as accurately as possible. The contractor shall be responsible to keep these intact till the final measurements are taken. Works involved in the preparation of sub-grade on cut formation shall be considered, as incidentally to this item and no extra payment shall be made on this account to the contractor. All other relevant specification shall be followed as specified here-in-before and MES Standard Schedule of Rates Part-I of 2009.

**1.3.19 Hard Core**

The material for hardcore (broken stone) shall be as per sample kept in GE's office and from the sources as described in Appendix 'B' to particular specifications.

Hardcore shall be stones of gauge not exceeding 63mm grade. Hardcore shall be deposited, spread and leveled in layers n exc 15cm thick and watered, well rammed to a true surface and compacted. The thickness of the hardcore after consolidation shall be as per drawings and where not specifically shown on drawings, it shall be 150 mm consolidated thickness.

**1.4 Anti-Termite Treatment to Foundations & Ground Floor**

Anti-termite treatment shall be carried out in strict compliance with IS 6313 (Part II) of 1981 for pre-construction treatment using chemical CHLOROPYRIOPHOS emulsifiable concentrate.

The scope of work pertaining to Anti-termite treatment shall be restricted to the provision in Para 6.2.1, 6.2.2, 6.3, 6.4, 6.5 and 6.6 of IS : 6313 (Part II). The provisions of chemical in other paragraphs of the said IS shall also apply to the extent they are applicable to the items of works, specified in various Para of IS mentioned above. The rate of application for different locations shall be as given in respective Paras of IS.

A record of chemicals obtained in sealed containers shall be maintained in the measurement book duly signed by GE and the contractor.

The work of anti-termite treatment shall be got executed by the contractor through an approved agency (as approved by GE) who is registered by the Pest Control Association of India (PCAI) / Indian Pest Control Association (IPCA) and have all relevant and upto date certifications for carrying out the work and holding valid licence as per clause 12 of Insecticides Act 1968 and persons employed to do the Anti-termite treatment shall be qualified as per rule 1991. The cost of anti-termite treatment is also deemed to be included in the unit rate quoted for buildings under all sections of Schedule 'A'.

With reference to Paras 6.2.2 and 6.3 of IS : 6313 (Part-II) the contractor shall note that earth filling to be done by him shall be carried out in layers not exceeding 25 cms each, watered and rammed as specified.

The contractor shall furnish 10 years guarantee for ant termite treatment. To check validity of guarantee, the following information will be inscribed on each building on a plate of size 450mm x 300mm, prepared by plastering the external plaster surface with 20 mm thick in cement and sand mortar (1:4) at such a place and in such a manner as approved by the GE. Date of expiry of guarantee shall be calculated or computed from the physical date of completion of the buildings as certified by the GE.

Anti-termite treatment carried out during

\_\_\_\_\_

Chemical used

\_\_\_\_\_

Agency who executed the work

\_\_\_\_\_

Guarantee expires on

\_\_\_\_\_

The guarantee shall be given in Performa at Appendix 'H'

The unit rates for buildings in Schedule 'A' Sections, Part I shall be deemed to have included this provision.

## 1.5 Concrete Filling / Cinder Filling

Concrete filling/cinder filling in sunken areas, if shown on drawings or specified elsewhere, shall be PCC (1:4:8) type D2 with brick aggregate not exceeding 40mm gauze. Brick aggregate shall be well graded so that after consolidation, it provides dense and compact sub base.

## 2 CONCRETE

Aggregate for all concrete work shall be from the approved sources, approved by the GE, conforming to samples, complying with the requirement as specified in para 4.4.7 (2) for grading zone I on page 53 of SSR 2009 (Part I) sand in the Zone II grading may also be permitted provided mix design is done and the requisite strength of the concrete is achieved.

### 2.1 Coarse Aggregate

Coarse aggregated shall meet the requirement specified in clause 20.B.2.6 on page 540 - 541 of SSR Part-I (2009) with following additional requirements & testings with complete satisfaction of GE:

- a) Aggregate obtained from crushed rock only shall be permitted in the Pavement Quality Concrete (PQC). Crushed gravel shall not be permitted to be used in PQC.

- b) Aggregate shall be non-reactive when tested for Alkali Aggregate Reactivity as per IS 2386 Part 7.
- c) Deleterious material content, when tested as per IS 2386 – Part 2 shall meet the requirements of IS 383.
- d) Aggregate Impact Value (AIV) of aggregate when tested as per IS 2386 Part 4, shall not exceed 24.
- e) Water absorption of coarse aggregate when tested as per IS 2386 Part 3, shall not exceed 1.0%
- f) Flakiness Index of coarse aggregate when tested as per IS: 2386 Part- 1 shall not exceed 20 percent by weight.
- g) Total chloride content as chloride ion content shall not exceed 0.06 percent by weight of aggregate and total sulphate content as sulphuric anhydride (SO<sub>3</sub>) shall not exceed 0.25 percent by weight.
- h) Sieve Analysis as per IS code.
- i) Elongation Index & Angular Number
- j) Estimation of deleterious materials
- k) Organic impurities
- l) Specific gravity: Density, Voids, Absorption & Bulking
- m) Soundness
- n) Alkali Aggregate reactivity test
- o) Mechanical properties:- Aggregate crushing value, Crushing strength(for rocks), Aggregate Abrasion value.
- p) Aggregate shall not contain pyrite/lignite.

## 2.2 Fine Aggregates

Aggregated for Dry lean Concrete and Quality Concrete works shall meet the requirement specified in clause 20.B.2.6.2 on page 540 of SSR Part-I(2009) with following additional requirements:

- a) If fine aggregate is natural sand, it shall meet the grading requirements stipulated in IS-383. The fineness modulus of fine aggregate shall neither be less than 2.0 nor greater than 3.5. Fine aggregate shall be tested for Water Absorption and Soundness once for each source of supply for its approval and subsequently as warranted by change in quality of aggregate/ quarry. Fine aggregate having Water Absorption more than 3% shall not be allowed in the

works. When tested for soundness as per IS 2386 (Part-V), loss in weight after 5 cycles shall not exceed 12 percent with Sodium sulphate solution or 18 percent with Magnesium Sulphate solution.

- b) Total chloride content expressed as chloride ion content shall not exceed 0.06 percent by weight of aggregate and total sulphate content expressed as sulphuric anhydride (SO<sub>3</sub>) shall not exceed 0.25 percent by weight
- c) The fine aggregate shall not contain deleterious substances more than the following percentages by weight of sand:

Clay Lumps:	1.0 percent
Coal & Lignite:	1.0 percent
Material passing IS sieve No 75 micron:	3.0 percent
- d) If crushed stone sand is used alone, percentage of fines passing 75 micron sieve shall not exceed 15 percent by weight of sand. If crushed stone sand is used in combination with natural sand, percentage of fines passing 75-micron sieve shall not exceed 8 percent by weight of sand.
- e) Aggregate shall be non-reactive when tested for Alkali Aggregate Reactivity as per IS 2386 Part 7.

## 2.3 Cement

Cement to be used in all types of works shall be ordinary Portland Cement Grade 43 conforming to IS:8112-1989 unless otherwise specified elsewhere.

Cement shall be procured by the contractor from the main producers of cement enumerated as per list of approved makes / agencies.

The particulars of the manufacturer/supplier of cement along with the date of manufacture shall be produced by the contractor for every lot of cement separately. The documents in support of the purchases of cement shall be produced before the GE for verification.

### 2.3.1 Testing

The contractor shall submit the manufacturer's test certificate in original along with the Test Sheet giving the result of each physical test as applicable and the chemical composition of the cement or authenticated copy thereof, duly signed by the manufacturer with each consignment clearly bringing out lot No. The GE shall record these details in the cement acceptance register after due verification. The GE shall also organize independent testing of random samples of cement drawn from various lots from the National Test House, SEMT, Regional Research Laboratories, Government approved laboratories as per IS: 3535 – 1986 (Method of sampling Hydraulic cement), IS: 4031 (Method of Physical test for Hydraulic Cement) and IS: 4032-1985 (Method of chemical analysis of Hydraulic cement).

**Following mandatory tests for every Consignment shall be carried out for cement procured by the contractor:**

- (i) Initial and final setting time
- (ii) Soundness test
- (iii) Compressive strength test at 3, 7 & 28 days as specified in relevant IS code.
- (iv) Fineness test

The cement shall conform to chemical requirements and physical requirements as specified in clause 4 & 5 respectively of IS : 269-1976. The tests carried out as per provisions of IS codes specified herein before shall be the criteria for acceptance of cement by GE. If samples from a lot/lots are not within the acceptance limits of Indian Standard the lot/lots shall be rejected without any claims or compensation to the contractor for the lot/lots purchased. The contractor shall replace the lot/lots with the fresh one, which shall be tested again for acceptance. The cost of all tests carried out on cement before acceptance for incorporation in the work shall be borne by the Contractor whether the results are acceptable or not.

### **2.3.2 Storage**

Cement shall be stored over dry platform at least 20 cm high in such a manner as to prevent deterioration due to moisture or intrusion of foreign matter. In case of store rooms, the stock should be at least 20 cm above from floors and away from walls. Inspections shall be carried out once a day by the DEPM consultant and every week by the GE. It shall be ensured by the GE that tested and untested cement are segregated and stored separately with distinct identification. The cement godown shall be provided with two locks on each door. The key of one lock at each door shall remain with the GE or his representative and that of the other lock with the contractor's authorised representative at site of works so that cement is removed from the godown only according to daily requirements with the knowledge of both the parties.

### **2.3.3 Documentation**

The contractor shall submit original vouchers from the supplier for the total quantity of cement supplied under each consignment to be incorporated in the work. All consignments received at the work site shall be inspected by GE alongwith the relevant documents before acceptance. The original vouchers and the Test Certificate shall be defaced by the GE and kept on record in the office of GE duly authenticated and with cross reference to the control number in the cement Acceptance Register (specimen for which is enclosed at appendix 'I' ) The cement Acceptance Register will be signed by GE, DEPM Consultant and the Contractor. The entire quantity of all types cement shall also be suitably recorded in the Measurement Book for record purpose before incorporation in the work and shall be signed by the DEPM Consultant, GE and the contractor.

### 2.3.4 Scheduling of Supply

Schedule of procurement of cement shall be finalised by the contractor with GE and shall be incorporated in the CPM chart so that procurement is in accordance with the progress contemplated in the CPM prepared. The complete requirement of cement shall be worked out before making any RAR payment and procurement of cement by the contractor shall be completed sufficiently in advance of the execution of work.

### 2.4 Mix of Cement Concrete

If not specified or shown on drawings, the concrete mix shall be as under :

(a)	PCC lean concrete in foundations of isolated footings, column footing, brick walls, brick pillars under brick steps and lean concrete not mentioned in (b) below.	-	PCC (1:4:8) type D-2 (by volume)
(b)	Sub base of floors except as mentioned	-	PCC (1:4:8) type D2 (by volume)
(c)	Lean concrete under floors for ramp	-	PCC (1:4:8) type D2 (by volume)
(i)	Plinth protection including toe wall	-	PCC (1:3:6) type C1 (by volume)
(ii)	PCC bed blocks, PCC bed plates and concrete filling around pipes, PCC block (Other than for hold fast).	-	PCC (1:3:6) type C1 (by volume)
(iii)	PCC blocks for hold fasts, PCC cills, coping, benching and any other PCC item not specifically mentioned elsewhere.	-	PCC (1:2:4) type B1 (by volume)

All RCC wherever shown / specified on drawings shall be of the following mix unless otherwise mentioned elsewhere.

All RCC work covered under schedule A shall be M-25 unless otherwise specified or shown on drawing. For precast structures (concrete) the design mix shall be not less than M-30 grade unless otherwise specified or shown on drawing.

#### 2.4.1 Mixing and Consolidation of Concrete

All cement concrete work e.g. in footing, walls, columns, beams, slabs, etc. shall be with batch mix concrete from automatic batching plant with printer installed at site with tested and calibrated water meter, control panel and of capacity 25-40 m<sup>3</sup> / hr. The mixing procedure, supplying, conveying, placing, etc. shall comply with IS 4925 for batching at site and IS 4926 for RMC and the specification mentioned under para 4.11 here in after. For smaller quantity i.e. for concreting to lintels, chajjas, shelves, etc., mechanical mixer with

weigh batcher may be used with approval of the GE and mixing of concrete shall be as per clause 10.3 of IS:456-2000.

Mechanical vibrators shall be used for consolidation/ compaction of all reinforced cement concrete. Consolidation by tamping may be resorted to with prior permission of GE in writing in locations where it is not practicable in the opinion of the GE to operate the vibrator. Care shall be taken to ensure that concrete is not over vibrated so as to cause segregation/ bleeding.

## 2.5 Casting of Concrete

RCC/PCC Cills, RCC lintels (except these with chajjas), RCC shelves and fins may be cast-in-situ or precast at the discretion of the contractor without any extra cost.

## 2.6 Design Mix Concrete

Where concrete is specified by grade that is M-20, M-25 & M-30, the same shall be of design mix all as per clause 9.2 of IS-456 – 2000, IS-10262-1982, SP-23 (S&T) 1982 and as specified herein after.

As soon as possible, after receiving the order to commence the work, the contractor shall procure sufficient quantities of the aggregate and cement and submit samples to any approved laboratory for testing and mix design.

The optimum mix to achieve the Target mean strength shall be determined in the laboratory conditions. The concrete shall conform to the following specifications :

	Specification required	Grade of Concrete		
		M-20	M-25	M-30
(a)	Slump (mm)	50-90	50-90	50-100
(b)	Permissible maximum water cement ratio	0.55	0.50	0.45
(c)	28 days characteristic strength (N/mm <sup>2</sup> )	20	25	30
(d)	28 days target Mean Strength (N/mm <sup>2</sup> )	26.60	31.60	38.75

### 2.6.1 Mixing by Volume / Weight

For controlled quality concrete of mix M-30, M-25 & M-20 only Automatic batching plant (with printer) will be adopted. No volume batching will be allowed for mix M-30, M-25 & M-20.

**2.7 Minimum Cement Content**

Minimum Cement Content for M-30, M-25 and M-20 grade of concrete shall be 350 Kg/cum, 340 Kg/cum and 320 Kg/cum respectively. The minimum cement content as mentioned above shall be provided even if the laboratory mix design gives lesser quantity of cement. If actual quantity of cement used as per mix design is more than the above minimum required, no price adjustment shall be made.

**2.8 Batching**

In proportioning concrete, the quantity of both cement and aggregate shall be determined by mass and all in accordance with clause 10.2 and sub clauses of IS-456: 2000.

**2.9 Trial Mixes**

The actual mix proportion will be arrived at by means of a number of trial mixes by changing the water cement ratio, proportions of fine and coarse aggregate, fineness module of aggregate by changing their grading and preparations etc. Attempts shall be made to make the mix design as economical as possible.

**2.10 Sampling**

The sampling procedure and the frequency of sampling shall be as per clause 15.2 of IS:456-2000.

**2.10.1 Test Specimen**

All test specimen shall be 150mm cubes. For each sample, six cubes shall be cast out of which three cubes each shall be tested for 7 days and 28 days compressive strength respectively. The specimen shall be tested as described in IS: 516 – 1959. If the pouring (concrete) distance is more than 100 meter from the batching plant, the specimens shall be casted in the pouring site only.

**2.10.2 Acceptance Criteria**

The acceptance criteria of the test results shall be as laid down in clause 16 of IS-456: 2000.

**2.10.3 Workability**

The workability of the concrete shall be checked frequently as per IS: 1199: 1959 (Methods of sampling and analysis of concrete).

**2.10.4 Change of Mix Design**

During the progress of work, mix design will have to be changed if there is change in the qualities and source of the ingredients of the concrete.



### 2.10.5 Packing and Transportation of Samples

The contractor must, at his own expenses, properly pack the samples. The contractor shall bear the cost of transportation of the samples required to be tested, from site of work to the laboratory as advised by the GE or any other laboratory.

### 2.10.6 Site Laboratory

The contractor shall establish a laboratory at site of work. The details of Lab equipment are attached separately.

### 2.11 Concrete Mix Proportioning

The mix proportion shall be selected to ensure the mix workability of the fresh concrete is suitable for the conditions of handling and placing so that after compaction it surrounds all reinforcements and completely fills the formwork. When concrete is hardened, it shall have the required strength, durability and surface finish as per relevant clauses of IS: 456-2000. The compaction of concrete in RCC roof and floor slabs shall be done with plate vibrators.

### 2.12 Ready Mix Concrete

Ready mix concrete (RMC) shall conform to IS:4926. For RMC, the contractor shall submit the following to GE and obtain approval.

- (i) Mix design including names of suppliers /Zone/Area from whom raw materials are to be procured.
- (ii) Technical details of batching plant.
- (iii) Location of batching plant and details of transportation of concrete by transit mixers.
- (iv) Brief details of projects where RMC have been used from the proposed manufacturer/ Plant.

**Mixing** .-Thorough mixing is essential for production of uniform concrete. Equipment and methods used shall be capable of effectively mixing concrete materials to produce uniform mixes of the lowest slump practical for the work.

Mixers both stationary and truck mounted shall be so charged that there is a preblending of the ingredients as the stream flows into the mixer.

Water shall enter the mixer first, but must continue to flow while other ingredients are entering the mixer. Water charging pipes shall be of proper design and of adequate size so that water enters at a point well inside the mixer. Water charging shall be complete within the first 25% of the mixing time.

Cement shall be charged along with other materials, but it shall be ensured that cement enters the stream after approximately 10% of the aggregate is in the mixer. When it is necessary to charge cement into truck mixers

separately, additional mixing time shall be allowed to obtain desired uniformity to mix.

Admixtures shall be charged to the mixer at the same time in the mixing sequence for every batch. Liquid admixtures shall be charged with the water. Powdered admixtures shall be sprinkled into the mixer with other dry ingredients. When more than one admixture is used, they shall be batched separately and they shall not be premixed before entering the mixer.

Mixer performance checks shall be made at regular intervals to ensure uniformity of the concrete. Visual examination of the concrete shall be one of the aids for maintaining and checking mixer performance.

Results of tests on air content, slump unit weight of air free mortar shall be guide lines on mixer performance.

Mixing time shall be measured from the time all ingredients are in the mixer.

Mixing time shall be established from mixer performance tests conducted at frequent intervals throughout the period of the works. However, as an initial guide, mixer manufacturer's recommendation may be followed. Other guide line being 1.33 mins. for 1 cum capacity of mixer and 0.33 min for every additional 1 cum of mixer capacity.

Mixer shall be designed to have audible indicators and combination inter locks which prevent mixer discharge prior to completion of a preset mixing time. Mixer shall also be designed to start and stop operation with full load.

Provided that design water - cement ratio is not exceeded, small increments of retempering water may be added to mixed batches to obtain the desired slump.

Addition of water in excess of designed water - cement ratio to compensate for slump loss resulting from delays in delivery or placing of concrete shall not be permitted.

Batch to batch uniformity of concrete with regard to slump, water requirement and air content is dependant on temperature of concrete. It shall, therefore, be ensured that the maximum and minimum temperatures of concrete throughout all seasons of the year do not vary beyond the limits given below :

Maximum : 30°C

Minimum : 20°C

Necessary measures shall be taken to lower or raise the temperature of water to maintain the mixed concrete between the specified temperature limits.

Mixer shall be capable of and handled properly so that concrete of lowest desired slump can be effectively discharged without causing segregation.

Ready - Mix concrete may be :-

- mixed in a central plant and transported to the job in agitating or non-agitating truck bodies.
- mixed entirely in transit.
- mixed entirely after reaching the job site.
- mixed partially in a central plant and completed in transit or after reaching the job site (shrink mixing).

In ready mix concrete, special attention shall be given to the addition of mixing water quantity, which if incorrect, shall result in reduction of concrete quality.

Concrete consistency (Slump) is also affected by :-

- amount and rate of mixing. length of haul
- time period for unloading
- temperature conditions.

In cool weather or short haul and with prompt delivery, concrete quality may not be significantly affected. But with reverse conditions, quality of concrete may be significantly affected.

Addition of water to compensate for slump loss shall not exceed that quantity necessary to compensate for a maximum 25mm slump loss. However, by this additional quantity of water, the design water cement ratio shall not be exceeded.

Loss in workability in warm weather shall be minimised by expediting delivery and placement, and by controlling the concrete temperature.

If it becomes necessary to use retarders to prolong the time the concrete will respond to vibrations after placement, prior approval shall be obtained from GE for their use.

In hot weather conditions or delays in delivery/placement, use may be made of the procedure of withholding some of the mixing water till the mixer arrives at the job site. In such cases, after addition of the balance (withheld) quantity of water, an additional 30 revolutions of mixer at mixing speed shall be given to adequately incorporate the additional water into the mix.

When loss of slump or workability cannot be controlled by measures stated above, complete mixing shall be done at the job site using centrally dry batched ingredients.

### **2.12.1 Supply and placing of ready-mix concrete**

Responsibility of in-place quality of ready-mix concrete shall be shared by the manufacturer/ supplier of ready mix concrete and the placing contractor. They shall work in close coordination. The placing crew shall be in direct radio/telecommunication contact with the batching plant to ensure :-

Avoidance of delay in dispatching concrete from batching plant, inform batching plant delays in formwork, reinforcement work, handling or placing.

The placement contractor shall give in writing his requirement of a particular batch of concrete to the supplier.

The ready-mix concrete manufacturer/supplier shall, along with each batch of concrete delivered to the placement contractor, give him a concrete delivery ticket along with the batch sheet showings the material consumption details.

The supplier shall give copies of all such delivery tickets and batch sheet to the GE for his record and also shall get duplicate copies of all such delivery tickets duly received and signed from the placement contractor.

Ready mixed concrete as supplied by the manufacturer and as placed by the contractor shall in no way be different from the specifications of concrete as approved by the GE.

Fresh concrete can be transported to the placement area by a variety of methods. Common among them are :-Mixer trucks.

Stationary truck bodies with or without agitators:- Buckets hauled by trucks. Conveyor belts. Hose or pipe line by pumping. Each type of transportation has specific advantages and limitations depending on the condition of use, mix, accessibility and location of placing.

#### **Transportation by mixer trucks**

These are essentially revolving drums mounted on truck chassis. Truck mixers used in the job shall be labeled permanently to indicate the manufacture specifications for mixing like : - Capacity of drum.

- Total number of drum revolutions required for complete mixing.
- Mixing speed
- Maximum time limit before completion of discharge and after cement has entered the drum.
- Reduction in time period of discharge.
- Due to warm weather or other variables.
- All above information shall only form guidelines for the manufacture/producer of concrete.

Fulfillment of the stipulated number of revolutions or elapsed time shall not be acceptable criterion. As long as the mixing water limit is not exceeded and the concrete has satisfactory plastic physical properties and is of satisfactory consistency and homogeneity for satisfactory placement and consolidation and is without initial set, the concrete shall be acceptable.

When the concrete is totally mixed in transporting trucks or in case of shrink-mix concrete, volume of concrete being transported shall not exceed 63% of the rated capacity of the drum. In case the concrete is totally mixed in the central batching plant, the transporting truck may be loaded upto 80% of the rated capacity of the drum. In this case the drum shall be rotated at charging speed during loading and reduced to agitating speed after loading is complete.

When transporting concrete by truck mixers, delivery time shall be restricted to 1.50 hours from the time cement has entered the mixer to completion of discharge.

Transporting by agitating/non-agitating trucks

Transporting ready mix concrete by this method shall consist of truck chassis mounted with open top bodies. The metal body shall be smooth and streamlined for easy discharge. Discharge may be from the rear when the body is mechanically tilted. Body of the truck shall have a provision of discharge gate. Mechanical vibrators shall be installed at the discharge gate for control of discharge flow.

Agitators, if mounted, also aid in the discharging of concrete from the truck in addition to keeping the concrete alive.

Water shall not be added to concrete in transport in this system.

Bodies of trucks shall be provided with protective covers during period of inclement weather.

Delivery period, when adopting this system of transporting, concrete shall be restricted to 30 minutes from the moment all ingredients including cement and water enters in mixer to completion of discharge.

#### **Transporting by buckets**

This method of transportation is very common for transportation of centrally mixed concrete. Buckets of suitable capacities may be fitted with concrete which is totally mixed in central plant and hauled to the job site. Buckets then may be conveyed to the actual point of placement either with the help of crane/ hoist or they may be carted.

As in the case of open truck transportation, water shall not be added to concrete transported in buckets. Concrete shall be protected from inclement weather by necessary covering arrangements. Also, maximum delivery period for this system of transportation from the time cement is introduced into the mixer to completion of discharge shall not exceed 30 minutes.

Before loading concrete in either truck mixer, open bodied trucks or buckets, the containers shall be thoroughly cleaned, washed and dried, so that there is no water or moisture in the container which may affect the designed water content of the concrete.

#### **Other methods of transportation**

Transportation of concrete either by belt conveyors or by pumping is envisaged in this work.

If, however, producer/manufacturer/purchaser of ready mix concrete desires to use such methods of transportation, they may do so provided their scheme

and complete specifications are submitted to the GE for his record and approval.

Method of transportation used shall ensure -  
Efficient delivery of concrete.

- No significant alteration of properties with regard to water cement ratio, slump, air content and homogeneity.

All variables in transportation, considering type and accessibility of placement locations, distance, time interval etc. shall be carefully studied before arriving at the method used.

### **2.12.2 Placing Concrete by Pumping Methods**

Concrete conveyed by pressure through either rigid pipes or flexible hoses and discharged directly into the desired area is termed as pumped concrete. The method of conveying the concrete through pipe lines is dealt with in these specifications.

Method of applying pressure to concrete is by pumps. Pumps to be used shall be either of the two types as mentioned below : -

- (a) Piston type pumps
- (b) Squeeze pressure type pumps.

Piston pump to be used in the works shall consist of a receiving hopper for mixed concrete, an inlet valve, an outlet valve, and the pump shall be a twin - piston pump. The two pistons shall be so arranged that one piston retracts when the other is moving forward and pushing concrete into the pipe line to maintain a reasonably steady flow of concrete. Single piston pumps shall not be acceptable.

Inlet and outlet valves shall be any one of the following types :-

Rotating plug type Sliding plate type Guided plunger type Swing type Flapper type or any combination of the above.

The pistons shall be mechanically driven using a crank or chain or hydraulically driven using oil or water.

The receiving hopper shall have a minimum capacity of 1.0 cum and the hopper shall be fitted with remixing rotating blades capable of maintaining consistency and uniformity of concrete. The primary power for pumps may be supplied by gasoline, diesel, or electric motors. The primary power unit and the pump unit may be truck, trailer or skid mounted.

Squeeze pressure pumps shall consist of a receiving hopper fitted with remixing blades. Re-mixing blades shall be such that these can push the concrete into the flexible hose connected at the bottom of the hopper.

The flexible hose shall pass through a metal drum around the inside periphery of the drum and come out through the top part of the drum.

The drum shall be maintained under a very high degree of a vacuum during operation. The drum shall be so fitted with hydraulically operation metal rollers, which when rotating, create a squeeze pressure on the flexible hose carrying concrete and forces the concrete out into the pipe line.

Effective range of pumps to be used in the work shall be decided by the contractors after studying the site conditions. However, the minimum horizontal range shall not be less than 150 metres and minimum vertical range shall not be less than 50 metres.

Selection of pumps based on discharge capacity shall be decided by the contractors after studying the requirements for the project. Discharge capacity shall be worked out by the contractors and approval obtained from the GE. As a guide line figure the contractors may assume a discharge capacity of 15 cubic metre/hour/pump.

### **2.12.3 Pipe Lines**

All concrete carrying pipe lines shall generally be rigid pipe lines. Flexible pipe lines may only be used at bend curves in lines or at discharge ends if required. Placements of flexible units shall be done judiciously and connected to the pipe lines only when it meets the approval of the GE.

Rigid Line/Hard Line/ Slick Line : Such Lines shall be made either of steel or plastic. Aluminium alloy pipes shall not be used.

Minimum pipeline diameter shall be 100 millimeters and shall have normal maximum length of 3 metre in each section connected through couplers.

Flexible Pipe Line : Flexible lines shall be made out of rubber or spiral wound flexible metal or plastic. The pipe shall again be such that they are in Sections of 3 metre length each and connected through couplers. These pipes shall be such that they are interchangeable with rigid lines. While installing flexible units, care shall be taken that there are no links in the pipeline, which is a normal tendency with these pipes having diameters 10mm and above

Couplers to be used for connecting pipeline sections (either hard or flexible) shall have adequate strength to withstand stresses due to handling, misalignments poor support to pipe lines etc.

For horizontal runs of pipes and for vertical runs up to 30-metre height the couplers shall be rated for a minimum pressure of 35 kg/cm square. Couplers used for rising runs between 30 metre and 50 metre heights shall have a minimum pressure rating of 50 kg/cm square. Couplers shall be designed to allow for replacement of any pipe section without displacing other sections. These shall provide for the full internal cross section with no constructions or service, which may disrupt the smooth flow of concrete. For pipelines of size

150mm and above, double logged type coupler with a thick rubber gasket and secondary wedge-take-up is recommended. Types of couplers that may be used shall be any of the following : -

- Grooved end coupler
- One piece extended lever swing type couplers
- And full flow oil line type couplers.

#### **Other Accessories**

Other accessories which shall be catered for, are as under: -

- Rigid and flexible pipes of varying lengths
- Curved sections of rigid pipes
- Swivel joints and rotary distributors
- Pin and gate valves to prevent back flow in pipelines
- Switch values to direct the flow into another pipeline
- Connection devices to fill forms from the bottom up
- Splints, rollers, and other devices for protection of conduit over rock concrete Reinforcing steel and form and to provide lifting and lashing points in the pipe line.
- Transitions for connecting different sizes of pipe sections
- Air vents for downward pumping.
- Clean out equipment.

For concreting of columns, walls and scattered small placements, recommendation is made for special cranes or power controlled booms carrying pipelines with a pendant type concrete delivery hose.

#### **2.12.4 Lubricating of Pipe Line**

Before pumping concrete into the pipeline, the line shall be lubricated with a properly designed mortar/grout lubricant. This shall be ensured by starting the pumping operation with a properly designed mortar, or with a batch of regular concrete with the coarse aggregate omitted. The quantity of mortar required as lubricant is dependent on the smoothness and cleanliness of the pipelines. As a guide line, for a 100mm diameter pipe line of 100metre length, 0.08 cum to 0.10 cum of mortar should normally be adequate, but this shall not be taken as specified, and the contractor shall establish his requirement.

The quantity of mortar that comes out of the delivery end of the pipeline shall not be used in place of the concrete work. However, with the approval of GE, this mortar may be used as bedding mortar against construction joints. The rest of the mortar shall be wasted.

Lubrication shall be maintained as long as the pumping of concrete continues.

Proper planning of concrete supply, pump locations, line layout, placing sequence and the entire pumping operation will result in savings of time and expense.

The pump shall be placed as near the placement area as practicable. The surrounding area of the pump shall be free of obstructions to allow for movement of concrete delivery trucks. The surface must be strong enough to



withstand the loaded trucks operating on it. If the surface is a suspended slab, the truck route shall be adequately supported in consultation with the GE.

Pipe lines from the pump to the placing area shall be laid with minimum number of bends. For large placement areas, alternate lines shall be installed for rapid connection when required. A flexible pipe at the discharge end will permit placing over a large area directly without rehandling of pipelines. The pipeline shall firmly supported.

If more than one size of pipe must be used, the smaller diameter pipe shall be placed at the pump end and the larger diameter at the discharge end.

When pumping downwards, an air release valve shall be provided at the middle of the top bend to prevent vacuum or air buildup. Similarly, while pumping upwards, a no-return valve shall be provided near the pump to prevent the reverse flow of concrete during the fitting of clean up equipments or when working on the pump.

It is essential that direct radio/telecommunication be maintained between the pump operator and the concrete placing crew. Good communication between the pump operator and the batching-plant is also essential. The placing rate shall be estimated by the pump operator so that concrete can be ordered at an appropriate delivery rate.

The pump shall be started for a check run and operated without concrete to ensure that all moving parts are in operation properly. Before placing concrete, the pump shall be run with some grout/l mortar for lubricating the line.

When concrete is received in the hopper, the pump shall be run slowly until the lines are completely full and the concrete is steadily moving. A continuous pumping must be ensured, because, if the pump is stopped, concrete in the line may be difficult to move again.

When a delay occurs because of concrete delivery or some form repair works or for any other reason, the pump shall be slowed down to maintain some movement of concrete in the pipeline. For longer delays, concrete in the receiving hopper shall be made to last as possible by moving the concrete in the lines occasionally with intermittent strokes of the pump. It is sometimes essential to run a return line back to the j pump so that concrete can be re-circulated during long delays.

If after a long delay, concrete cannot be moved in the line, it may be necessary to clean out the entire line. However, quite often only a small section of pipeline may be plugged and required cleaning. The pump operator who know such details as the length of line, age of concrete in the line etc., should be I, dependent upon to aid in deciding the appropriate section to be cleaned.

When the form is nearly full, and there is enough concrete in the line to complete the placement, the pump shall be stopped and a "go-devil" inserted

at the appropriate time so that concrete ahead of the go-devil shall be forced completion of the work. The go-devil shall be forced through the pipeline to clean it out. Use of water pressure is a safer method. The go-devil shall be stopped at the -discharge end to ensure that water does not spill on the placement area. If air pressure is used, extreme care shall be taken and the pressure must be carefully regulated. A trap shall be installed at the end of the line to prevent the go-devil being ejected as a dangerous projectile. An air release valve shall also be installed in the line to prevent air pressure build up.

It is essential to clean the line after concrete placing operation is complete. Cleaning shall be done in the reverse direction from the form work end to the pump-end where the concrete in the line can be dumped in a bucket. After removal of all concrete, all pipe lines and other equipments shall be cleaned thoroughly and made ready for the next use.

### **2.13 Concrete Surfacing**

Exposed surfaces of all RCC work such as soffit of roof/floor slab, sides & bottom of beams, lintels, seismic bands, shelves & RCC railing / parapets etc. unless otherwise specified hereinafter in particular specification shall be provided with a coat of 5mm thick plaster in cement and sand mortar (1:3) finished even and smooth. In case this thickness of plaster exceeds 5mm at places due to local unevenness, no extra payment is admissible. The exposed surfaces of columns, beams, lintels and the like coming in conjunction with plastered surfaces shall be plastered as specified in plastering section. Sand for plaster shall be 50% coarse sand and 50% fine sand. The term exposed surfaces does not include the surfaces hidden under earth filling etc. and in such cases irregularities, protruding form work marks shall be removed and air holes, if any, shall be stopped with cement and sand mortar (1:3). Cost of above provisions shall be deemed to be included in the contractors quoted rates.

### **2.14 Work In Extreme Weather Conditions**

Work in extreme weather condition (hot or cold) shall be carried out as per clause 14.2 of IS: 456 – 2000 and IS 7861 – 1975 (part-I) for hot weather concreting and IS 7861 – 1985 (part-II) for Cold weather concreting.

### **2.15 Plinth Protection**

Plinth protection, unless and otherwise shown on drawings shall be 75mm thick and mix of concrete not less than (1:3:6). 75mm Hard core of 40mm graded stone aggregate and well compacted over rammed earth and shall be finished even and fair with steel trowel without using extra cement. Plinth protection shall be laid to a slope of 1 in 24 in alternate bays system. Each bay shall not exceed 3 metre in length. 12mm wide and 7.5 mm deep joint shall be formed between the bays which shall be filled with mastic filling to full depth, comprising a mixture of one part of heated hot blown bitumen 85/25 Penetration and two parts of heated coarse sand (by volume). The toe of plinth protection of size 75mm deep and 75mm wide shall also be of PCC

1:3:6 type C-2 and shall be provided in buildings irrespective of whether shown on drawings or not.

Construction joints in plinth protection shall be as per clause 13.4 of IS:456-2000 and IS:11817. Concreting shall be carried out continuously upto the construction joint and prior to start of concreting written approval shall have to be obtained from the GE.

## 2.16 Expansion joints (In Building)

Before commencement of work, shop drawings showing location of each type of joint shall be submitted for approval. Detailed shop drawings on this basis suited to the exact site conditions and dimensions for each separate area shall be prepared by the Contractor and got approved by the PMC/GE well before proceeding with the work.

### 2.16.1 Metal Expansion Joint

- (i) Where shown on the drawings, joints in the structural Aluminium and Aluminium – alloy sheet & plate shall be conforming to ASTM B209.
- (ii) The metal expansion joint shall accommodate upto + 50% of the joint – width movement. It shall have multi direction seismic control features, jerk free system and spring centering system, suited for new jobs. In addition to this it shall provide a low profile expansion joint system to accommodate new construction. It shall have provision of moisture barrier membrane in the joint system to have water tight joint and is a mandatory requirement.

Jointing (mm)	Movement (mm)	Total Movement (mm)	System Width (mm)	
			Floor to Floor	Floor To all
50	+ 25	50	200	125
100	+ 50	100	250	250
125	+ 62.5	125	250	300

- (iii) All Joint components shall be shop assembled and provided with required anchors and fittings. Assembled component shall be provided in single length.
- (iv) The material shall be protected from damage after it is delivered for the installation to final construction/ complete installation of joints. Adequate precautions shall be taken to ensure safe keeping of material at the store. The protective covers/ material on the joints shall not be removed till the finishing work in adjoining area is completed. When the protective material is removed, the exposed metal surface shall be cleaned to comply with as per the specification or manufacturer's instruction.
- (v) For floor to floor condition, the joints shall comprise of aluminium extrusion on the adjoining slab with anchor fasteners @ 300 c/c,

grouted with non shrink compound. Water proofing moisture barrier membrane in between the joints with proper drainage system at the end , shall be provided below the aluminium extrusion section, throughout the joints to make the section water tight. Aluminium Cover plate of 3mm thick shall be fixed with Turn up bar with counter sunk screws @ 450 c/c at the top of the extrusion section.

- (vi) For floor to wall condition, the joints shall comprise of aluminium extrusion on the adjoining slab with anchor fastener @ 300 c/c, grouted with non shrink compound. Aluminium angle shall be provided with self tapping screw with plastic insert @ 300 c/c .Water proofing moisture barrier membrane in between the wall and floor joints with proper drainage system at the end, shall be provided between the wall and floor, throughout the joints to make the section water seal. Aluminium Cover plate of 3mm thick shall be fixed with Turn up bar with counter sunk screw@ 450 c/c at the top of the extrusion section and aluminium angle.
- (vii) For roof level condition, the joint shall be protected from water ingress by providing double wall and coping fixed on one wall and simply supported on the other by keeping separation with Shalitek board and sealing the joint with Polysulphide sealant all as shown on drawing. Individual component as mentioned above shall be paid for separately in the respective items of BOQ.
- (viii) The interior straight system cover plate shall be 3mm with thick straight 1800 vertical pieces with counter sunk hole @ 300 c/c in one side and slotted hole with other side. The cover plate shall be fixed with concrete surface with plastic inserted anchor through these holes.
- (ix) For exterior straight system, the cover plate shall be 3mm with thick straight 1800 vertical pieces with counter sunk hole @ 300 c/c in one side and slotted hole with other side. The cover plate shall be fixed with concrete surface with plastic inserted anchor through these holes. Water proofing moisture barrier membrane in between the Concrete structure and cover plate with proper drainage system at the end shall throughout the joints to make the section water seal.

## 2.17 Form Work

Formwork shall be as per clause 11 of of IS-456-2000 & IS:14687.

Formwork shall be of plywood or steel of adequate strength. However, the form work to be used for surfaces specified in these specifications to be plastered shall be such that after application of the specified thickness, fair finished surface is achieved as specified herein. Wall thickness shall not be made use of as formwork. Wall shall be built after the columns are casted.

Form work shall be provided to vertical sides of column pedestals as necessary and as directed by GE. Slopped portion and RCC column footing if

any, under brick work shall be filled with PCC (1:5:10) type E-2 to maintain continuity and level of brick work.

Scaffolding, supporting the formwork shall be of mild steel with adjustable stirrups head made out of 32mm/36mm dia M.S. round and "U" head made out of 100 x 6mm M.S. Plate, suitable to place on 40mm /50mm NB pipe. Props supporting the slab shall be telescopic type with fixed base plate made out of 150mm x 150mm x 6mm square M.S. Plate.

Prior to the work, the contractor shall submit the shuttering design to the GE / DEPMC for the approval.

Shuttering of RCC cantilever canopy / chajja shall not be removed unless counter balancing load have been imposed.

## **2.18 Curing**

Curing of RCC / PCC shall be as per clause 13.5 of IS:456-2000.

## **3 BRICK WORK**

### **3.1 Materials**

The bricks of type Common Burnt Clay shall be of best quality locally available and shall have minimum compressive strength of 75 Kg per sqcm and shall conform to IS:1077. It shall be hand moulded or machine moulded and shall be free from nodules of free lime, visible cracks, flaws warpage and organic matter, have a frog 100 mm in length 40 mm in width and 10 mm to 20 mm deep on one of its flat sides. Bricks made by extrusion process. Each brick shall be marked (in the frog where provided) with the manufacturer's identification mark.

Testing of the bricks shall be carried out in accordance with procedures listed in IS:13757-1993. Frequency of tests shall be as per IS: 1077 and IS:5454.

Fine aggregate for mortar in all the brickwork shall be coarse sand.

### **3.2 Workmanship**

All brick work unless mentioned otherwise in particular specifications shall be built in CM (1:6) except half brick walls, brick on edge walls, brick bonds, brick pillars (isolated), brick steps, brick fins which shall be built in cement and sand mortar (1:4).

Unless otherwise shown on drawings all brick work in half brick walls shall be built from sub floor level in ground floor and from RCC slabs in subsequent floors. All Half brick wall shall be reinforced with 2 Nos. 8mm dia TOR steel at every fourth course above DPC/floor slab. These bars shall be extended into

the junctions with adjoining walls / columns for a minimum length of 75 mm. Laps shall be 300 mm.

Nominal width of brick shall be considered 115 mm/ 125mm as the case may be.

For full brick wall more than 5m length shall have mullions of size 230mm x 230mm and half brick walls more than 3000 mm in length, vertical RCC bands of size 115 mm x thickness of the wall shall be provided at maximum 3000 mm c/c spacing. The vertical bands shall be reinforced with 4 nos. 8mm TOR reinforcement bars with 8mm TOR links at 100 mm/cc. No foundation shall be provided for these vertical bands. The vertical 8mm bar shall, however, be anchored into the slabs / beams / lintels both at the top and at the bottom. The anchorage length shall be 200 mm minimum.

2 nos. 12mm TOR bars shall be provided longitudinally in RCC floor slabs where half brick walls are supported on them.

Bearings of all slabs on load bearing masonry walls shall be for the full thickness of wall.

### **3.3 Thickness Of Brick Wall / Pillar & Concrete Members**

Width of concrete lintels, beams, cills, columns and the like coming in conjunction with brick walls/pillars shall be kept to the actual width of brick work unless off sets have been specifically shown, in case width as shown on drawings shall be maintained.

The walls shall be laid out strictly as per drawings. Before carrying out the brick work the layout of the brickwork shall be done and got approved from the GE and changes instructed incorporated.

Mortar bed joints shall be such that four courses of brickwork and three joints taken consecutively shall measure 3 to 4cm in addition to the combined height of the brick themselves. Accordingly, the provision under clause 5.26 on page 5-6 of SSR (Part I) shall not be made applicable to this contract and no price adjustment shall be done on this account. However, in the case of half brick walls where reinforcement has been specified herein above such four courses will be selected between the horizontal joints having the reinforcement.

Thickness of brick walls/pillars shown on drawings as 115mm, 125mm, 230mm, 250mm, 345mm and 375mm for half brick wall, one brick wall and one & half brick wall respectively, shall be deemed to have been amended to the thickness obtainable with the use of bricks as specified herein before without adjustment in prices.

For brickwork, where two walls are constructed to form insulated double wall, both the walls are to be tied intermediately together as required.

#### **3.3.A PRECAST PCC SOLID BLOCK MASONRY**

The masonry work shall be in PCC solid blocks. PCC solid blocks shall conform to IS-2185.

**Type of mix** :- The precast PCC solid block shall be of PCC (1:5:8) ie. One part cement, five part sand and eight part aggregates (05 part 20mm and 03 part 12.5mm stone aggregates). Aggregates shall be mixed thoroughly to achieve desired grading. PCC blocks with above mix shall be checked and verified for 28 days compressive strength as per IS 2185 at the commencement of work and whenever there is change in source of ingredients. The block shall have minimum compressive strength of 50 Kg/cm<sup>2</sup>.

The mix ratio as given is minimum and is only for guidance. Trial mixes shall be carried out before casting the blocks to ensure that the required strength and block density is achieved as per IS. In case superior mix ratio is required to achieve the desired strength, nothing extra will be paid to contractor on this account.

**Size**: The block shall be one of the following sizes:-

SI No.	Nominal size in cm			Actual size in cm		
	Length	Breadth	Height	Length	Breadth	Height
1	40	20	20	39	20	19
2	40	10	20	39	10	19
3	20	20	20	19	20	19
4	20	10	20	19	10	19

Size other than those specified above may also be used with the approval of Engineer-in-charge/GE.

### **MATERIAL (AGGREGATE)**

**Coarse aggregate** These shall be crushed or natural aggregates 20 mm and down size of approved quality and shall conform to IS-383.

**Fine aggregates (sand)** - This shall be free from dust and well graded.

A block shall be deemed to be solid if the solid material is not less than 75% of the total volume of the block calculated from the overall dimension.

### **MANUFACTURE OF BLOCKS**

The block shall be machine made. The mixing of concretes, manufacture of block, curing and drying shall be in accordance with the Para 6 to 10 of IS-2185.

Faces of the block shall be flat and rectangular.

**Mixing** – Concrete shall be mixed in mechanical mixer. Mixing shall be continued until there is uniform distribution of material and the mix is uniform in colour and consistent.

### **Placing and compaction**

- I. In case of mechanical compaction, the mould shall be filled up to over flow, vibrated or mechanically tamped and struck off level.
- II. After remolding the block shall be protected until they are sufficiently hardened to permit handling without damage.

**Curing**- The block hardened as mentioned here in before shall then be cured in the curing water tank or in curing yard and shall be kept continuously moist for at least 14

days. Where the blocks are cured in an immersion tank, the water of tank shall be changed at least every 4 days.

**Note:-** Curing yard is a paved yard sub divided by shallow drains 4 to 5 metre, Square platform which are provided with water fountain in the centre. The blocks are stacked on the platform around the fountain, which works continuously. The fountain is connected to an elevated water storage tank.

**Drying:-** After curing the block shall be dried for a period of 4 week before being used in the work. They shall be stacked with voids horizontal to facilitate thorough passage of air. The dimensioned stability of concrete block is greatly affected by variation in their moisture content. Since the shrinkage of the block is much greater at the time it dries for the first time than due to subsequently wetting and re drying, it is necessary to ensure that the blocks are dried so that initial shrinkage is completed before they are delivered to use. Further their moisture content should not exceed 25% of their maximum water absorption capacity, if the blocks are to be used in situation where the relative humidity of air average more than 60% the blocks can be dried to a moisture content of 40 % of their maximum water absorption capacity.

### **PHYSICAL REQUIREMENT**

**General:-** All blocks shall be sound and free from cracks or other defects which interfere with proper placing of the block or impair the strength or performance of the construction. Minor chipping resulting from the customary methods handling during delivery shall not be deemed the ground for rejection.

**Tolerance:-** The maximum variation in the length of the units shall not be more than  $\pm 5$ mm for length and maximum variation in heights and width of unit, not more than  $\pm 3$ mm.

**Block Density:-** The block density shall be as per Para 4 of IS 2185 for solid PCC blocks. It shall not be less than 1800 kg/M<sup>3</sup>.

**Compressive strength:-** The average compressive strength of eight blocks when determined in the manner described in IS-2185 shall not be less than 50 kg/sq cm of gross area. The strength of lowest individual block shall be not less than 80% of the average compressive strength of eight blocks.

**Water Absorption:-** The water absorption shall be as per IS-2185.

Drying shrinkage and moisture movement shall be as per IS 2185.

**TESTS :-** Tests as described in appendices 'A' to 'F' of IS-2185 shall be conducted on samples of blocks selected according to the samples procedure given in Para 1(c) of IS-2185 to ensure conformity with the physical requirement laid down in Para 8 of IS-2185. Cost of testing such as transportation, casting of block, testing fee and other expenses shall be borne by the contractor. The tests listed in Appendix 'A' to IS-2185 shall be conducted from the laboratory as approved by GE and other tests shall be carried out as listed in Appendix 'C' to Particular Specifications.

### **SAMPLING CRITERIA FOR CONFORMITY**

The blocks required for carrying out the test laid down in standard shall be taken by one of the method given in Para 10 of IS-2185 and shall be considered as conforming to the requirements of the specifications, if the conditions mentioned in Para 11.2 to 11.5 of IS 2185 are satisfied.

### **PRECAST PCC SOLID BLOCK WALLING:**

20cm thick PCC solid block walling shall be built in cement mortar (1:6). 10cm thick PCC solid block walling shall be built in cement mortar (1:4).



**LAYING**:-The block shall be slightly wetted before & during laying in the wall. The block shall be laid with mortar joints completely filled without any void left in the masonry. The thickness of the horizontal and vertical joints shall not exceed 1cm. The 1/2, 1/3 and 2/3 blocks shall be used for breaking the joints. The face joints shall be raked to a depth of 1cm by raking tool during the progress of the work, when the mortar is still green so as to provide proper key for plaster or to facilitate pointing to be done later. Where plaster or pointing is not required the joints shall be struck flush and finished side by side.

**CURING OF WALLING**-Masonry work shall be kept constantly moist on all the faces for a minimum period of 7 days.

**SCAFFOLDING FOR WALLING** Only double scaffolding shall be used. The scaffolding shall be strong and sound. No holes in the masonry for supporting scaffolding will be allowed.

230/115 mm thick walls wherever shown on drawings shall be 200/100 mm thick precast solid block walling. Dowel bars (connecting bars) shall be provided in the adjoining RCC columns all as specified.

All 10cm thick partition walls shall rest on sub base of the floor in ground floor or as shown on drawing and on RCC slab in first floor. 10cm thick partition wall/column shall be properly bonded at ends into adjoining wall/column. RCC bands in walls shall be provided at the locations as per provisions given in drawings.

- a) RCC band at lintel level for the entire length (including over opening) shall be provided. The RCC band shall be 100 mm x100 mm size reinforced with 2 Nos 10 mm dia deformed twisted TMT steel bars as longitudinal bars and 8 mm dia deformed twisted TMT steel bars links at 150 mm C/C. Longitudinal bars shall be anchored in supporting walls/columns.
- b) If length of the wall exceeds 3 metre in plan which is unsupported in perpendicular direction, the vertical RCC band of size 100x75 mm reinforced with 4 Nos 10 mm dia deformed twisted TMT steel bars as longitudinal bars and 8 mm dia deformed twisted TMT steel bars stirrups at 250 mm centre to centre. This band shall be anchored in slab/beam/sub base.
- c) Whenever partition walls rest over slabs, reinforcement 6 Nos 10mm dia deformed twisted TMT steel bars as longitudinal bars and 8mm dia deformed twisted TMT steel bars stirrups at 250mm center to center shall be provided in the RCC slab along the direction of wall.

**DEVIATION** In case of deviation the rates of PCC solid block masonry shall be Rs.3100.00 per cum for 20cm thick walling and Rs 488.00 per Sqm for 10cm thick walling subject to percentage quoted by the contractor for Schedule 'A' Part-I.

### **3.4 Cavity Wall Insulation**

The wall insulation shall comply with the requirement of IS: 11050- 1984 (part-I). Rock wool slab shall be 100 mm thick 64 kg/m<sup>3</sup> density water repellent grade conforming to IS:8183 & type tested by CBRI for BS:476 part 4 for non-combustibility and encased in 200 gauge polythene sheet, on the brick wall with the help of mechanical fasteners and washers provided at each corners of the insulation slab and one at the centre.

GI wire netting shall be done to the fastener to fill the insulation slabs in place. The wall insulation shall be duly plastered with brick wall without any air gap in between the insulation and inner brick wall.

### **3.5 Fly Ash Bricks**

Flyash to be used in the manufacture of Burnt clay flyash cement bricks shall conform to Grade 1 or 2 of IS: 3812-1981. Additives gypsum and coarse sand shall be added during the process of manufacturing of flyash cement bricks in appropriate proportions. It's strength shall be minimum 50Kg/sqcm and of class-5.

Minimum percentage of flyash to be used in the flyash cement bricks shall not be less than 25%. Manufacturer's certificate and independent testing conforming chemical and physical requirement / characteristics and proportion of flyash shall be produced by the contractor to the GE for Approval. Flyash shall be procured from coal/lignite based thermal power plants. Fly ash shall be used compulsorily within 300 km radius from thermal power plants.

Water absorption for the flyash cement bricks shall not be more than 20% of weight.

Efflorescence when tested according to IS:3495 (Part-3): 1976 shall have the rating of efflorescence not more than moderate.

Testing of the flyash cement bricks shall be carried out in accordance with procedures listed in IS:13757-1993. Frequency of tests shall be as per IS: 1077 and IS:5454.

## **4 METAL DOOR SHUTTER & FRAME**

Door frame for metal door shutter shall be single rebate of size 100mm x 57mm made out of 1.6mm thick galvanized steel sheets as shown on drawing and shall comply with requirements of IS:4351 of 1976 (specification for steel doors frames). The threshold to the feet of frames shall be provided & PCC 1:3:6 (Type C-I) shall be filled in the back portion of doors frames completed including providing shock absorbers all as specified in clause 10.27 on page 212 of SSR Part-I (2009) and as shown on drawings. Steel surfaces shall be painted with 2 coats of synthetic enamel paint over a coat of red oxide primer over prepared surface. To avoid bulging of frame during back fill, 2 nos. flat iron 25 x 3mm horizontal member and 3 nos. each in vertical member to be provided in each frame & shall be 200mm long. Frames shall be of cold formed section manufactured by standard rolling mills. Pressed steel framed chowkhats shall be factory made. 125mm long heavy duty butt hinges shall be continuously welded to frame.

Shutter shall be double / single leaf consists of pressed galvanized steel hollow metal door of 46mm thick fully flush double skin door made up of 0.8mm (22 gauge) thick galvanised steel sheet with polyurethane foam as infill material all complete as per the specification. Doors shutters shall be fixed as per manufacturer's instructions.

Ironmongery (hardware fittings) shall conform to the samples or shall be of approved make and as specified hereinafter. All ironmongery and hardware fittings, (except hinges shall be of stainless steel. All fittings (stainless steel) shall be ISI marked.

#### **4.1 Compact Laminate Doors**

Toilet door shutter shall be single leaf of size as shown in drawings. Aluminium frame/ sections for doors shall be as specified in clause 14 on page no.504. the intermediate panel shall be 12mm thick (+ 0.6mm) solid compact laminate with edge chamfered conforming to ASTM D 790 & D 638. The compact laminate (phenolic core board) shall be impregnated with phenolic resin based on thermosetting resin, homogeneously reinforced with cellulose fibers and laminate on both side with matt/ textured finish melamine.

The panel shall possess the characteristic of colour, scratch and impact resistance having 8-12 surface gloss value. The sheet shall be bounded at high pressure greater than 110kg/Sqcm at the temperature of 65 degree Celsius.

The door shall have all the fittings and fixtures as required and specified in drawings.

#### **4.2 Grills/ Guard Bars**

Guard bars/Grills shall be provided to all windows/vents as per detailed drawings. All guard bars shall be aluminium anodized.

#### **4.3 Expanded Metal**

Where shown on drawings expanded metal shall be 12.5mm (SWM) x 40mm (LWM) with strands of 3.25mm width and 1.60mm thickness weighing not less than 5.037 kg. Per square metre conforming to IS: 412.

#### **4.4 Hold Fast**

Holdfasts for doors shall be as shown in the drawings. Holdfasts for doors irrespective of what is shown in the drawings shall be embedded in PCC 1:2:4 (type B-1) blocks built in brick work. The size of the blocks for walls one brick thick and over shall be 23 cm x 23 cm x 15 cm. and that for half brick thick wall shall be 23cm x 11.5cm x 15cm Lugs of steel windows shall also be embedded in PCC 1:2:4 (Type B-1) blocks of size as specified above for holdfasts. The size of holdfasts shall be as indicated in the drawings. However, GE may allow to use adequate number of approved DASH TRUE fasteners bolts in case of steel windows/doors to be fixed with RCC columns where not shown on drawings without any price adjustment. The section of steel shall be FI 25 x 3mm for holdfasts unless otherwise shown on drawings.

#### **4.5 Anchor Fasteners**

For fixing of aluminium doors/window frame with concrete/ masonry, adequate members of approved dash fasteners of approved make shall be

provided. The size of the fastener shall be designed to take load of the frame for which the same is used

#### 4.6 Rolling Shutter

Rolling shutter shall be provided where shown on drawings. Rolling shutter shall be made of flats of MS black sheet 1.25mm thick all as specified in clause 10.23 on page 206-208 of SSR (2009) Part-I and shall conform to IS:6248. Top cover shall be of the same material as that of flats. Wherever grill is shown in rolling shutter it shall be made up of same grade of material and the details shall be as shown on drawing. These shall be push or pull type and shall be painted with two coats of synthetic enamel paint over a coat of red oxide primer. These shall be suitable for fixing in position above lintel all as shown on drawings. Rolling shutter shall be procured from any of the manufacturers as mentioned in the list of approved makes/ agencies.

#### 4.7 Builders Hardware Fittings

Ironmongery (hardware fittings) shall conform to the samples or shall be of approved make and as specified hereinafter. All ironmongery and hardware fittings, (except hinges) shall be of aluminum alloy, anodized. All fittings (Aluminium/ mild steel) shall be ISI marked and as approved by GE. All screws shall be of cadmium plated steel. Hinges shall be of stainless steel

Aluminium alloy sliding door bolts with hasps and staple and fixing clips of dye cast sheet and bolt of extrudate section (16mm dia), and shall be ISI marked (IS-2681).

Aluminium tower bolt shall be barrel tower bolt, ISI marked (IS-204). However, the diameter of the bolts shall be 12mm.

Door stopper where shown on drawings shall be vulcanized rubber 40mm dia and shall be fixed to bottom rail of door shutter with steel screws as directed by GE.

#### 4.8 Stainless Steel Fly Mesh

Stainless steel fly mesh (having mesh of 0.63mm dia having average aperture width of 1.4mm) in operation enable window/ ventilator panes of shutter, as shown in drawings.

### 5 STEEL AND IRON WORK

#### 5.1 Reinforced and Structural Steel :

Following types of steel shall be used in the works:

- a) **Reinforcement Steel** : High strength deformed steel bars produced by Thermo Mechanical Treatment Process (TMT steel bars of grade Fe 500D) meeting all other requirements of IS:1786.

- b) **Structural steel** :
  - (i) Standard Quality – Conforming IS: 2062.
  - (ii) Ordinary Quality - Conforming IS: 1977.
- c) Galvanised Steel Sheets (Plain & Corrugated) conforming IS: 277.

#### 5.1.1 Procurement

##### a) **Structural Steel**

The Structural Steel to be supplied by the contractors shall be procured from main manufacturers.

##### b) **TMT Steel**

- i) TMT Steel supplied by the contractor will be procured from either Main producers of steel i.e. SAIL, Rashtriya Ispat Nigam Ltd., IISCO, TISCO and other manufacturers as mentioned in approved list of makes as per Appendix 'E'. The documents in support of the purchase of steel shall be verified by GE. The particulars of the manufacturer/supplier of steel shall be submitted to GE by the contractor for every lot of steel separately. The form given at **Appendix 'J'** shall be used for this purpose.
- ii) The contractor shall place their demand/requisition of steel with adequate lead-time. The steel should be purchased directly from the primary producers only. No steel shall be procured from their authorized agent /dealers./ conversion agents.

#### 5.1.2 Testing of Steel

The contractor shall submit the manufacturer's test Certificate in original alongwith the Test Sheet giving the results of each mechanical test as applicable and the chemical composition of the steel or authenticated copy thereof, duly signed by the manufacturer with each consignment. The GE shall record these details in Steel Acceptance Register, as given at **Appendix 'J'** after due verification. The GE shall also organize independent testing of random samples of steel drawn from various lots from a National Test House, SEMT CME, Regional Research Labs, Government approved Labs, Zonal Labs, etc. as per the recommended minimum frequency shown in Table at **Appendix 'J1'**. In order to undertake Departmental testing, requisite facilities shall be organized by the contractor. Cost of samples and cost of testing shall be borne by the contractor. In addition to above tests, the TMT steel received from secondary producers shall be tested by GE or his representative in person, before incorporation in the works, by simple field tests and records shall be maintained. GE will carry out random checks where he has not tested the steel by himself. The records of such random checks shall be maintained in the steel test register. Simple field test involves sand papering the X-

Section of the TMT bar and dipping the same in chemical solution to give a clearly defined annular ring of tempered steel. The contractor at his cost shall arrange facilities for such tests.

### **5.1.3 Documentation**

The contractor shall submit original machine numbered paid vouchers from the manufacturer for the total quantity of steel supplied under each consignment to be incorporated in the work. All consignment received at the work site shall be inspected by the GE along with the relevant documents before acceptance. The original vouchers and Test Certificates shall be defaced by the GE and kept on record in the site office of the GE duly authenticated and with cross reference to the control number recorded in the Steel Acceptance Register. The Steel Acceptance Register shall be signed by GE and contractor. The entire quantity of all steel items shall also be suitably recorded in the Measurement Book for record purposes as not to be abstracted, before incorporation in the work and shall be signed by the GE and the Contractor.

#### **5.1.3.1 Steel in coils etc.**

Any bar of any dia for reinforcement may be procured in round bundles or coils and the cost of straightening the same shall be borne by the contractor. When bars are procured in bundles, the length of each bundle shall be worked out on the basis of unit weight predetermined by the GE by getting suitable length (not less than 3 metres) out of each consignment received, getting it straightened, length measured and weighed in presence of contractor's accredited representative. The said length and the weight shall be recorded from which unit weight (weight per unit length) shall be calculated. The length of bars worked out on the basis of unit weight determined as above shall form the basis for the purpose of calculating quantity of steel used/to be used in work and making payment of materials lying at site. However, if the unit weight works out more than the unit weight given in SSR, then unit weight given in SSR shall be followed for computing weight of steel for the purpose of making payment of steel lying at site.

Size, type and grade of steel shall be as shown on drawing(s). However, if grade and type of steel are not shown on drawings, the same shall be high strength deformed bars (TMT) Grade – Fe 500D for reinforcement and MS grade I Fe-410-S for structural purpose. Various types of steel are given as under :

#### **i) Reinforcement Steel**

- a) High strength deformed bars (TMT) Grade Fe-500D conforming to IS-1786-2008 as specified or indicated on drawings.
- b) Mild steel Grade I conforming to IS-432 (Pt I) 1982. Chemical composition shall be in accordance with steel designation Fe-410-S of IS-226-1975.

- c) Fabric reinforcement of concrete shall be conforming to IS-1566 of 1962.
- d) TMT bars of Fe-500D grade conforming to IS: 1786-2008 shall only be used wherever HYSD/ TOR steel is shown on drawings.

**ii) Structural Steel**

- a) Definition of structural steel as given in clause 10.4 of SSR Part-I quality steel Fe-410-S conforming to IS-226-1975 for all types of steel structures including those subject to dynamic loading shall be used.
- b) Ordinary quality steel Fe-310-S conforming to IS-1977-1975 shall be used for doors, windows guard bars, grills, steel gates handrails, fencing post etc.

**5.1.4 Storage**

Steel of different sizes shall be stacked separately. For each classification of steel, separate areas shall be earmarked. Steel shall be marked with distinct painting marks for each identification. All steel shall be so stored that it is always at least 15cm above the GL. Steel shall be stored in a manner so as to prevent distortion and corrosion. Any section, that has deteriorated and corroded or if considered defective by GE, shall not be used in the work and shall be removed by the contractor without any extra cost. It will be the responsibility of the contractor to make sure that all possible arrangements are made for the safe custody of the steel. In case of any loss of steel only contractor will be responsible and the loss will/shall be made good without any delay or claim whatsoever.

**5.1.5 Scheduling and Supply**

Schedule of supply of steel shall be finalized by contractor with GE and shall be incorporated in CPM chart so that supply of steel is monitored in a way to avoid any delay in completion of the work. The complete requirement of steel of various sizes will be worked out before making any RAR payment and procurement of steel by the contractor will be completed sufficiently in advance of the date of completion.

**5.1.6 Welding**

Welding where specified or shown on drawings shall be gas or arc electric welding which shall be at the contractor's option and as per IS: 816 and IS: 1323 as applicable.

**5.1.7 Nuts- Bolts and Washers**

High strength bolts shall be hot dip galvanized and conforms to ASTM A 325M (full thread), Class 8.8 Type 1(or equivalent) used to connect primary

members. Machine bolts are electro-galvanized with a yellow chromate color conversion coating and conform to DIN 933 Class 4.6 (or equivalent) which may be used to connect secondary members like purlins and girts. Anchor bolts shall be manufactured from rods conforming to ASTM A 36M (or equivalent) with a minimum yield strength of 250MPa. Anchor bolts shall be provided along with necessary templates during fixing of anchor bolts. Nuts shall be of at least the strength grade appropriate to the grade of bolts or other threaded elements with which they are used.

Plain washers shall be made of mild steel conforming to IS: 5369 unless noted otherwise. Minimum one washer shall be supplied for each bolt and in case of special types of bolts more than one washer as required for the purpose shall be supplied.

Helical spring washer conforming to IS: 6755 shall be provided for bolts carrying dynamic or fluctuating loads and those in direct tension. Tapered washers conforming to IS: 5372 & IS: 5374 shall be used for channels & beams respectively. Washers for high strength friction bolts shall conform to IS: 6649. Washer with relevant grade compatible with grade of bolts/ nuts may be used as per relevant standard.

#### **5.1.8 Welding Consumables**

Welding consumables & procedures shall be such that the mechanical properties of deposited weld metal are not less than the respective minimum values for the parent metal being welded.

Covered electrodes (for metal arc welding of structural steel) shall conform to IS: 814 & IS: 2062. Filler rods & wires for gas welding shall conform to IS: 1278. The combination of wire and flux shall comply with the requirements of IS: 3613. Filler rods & base electrodes (for gas shield arc welding of structural steel) shall conform to IS: 6419.

#### **5.1.9 Material Tests**

The Contractor shall submit manufacturers' quality certificates for all the materials supplied by him. In case, quality certificates are not available or are incomplete or when material quality differs from standard specifications, such materials shall not be used in the construction. However, the Contractor shall get all appropriate tests conducted in approved test houses for such materials as directed by the Project manager, at no extra cost, and submit the same to Project manager for his approval. The Project manager may approve the use of such materials entirely at his discretion. The Contractor shall ensure that all materials brought to site are duly approved by the Project manager. Rejected materials shall not be used and shall be removed from site forthwith. Any material of doubtful quality for which specific tests are to be carried out as per the instruction of the Project manager shall be separately stacked and properly identified and shall not be used. These shall be removed from site forthwith.



**5.1.10 Fabrication drawings**

Fabrication and erection drawings shall be prepared by the Contractor based on the analysis and design carried out as approved by DEPMC / GE.

All fabrication and erection drawings shall be issued for construction by the Contractor directly to his work-site after the approval of the DEPMC. However, the Contractor shall not proceed with the fabrication of such structures whose fabrication drawings are required to be reviewed before taking up the fabrication work as noted on "Approved for Construction (AFC)" design drawings issued to the Contractor or as conveyed by the Project manager. The fabrication of such structures shall be done only as per the reviewed fabrication drawings.

Connections, splices and other details where not shown on the design drawings shall be suitably designed and shown on the fabrication drawings based on good engineering practice developing full member strength. Design calculations for such connections/splices shall be submitted to the DEPMC along with the fabrication drawings. Any substitution or change in section shall be allowed only when prior written approval of the Project manager has been obtained. Fabrication drawings shall be updated incorporating all such substitutions/changes by the Contractor at no extra cost to the Owner.

Contractor shall incorporate all the revisions made in the design drawings during the course of execution of work in his fabrication drawings, and resubmit the drawings at no extra cost to the Owner. All fabrication shall be carried out only as per the latest AFC design drawings and corresponding fabrication drawings.

The Contractor shall supply two prints each of the final/as built drawings along with their transparencies to Project manager for reference and record. The rates quoted shall include for the same.

**5.1.11 Fabrication**

Fabrication of structures shall be done strictly as per "Approved for Construction" fabrication drawings (prepared by the Contractor based on the latest design drawings) and in accordance with IS: 800, 9595 & other relevant IS Codes and IS Hand Book SP: 6(1). Prior to commencement of structural fabrication, undulations in the fabrication yard, if any, shall be removed and area leveled and paved by the Contractor. Any defective material used in the work shall be replaced by the Contractor at his own expense. Necessary care and precautions shall be taken so as not to cause any damage to the structure during any such removal and replacement. Any faulty fabrication pointed out at any stage of work by the Project manager, shall be made good or replaced by the Contractor at his own cost. Tolerances for fabrication of steel structures shall be as per IS: 7215.

All materials shall be straight and if necessary, before being worked shall be straightened and/or flattened (unless required to be of curvilinear form) and

shall be free from twists. Bending of rolled sections and plates shall be done by cold process to shape/s as shown on drawings.

The erection clearance for cleated ends of members shall be not greater than 2mm at each end. The erection clearance at ends of beams without web cleats and end plates shall be not more than 3mm at each end but where for practical reasons, greater clearance is necessary, suitably designed seatings approved by the Project manager shall be provided.

Prior to cutting, all members shall be properly marked showing the requisite cut length/width, connection provisions e.g. location and dimensions of holes, welds, cleats etc. Marking for cutting shall be done judiciously so as to avoid wastages or unnecessary joints as far as practicable. Marking shall be done by placing the members on horizontal supports/pads in order to ensure accuracy. Marking accuracy shall be limited to + 1mm. Cutting may be affected by shearing, cropping or sawing. Gas cutting by mechanically controlled torch shall be permitted for mild steel. Hand flame cutting may be permitted subject to the approval of the Project manager. Except where the material is subsequently joined by welding, no loads shall be transmitted into metal through a gas cut surface. Shearing, cropping and gas cutting shall be clean, square, free from any distortion & burrs, and should the Project manager find it necessary, the edges shall be ground afterwards, to make the same straight and uniform at no extra cost to the Owner.

Holes for bolts shall not be formed by gas cutting process. Holes through more than one thickness of material of members such as compound stanchions and girder flanges shall, where possible, be drilled after the members are assembled and tightly clamped/bolted together. Punching may be permitted before assembly, provided the thickness of metal is less than 16 mm and the holes are punched 3 mm less in diameter than the required size and reamed, after assembly, to the full diameter. Punching shall not be adopted for dynamically loaded structures. Holes may be drilled in one operation through two or more separable parts and burrs removed from each part after drilling. Holes in connecting angles and plates, other than splices, also in roof members and light framing, may be punched full size through material not over 12 mm thick, except where required for close tolerance bolts or barrel bolts. All matching holes for black bolts shall register with each other so that a gauge of 2 mm less in diameter than the diameter of hole shall pass freely through the assembled members in the direction at right angle to such members. Finished holes shall be not more than 2 mm in diameter larger than the diameter of the black bolt passing through them, unless otherwise specified by the Project manager. Holes for turned and fitted bolts shall be drilled to a diameter equal to the nominal diameter of the shank or barrel subject to H8 tolerance specified in IS: 919. Parts to be connected with close tolerance or barrel bolts shall be firmly held together by tacking bolts or clamps and the holes drilled through all the thicknesses in one operation and subsequently reamed to size. Holes not drilled through all the thicknesses in one operation shall be drilled to a smaller size and reamed out after assembly. Where this is not possible, the parts shall be drilled and reamed separately. To facilitate grouting, holes shall be provided in column bases or seating plates exceeding 300mm in width for the escape of air. To avoid

accumulation of water in gusseted column bases of laced, battened or box type stanchions, suitable reverse U-type holes shall be provided at the junction of base plate and column section in the vertical gussets for draining out of any water.

The component parts shall be assembled and aligned in such a manner that they are neither twisted nor otherwise damaged, and shall be so prepared that the required camber, if any, is provided. Proper clamps, clips, jigs and other fasteners (bolts and welds) shall be placed in a balanced pattern to avoid any distortion in the members and to ensure their correct positioning (i.e. angles, axes, nodes etc.). Any force fitting, pulling/stretching of members to join them shall be avoided. Proper care shall be taken for welding shrinkage & distortion so as to attain the finished dimensions of the structure shown on the drawings.

All joints shall be welded unless noted otherwise on the design drawings. Welding shall be in accordance with IS: 816, IS: 819, IS: 1024, IS: 1261, IS: 1323 and IS: 9595. The Contractor shall make necessary arrangement for providing sufficient number of welding sets of the required capacity, all consumables, cutting and grinding equipment with requisite accessories/ auxiliaries, equipment & materials required for carrying out various tests such as dye penetration, magnetic particle, ultrasonic etc. Adequate protection against rain, dust, snow & strong winds shall be provided to the welding personnel and the structural members during welding operation. In the absence of such a protection no welding shall be carried out. It shall be the responsibility of the Contractor to ensure that all welding is carried out in accordance with the terms of this specification and relevant BIS codes. The Contractor shall provide all the supervision to fulfill this requirement.

Edge preparation/beveling of fusion faces for welding shall be done strictly as per the dimensions shown in the drawings. In case, the same are not indicated, edges shall be prepared (depending on the type of weld indicated in the drawing) as per the details given in IS: 9595. Beveling of fusion faces shall be got checked and approved by the Engineer in- Charge. The tolerances on limits of gap, root face & included angle shall be as stipulated in IS: 9595.

Welding edges and the adjacent areas of the members (extending up to 20mm) shall be thoroughly cleaned of all oil, grease, scale and rust and made completely dry. Gaps between the members to be welded shall be kept free from all foreign matter.

Preheating of members shall be carried out as per IS: 9595 when the base metal temperature is below the requisite temperature for the welding process being used. Preheating shall be done in such a manner that the parts, on which the weld metal is being deposited, are above the specified minimum temperature for a distance of not less than 75mm on each side of the weld line. The temperature shall be measured on the face opposite to that being heated. However, when there is access to only one face, the heat source shall be removed to allow for temperature equalization (1 minute for each 25mm of plate thickness) before measuring the temperature.

Column splices & butt joints of struts and compression members (depending on contact for load transmission) shall be accurately ground and close-butted over the whole section with a tolerance not exceeding 0.2mm locally at any place. In column caps & bases the ends of shafts together with the attached gussets, angles, channels etc., shall be accurately ground so that the parts connected butt over minimum 90% surface of contact. In case of connecting angles or channels, care shall be taken so that these are fixed with such accuracy that they are not reduced in thickness by grinding by more than 2 mm.

Ends of all bearing stiffeners shall be ground to fit tightly at both top and bottom. Similarly bottom of the knife edge supports along with the top surface of column brackets shall be accurately ground to provide effective bearing with a tolerance not exceeding 0.2 mm locally at any place.

Slab bases and caps shall be accurately ground over the bearing surfaces and shall have effective contact with the ends of stanchions. Bearing faces which are to be grouted direct to foundations need not be ground if such faces are true & parallel to the upper faces.

Welding of various materials under this specification shall be carried out using either Manual Metal Arc Welding Process (MMAW), Flux Cored Arc Welding Process (FCA W) or Gas Metal Arc Welding Process (GMAW). The welding procedure adopted and consumables used shall be specifically approved by the Project manager. A combination of different welding processes or a combination of electrodes of different classes/makes may be employed for a particular joint only after qualifying the welding procedures to be adopted and obtaining the written approval of the Project manager.

#### **5.1.12 Approval & Testing of Welding Procedures**

The Contractor shall carry out procedure tests in accordance with IS: 7307 to demonstrate by means of a specimen weld of adequate length on steel representative of that to be used, that he can make welds with the welding procedure to be used for the work to the complete satisfaction of the Project manager. The test weld shall include weld details from the actual construction and it shall be welded in a manner simulating the most unfavorable instances of fit-up, electrode condition etc., which are anticipated to occur on the particular fabrication. Where material analysis is available, the welding procedure shall be carried out on material with the highest carbon equivalent values. After welding, but before the relevant tests given in IS: 7307 are carried out, the test weld shall be held as long as possible at room temperature, but in any case not less than 72 hours, and shall then be examined for cracking. The examination procedure shall be sufficiently rigorous to be capable of revealing significant defects in both parent metal and weld metal. After establishing the welding method, the Contractor shall finally submit to the Project manager for his approval the welding procedure specification in standard format given in IS: 9595 before starting the fabrication.

As far as practicable, all welds shall be made in a sequence that will balance the applied heat of welding while the welding progresses. The direction of the general progression in welding on a member shall be from points where the parts are relatively fixed in position with respect to each other towards points where they have a greater relative freedom of movement. All splices in each component part of a cover-plated beam or built up member shall be made before the component part is welded to other component parts of the member. Joints expected to have significant shrinkage shall be welded before joints expected to have lesser shrinkage. Welding shall be carried continuously to completion with correct number of runs. The Contractor shall choose the welding sequence after carefully studying each case such as to minimize distortion and shrinkage & submit the same to the Engineer-in-Charge for comments and approval. The welding seams shall be left to cool slowly. The CONTRACTOR shall not be allowed to cool the welds quickly by any other method

#### **5.1.13 Welding Technique**

After the fusion faces are carefully aligned and set with proper gaps, the root pass of butt joints shall be executed properly so as to achieve full penetration with complete fusion of the root edges. On completion of each run all slag and spatters shall be removed and the weld and the adjacent base metal shall be cleaned by wire brushing and light chipping. Visible defects such as cracks, cavities and other deposition faults, if any, shall be removed to sound metal before depositing subsequent run of weld. All full penetration butt welds shall be completed by chipping/gouging to sound metal and then depositing a sealing run of weld metal on the back of the joints. Where butt welding is practicable from one side only, suitable backing steel strip shall be used and joint shall be arranged in such a way as to ensure that complete fusion of all the parts is readily obtained. While welding is in progress care shall be taken to avoid any kind of movement of the components, shocks, vibrations to prevent occurrence of weld cracks. Any deviation desired from the recommended welding technique and electrodes shall be adopted only after obtaining written approval of the Project manager.

#### **5.1.14 Inspection & Testing of Welds**

The method of inspection shall be according to IS: 822 and extent of inspection and testing shall be in accordance with the relevant applicable standard or, in the absence of such a standard, as specified by the Project manager. Welds shall not be painted or otherwise obscured until they have been inspected, approved and accepted. The Project manager or his representative shall have access to the Contractor's work at all reasonable times and the Contractor shall provide him with all facilities necessary for inspection during all stages of fabrication and erection with, but not limited to, the following objectives.

- i) To check the conformity with the relevant standards and suitability of various welding equipment and their performance.

- ii) To witness/approve the welding procedure qualification.
- iii) To witness/approve the welders performance qualification.
- iv) To check whether shop/field welding being executed is in conformity with the relevant specifications and codes of practice. Inspection and testing of all fabricated structures shall be carried out by the Contractor by any, or, a combination of all the following methods as directed by the Project manager and no separate payment shall be made, unless otherwise mentioned, for inspection and testing of welds/fabricated structures:

#### **5.1.14.1 Visual Inspection**

All finished welds (i.e. 100 percent) shall be visually inspected for identification of the weld defects & faults like: surface cracks, Damages to the parent metal such as undercuts, burning, overheating etc. Profile defects such as excessive convexity or concavity, overlapping, unequal leg lengths, excessive reinforcement, incompletely filled grooves, excessive penetration beads, root grooves etc . Distortion due to welding i.e., local shrinkage, camber, bowing, twisting, rotation, wariness etc. And Linear eccentric, angular and rotational misalignment of parts.

#### **5.1.14.2 Mechanical Tests**

The mechanical testing (such as tensile load tests, bend tests, impact tests etc.) shall be done in accordance with the relevant standards and as per the instructions of the Engineer-in- Charge.

#### **5.1.14.3 Magnetic Particle/Dye Penetration/Ultrasonic Examination**

The examination shall be done at random as directed by the Project manager. Whenever such tests are directed, the tests shall be carried out on joints chosen by him. The tests shall be carried out by employing approved testing procedure in accordance with IS: 822.

#### **5.1.14.4 Radiographic Examination**

Radiographic examination shall be carried out only in special cases for random joints as directed by the Project manager. The Contractor shall make necessary arrangement at his own expense for providing the radiographic equipment, films and all other necessary materials required for carrying out the examination. The tests shall be carried in the presence of the Project manager by employing approved testing procedure in accordance with IS: 822. The Contractor shall fulfill all the statutory safety requirements while handling X-ray and Gamma-ray equipment and provide the Engineer- in-Charge all the necessary facilities at site such as dark room, film viewer etc., to enable him to examine the radiographs.

**5.1.15 Bolting**

All bolts shall be provided such that no part of the threaded portion of the bolts is within the thickness of the parts bolted together. Washers of suitable thickness shall be used under the nuts to avoid any threaded portion of the bolt being within the thickness of parts bolted together. The threaded portion of each bolt shall project through the nut at least one thread. Flat washers shall be circular and of suitable thickness. However, where bolt heads/nuts bear upon the beveled surfaces, they shall be provided with square tapered washers of suitable thickness to afford a seating square with the axis of the bolt.

**5.1.16 Splicing**

Splicing of built up/compound/latticed sections shall be done in such a fashion that each component of the section is joined in a staggered manner. Where no butt weld is used for splicing, the meeting ends of two pieces of joist/channel/built up section shall be ground flush for bearing on each other and suitable flange and web splice plates shall be designed and provided for the full strength of the flange/ web of the section and welds designed accordingly. Where full strength butt weld is used for splicing (after proper edge preparation of the web and flange plates) of members fabricated out of joist/ channel/ angles/ built up section, additional flange and web plates shall be provided, over and above the full strength butt welds, to have 40% strength of the flange and web. Where a cover plate is used over a joist/channel section the splicing of the cover plate and channel/joist sections shall be staggered by minimum 500mm.. Prior approval shall be obtained by the Contractor for locations of splices where not shown on design drawings. Only a single splice at approved location shall be allowed for members up to a length of 6 to 7m. Maximum two numbers of splices shall be allowed for members exceeding this length.

**5.1.17 Machining & Grinding**

All slab bases and slab caps shall be accurately machined over the bearing surfaces and shall be in effective contact with the ends of column sections (shafts). For slab bases and slab caps, ends of column shafts shall be accurately machined. However, for gusseted bases and caps, the column shafts shall be ground flush for effective contact with parts connected together. Gusseted bases and caps shall be ground flush for effective contact with ends of column sections. End of all bearing stiffeners shall be machined or ground to fit tightly at top and bottom without any air gap. While machining or grinding care shall be taken so that the length or thickness of any part does not get reduced by more than 2.0 mm. For all machining or grinding works for gusseted base and cap plates, the clearance between the parts joined shall not exceed 0.2 mm at any location.

**5.1.18 Inspection & Testing of Structures**

The Project manager (or his authorized representative) shall have free access at all times to those parts of the Contractor's works which are concerned with

the fabrication of the steel work and shall be provided with all reasonable facilities for satisfying himself that the fabrication is being undertaken in accordance with the provisions of these specifications & other relevant BIS Codes. Should any structure or part of a structure be found not to comply with any of the provisions of this specification (or relevant BIS Codes as referred to), it shall be liable to rejection. No structure or part of the structure, once rejected shall be resubmitted for inspection, exception cases where the Project manager or his authorized representative considers the defect as rectifiable. Defects which may appear during/after fabrication/ erection shall be made good only with the consent of the Project manager and procedure laid down by him. All necessary gauges and templates shall be supplied free to the Project manager by the Contractor whenever asked for during inspection. The Project manager may at his discretion, check the test results obtained at the Contractor's works by independent tests at a test house, and the cost of such tests shall be borne by the Contractor.

#### **5.1.19 Shop Painting**

Surface preparation shall be done by grit blasting. The grit blasting of the surface shall be carried out by compressed air and blasting gun. Clean screened grit of uniform size shall be used for blasting purpose. For grit blasting, the surface shall be made free from mill scale, rust, grease, oil or other foreign material and shall appear to have foreign white base metal roughened texture to form good adhesion of the primer coating, conforming to Swedish Standards "Sa 2 ½". Compressed air should be free from moisture and oil. The grit blasted surface shall be applied with primer coat within 3 to 4 hours or before any trace of oxidation appears on the cleaned surface.

All components and members of steel work shall be given one coat of Inorganic Zinc Silicate Epoxy primer. Primer coat shall be applied immediately after the surfaces have been properly prepared by grit blasting as explained above and cleaned. The primer coat shall be applied over completely dry surfaces (using brushes of good quality) in a manner so as to ensure a continuous and uniform film without "holidaying". Special care shall be taken to cover all the crevices, corners, edges etc. However, in areas which are difficult to reach by brushing, daubers/mops shall be used by dipping the same in paint and then pulling/ pushing them through the narrow spaces. The primer coat shall be air dried and shall have a minimum film thickness of 75 microns or (tolerance + 10%) after drying, as applicable.

#### **5.1.20 Packing**

All items shall be suitably packed in case these are to be dispatched from the fabrication shop to the actual site of erection so as to protect them from any damage/distortion or falling during transit. Where necessary, slender projecting parts shall be temporarily braced to avoid warping during transportation.

Small parts such as gussets, cleats etc., shall be securely wired on to their respective main members. Bolts, nuts washers etc. shall be packed in crates.



**5.1.21 Transportation**

Loading and transportation shall be done in compliance with transportation rules. In case, certain parts cannot be transported in the lengths stipulated on the drawings, the position details of such additional splice joints shall be got approved by the Engineer-in- Charge.

**5.1.22 Site (Field) Erection****5.1.22.1 Plant & Equipment**

The suitability and capacity of all plant and equipment used shall be to the complete satisfaction of the Engineer-in-Charge.

**5.1.22.2 Storing & Handling**

All steel work shall be so stored and handled at site so that the members are not subjected to excessive stresses and any damage.

**5.1.22.3 Setting Out**

One set of reference axes and one bench mark level shall be furnished to the Contractor. These shall be used for setting out of structures.

The Contractor shall assume complete responsibility for correct setting out of all steel work, erecting it correctly as per alignment / levels shown in the drawings and plumb (verticality) of vertical members.

**5.1.23 Safety & Security during Erection**

The contractor shall comply with IS: 7205 for necessary safety and adhere to safe erection practices and guard against hazardous as well as unsafe working conditions during all stages of erection.

During erection, the steel work shall be securely bolted or otherwise fastened and when necessary, temporarily braced/guyed to provide for all loads to be carried by the structure during erection till the completion, including those due to the wind, erection equipment & its operation etc. at no extra cost to the owner. For the purpose of guying, the Contractor shall not use other structure in the vicinity without prior written permission of the Engineer-in-Charge.

No permanent bolting or welding shall be done until proper alignment has been achieved. Proper access, platform and safety arrangement shall be provided for working and inspection, (at no extra cost to the owner) whenever required.

**5.1.24 Field Connections****5.1.24.1 Field Bolting**

Field bolting shall be carried out with the same care as required for shop bolting.

**5.1.24.2 Field Welding**

All field assembly and welding shall be executed in accordance with the requirements for shop assembly and welding. Holes made for all erection bolts- where removed after final erection shall be plugged by welding. Alternatively erection bolts may be left and secured.

**5.1.24.3 Maximum Permissible Erection Tolerances****A. Columns**

1. Deviation of column axes at foundation top level with respect to true axes.
  - i) In longitudinal direction  $\pm 5$  mm.
  - ii) In lateral direction  $\pm 5$  mm
2. Deviation in the level of bearing surface of columns at foundation top with respect to true level  $\pm 5$  mm.
3. Out of plumb (Verticality) of column axis from true vertical axis, as measured at top :
  - i) Up to and including 30m height  $\pm H/1000$  or  $\pm 25$  mm Whichever is less
  - ii) Over 30m height  $\pm H/1200$  or  $\pm 35$  mm Whichever is less.
4. Deviation in straightness in longitudinal & transverse planes of column throughout the height.  $\pm H/1500$  or  $\pm 10$  mm Whichever is less.
5. Difference in the erected positions of adjacent pairs of columns along length or across width of building prior to connecting trusses/beams with respect to true distance.  $\pm 5$  mm.
6. Deviation in any bearing or seating level with respect to true level  $\pm 5$  mm .
7. Deviation in difference in bearing levels of a member on adjacent pair of columns both across & along the building.  $\pm 5$  mm.

**Note – 1** : Tolerance specified under 3 should be read in conjunction with 4 & 5.

**Note – 2** : 'H' is the column height in mm.

**B. Trusses**

1. Shift at the centre of span of top chord member with respect to the vertical plane passing through the centre of bottom

chord.  $\pm 1/250$  of height of truss in mm at centre of span or  $\pm 15$  mm whichever is less.

2. Lateral shift of top chord of truss at the centre of span from the vertical plane passing through the centre of supports of the truss.  $\pm 1/1500$  of span of truss in mm or  $\pm 10$ mm whichever is less.
3. Lateral shift in location of truss from its true position.  $\pm 10$ mm.
4. Lateral shift in location of purlin from its true position.  $\pm 5$ mm
5. Deviation in difference of bearing levels of truss from the true level.  $\pm 1/1200$  of span of truss in mm or 20mm whichever is less.

**5.1.25** At site 02 coat of Polyurethane paint having thickness as per manufacturer's recommendations but not less than 30micron DFT each coat shall be applied over the existing shop primer coating. V

## **5.2 Steel Railing**

Steel railing shall be provided as per location, design and detail shown on drawings. Mild steel work shall be painted with two coats of synthetic enamel paint. Unless otherwise shown hand rail shall be of 50mm dia MS pipe in the profile as shown in drawing.

## **5.3 ROOF AND FLOOR SLABS**

### **5.3.1 Metal Sheet Roofing and Cladding**

The work described herein shall cover providing and installing metal sheet roofing and cladding including translucent sheets and all accessories such as Turbo Ventilators, flashings, capping, gutters, trims, supporting straps, brackets, foam fillers, sealants and the work shall be carried out in strict accordance with this specification and applicable drawings. Supplier shall prepare shop drawings for roofing, cladding, gutters etc. and shall take the approval of GE prior to manufacturing and supply

Material for sheets and accessories shall strictly conform to BIS/BS/ASTM/AS specifications as mentioned. Supplier shall furnish test certificates for verification of the same and shall make arrangements for inspection and marking of the materials at his works. Erection shall not be started before approval of materials including all accessories. Length shall be such that number of joints is minimum. Wherever specified, to avoid longitudinal overlaps for larger span, sheets shall be of single length and shall be site formed.

### 5.3.2 Galvalume Single Sheet Roofing & Wall Cladding

Galvalume sheet for roofing shall be of 0.55mm TCT high tensile zinc aluminum alloy coated steel sheet, 550 Mpa minimum, yield strength having a trapezoidal profile of depth min.28 at pitch distance of maximum of 200mm fixed to the purlins. It shall be coated with Zinc aluminium alloy coating of 55% Aluminium 43.5% Zinc 1.5% silicon @150gm/sqm of coating ( total both surfaces) as per AS:1397:1993 and finished with Silicon modified Polyester paint coat on both surfaces having overall thickness of 35 microns inclusive of 10 micron primer on each side as per AS/NZ-2728:1997(Category-3) and shall be fixed using self drilling and self taping fasteners conforming to AS:3566 Class-3 having neoprene/EDPM washers. Penetration and laps in sheet shall be sealed by using proper sealant profile. Fillers shall be provided wherever required to close voids between sheets, sheet & fasteners etc.

Galvalume sheet for wall cladding shall be same as for roof and shall have a trapezoidal profile of depth min.28 at pitch distance of maximum of 200mm fixed with self taping fastener at valley to the support structure.

Roof Sheet / Panel are pre-painted and with Camouflage pattern as approved by GE.

### 5.4 Specification for Colour Coating

a)	Paint Coating	:	Super Polyester / SMP Paint
b)	Colour	:	Outer : Camouflage Inner: White
c)	Thickness of Paint i) Top coat ii) Bottom coat iii) Primer	:	20 microns (nominal) 5 microns (nominal) 5 micron (each Side)
d)	Hardness (Pencil) as per AS : 2728	:	HB or Harder
e)	Adhesion (T-Bend) as per AS : 2728	:	Minimum 5T (no cracking)
f)	Flexibility (T-Bend) as per AS : 2935	:	Minimum 7T (no cracking)
g)	Resistance to corrosion (Salt Spray Test as per ASTM B-117)	:	1000 hrs. at 35 deg.C + deg.C (passed)
h)	Scratch resistance as per AS : 1580.403.1	:	For 1500 gms. minimum ( no scratch)
i))	Resistance to heat at 100 deg.C for 24 hrs.	:	No change in colour (passed)

### 5.5 Accessories

Materials and coatings for ridge capping, barge capping, apron flashing, cover flashing, monitors and expansion joints shall be manufactured out of same material as roofing / cladding sheets material and shall be shaped to match sheet profile.

**5.6 UPVC down take Pipe**

UPVC down take pipe shall be provided as per schedule 40 -4 Kg/cm<sup>2</sup> as per manufacture's specification and as directed by MMCI/HPCL Engineer In charge. Necessary pipe bends, socket/collar required for joining the pipes.

**5.7 Fasteners**

Fasteners shall be of metallic polyester coated heat treated carbon steel conforming to AS 3566 Class 3 or equivalent. Sheets shall be fixed with hexagonal head self-drilling screws, assembled with galvanised steel washers with EPDM seals. For self-drilling / self-tapping screws, high rpm (2000-2500 rpm) drivers with high amperage (4-7 amps) shall be used to achieve the proper torque to secure fastening. Drill bits shall be cleared out after the completion of drilling of sheets.

**5.8 Handling & Storage at Site**

The materials specified herein above shall be handled and stored in the manner so as not to damage the same. The material damaged in transit, storage and erection or otherwise shall not be used and paid for. Such damages shall be borne by the Contractor. Sheets shall be stacked on the firm and levelled ground on wooden battens according to the approved stacking methods and /or as per instructions of the manufacturer. Sheeting or panels shall preferably be stored with a slight inclination in longitudinal direction to allow water that may get into the stack to drip off. Sheets shall be stored in a covered place.

**5.9 Installation & Fixing**

The work shall be completed to the satisfaction of GE as per the approved detail drawings and as per the instructions of the manufacturer wherever necessary and shall be approved by the Consultants / Client. Sheets shall be lifted onto roof supports with ribs up. First sheet shall be fixed in position with the female rib facing the starting edge. Female rib of the second sheet shall be lapped with the male rib of the first sheet and shall be fixed with side lap fasteners before fastening the second sheet to supports. Same procedure shall be followed for subsequent sheets. For side cladding same procedure shall be followed. Minimum end lap shall be 150mm for roof and 100mm for side cladding. Side lap shall be minimum one crest. For roof pitches below 70 end laps shall be sealed with approved silicone sealants.

Roof sheeting shall be fixed by crest fixing only. Side cladding shall be fixed preferably by crest fixing but can be fixed by valley fixing also. In valley fixing fastener locations should be as close as possible to the ribs. Side lap fasteners to be fixed at an interval of 350-450mm to hold the side laps of sheets firmly in place and to maintain a weather-proof joint. Holes must always be drilled and not punched. Extreme care shall be taken to avoid over tightening of fasteners, which will lead to deformation of sealing washers,

sheet damage and sometimes damage of the fastener threads. Fixing of flashings in masonry / concrete wall shall be done by making groove of appropriate height and depth and embedding the same with mastic / cement mortar (1:2) and water proofing compound. Specific workmanship shall be employed while carrying out work at laps and expansion joints to ensure zero leakage. All the sheets and accessories which are found to be cracked / bend after fixing shall be replaced by new ones. The cracked sheet so removed shall be salvaged by the Contractor by cutting into smaller but sound lengths whenever ordered. No extra payment for such work shall be made.

## **6 WATER PROOFING**

### **6.1 Water Proofing Treatment to RCC Roof Slabs**

The contractor shall give guarantee for safe performance of all water proofing work as per the format attached in **Appendix 'G'**.

Before taking up roof treatment as specified herein below, testing by ponding shall be done after completion of curing of slab and removal of formwork with 25mm height of water for 72 hours.

Unless otherwise mentioned herein, the waterproofing on roof shall be as described on clause 11.43 page 262 of SSR part-I 2009. All RCC roofs shall be given water proofing treatment as mentioned below:

### **6.2 Horizontal Roof:**

- i) First layer of Grading with cement concrete 1:2:4 (minimum 50mm thick) in slope of 1:120.
- ii) Laying second layer of approved bituminous primer @ 100gm per Sqm..
- iii) Third layer of APP modified membrane non-woven polyester reinforcement (160GSM) with mineral finish on top to be laid by torch application method. Minimum weight 4.0 Kg per Sqm with mineral weight and minimum 3.5 kg / Sqm without mineral weight and minimum 3 mm thick without considering mineral, laid on primed surface complete all as specified. This will be allowed to air cure for 4 hours followed by water curing for 48 hours. The entire treatment will be taken upto 30cm on parapet wall and tucked into groove in parapet all around.
- iv) Laying top layer with cement concrete tiles, 250mm x 250mm x 22mm thick machine pressed, set jointed and pointed in neat cement slurry in floors over 20mm thick cement mortar (1:4). Water proofing compound to be added as per manufacturer specification with the mortar as per SSR clause no. 13.16 & 13.29.

- v) PCC (1:2:4) type B-0 benching shall be provided at the junctions of RCC facia/brick parapet wall and roof tiles as shown on drawings.

### **6.3 Rain Water Pipes**

Rain water pipes and fittings shall be 110 mm outer dia UPVC pipe. The pipes and fittings shall be ISI marked (IS-4985) and 4 Kgf/Sqcm pressure rating, procured from any of the manufacturers as per the approved list of makes/ agencies.

Pipe shall be fixed as shown on drawings. Where the pipes are shown to be fixed on walls, these shall be fixed with suitable PVC holder bat clamp and shall be embedded in PCC 1:3:6 block of size 150 x 150 x 150 mm and as directed by GE.

For all rain water pipe inlet 450mm x 450mm Khurrah shall be provided as per detail shown on drawing.

## **7 FLOORING**

### **7.1 General**

Floors of various types shall be provided as specified here in after and as shown in drawings.

Floors shall be laid to levels or to falls as shown on drawings / directed by GE. Floors shall be sunk below the general floor level to the required depth where shown in drawings, by suitably sinking the slabs at the time of casting them.

Floor finish shall be carried over all openings and dwarf walls.

Colour and pattern of the tile (both ceramic and vitrified) and dado / skirting shall be approved by GE/ DEPMC.

Surface of concrete floors unless otherwise specified shall be finished even and smooth using extra cement with steel trowels.

Ramp shall have cement concrete flooring over sub base as specified hereinafter.

Where the floor finish is to be laid over RCC slab, the top surface of slabs shall be cleaned with hard wire brushes and given a coat of neat cement slurry using 3 kg. of cement per square metre just before laying the floor finish.

Cutout to floor slab to be kept to fix plumbing piping to be hung on ceiling above false ceiling during concreting. Cost of sealing of holes/cutouts after fixing of trap/ piping with suitable leak proof sealing system as approved by the GE shall be deemed included in the lump sum price in Schedule 'A', Sec.- I.

The dividing line between the floors of different type wherever they so meet between adjoining rooms shall be, unless otherwise shown, at the centre line of the door shutter in closed position and the applicable finish shall accordingly be provided. Exposed edges of floors shall be finished to match with top surface finish.

Concrete sub base shall be laid in bays not exceeding 20 square metres.

Cement concrete sub base or sub base floor and wearing coat shall be laid separately and not monolithically.

PCC floor topping shall be laid in square or rectangular panels with each side not exceeding 1.2 metres.

If any extra thickness of concrete is required to provide slope in the floor as directed by the GE the same shall be provided by the contractor at no price adjustment.

Wherever required to made up to level of floor finish, cement concrete screed of required thickness shall be laid at no extra cost.

## **7.2 Cement Concrete Floors**

PCC floors where indicated in drawings / schedule of finishes shall be of the following composition : -

40 mm thick PCC (1:2:4) type B-0

Floor in case of ramp and parking area/ stilt area shall be of 52mm 1:2:4 concrete with hardcrete topping finished chequered, laid over base concrete of 150mm thick 1:4:8 over 75mmhardcore on compacted earth.

Sub base floor other than ramp/ Garages/ stilt shall be of 75mm concrete of 1:4:8 laid over 75mm thick hard core.

### **Glass Dividing Strips**

PCC floor topping shall be laid in bays/panels not exceeding 1.2 m x 1.2m. Panels shall be formed with glass dividing strips of 3mm thickness (Plain glass). Depth of the glass dividing strips shall be 38 mm for 40 mm thick PCC floor topping and 48 mm for 50 mm thick PCC floor topping. Bays shall be so formed that not more than 3 strips meet at a point i.e. only 'T' junction is formed.

Uses of all temporary fillets, side forms etc. shall be dispensed with where glass dividing strips occur. No price adjustment shall be made on account of non-use of temporary fillets, side forms etc.

Surface of concrete floors, PCC skirting / dado shall be treated with sodium silicate all as specified in para 13.35 on serial page 13-9 of SSR 1991 (Part-I).



### 7.3 Ceramic Tile Floor

Where shown / specified in drawing, ceramic tile shall be non-skid type in floor. Size shall be as shown in drawings, thickness as specified in the IS Code, laid on cement mortar screed (1:4) of 20 mm thickness. Cement slurry for laying tile and jointing shall be with white cement mixed with matching pigment. Ceramic tile flooring shall be done as specified in clause 13.40 on page 13 – 12 of SSR Part-I.

## 8 PLASTERING AND POINTING

### 8.1 General

External finish shall be taken 15 cms below the ground level except where plinth protection / ramp/ etc. is provided, in which case it shall be taken upto the bottom of the plinth protection / ramp etc.

Plaster / pointing, skirting / dado shall be returned to in jambs reveals and soffits of lintels / window cills etc.

All plastered / rendered surfaces shall be troweled to fair and even surface with steel trowel (without using extra cement).

Unless Coarse sand is specifically stipulated, sand for plastering shall be 50% fine sand and 50% coarse sand conforming to the samples approved by the GE.

To avoid cracks at junction of RCC and brick walls, 150 mm wide GI chicken wire mesh of 24 gauge, 20 mm mesh shall be nailed on the joints before plastering. Unless and otherwise specified in drawings, grooves at junction of RCC & masonry shall be formed wherever directed by the GE.

### 8.2 Plastering

Cement plaster on internal surfaces above skirting / dado shall be done in cement and sand mortar (1:6) in one coat and shall be 12 mm thick on fair faces & other than fair faces, unless specified otherwise elsewhere in particular specifications or shown on drawings. Mortar for dubbing out and rendering shall be of same type and mix. Dubbing out may be executed as separate coat or along with the rendering coat.

For external surfaces where shown on drawings as plain cement plaster or specified to be plastered it shall be cement plaster 15 mm thick at proud part in cement and sand mortar in two coats (1<sup>st</sup> coat with 10mm thick 1:6 and 2<sup>nd</sup> coat of 5mm thick 1:4. 2<sup>nd</sup> coat shall be mixed with waterproof compound) as specified in clause 14.18 on page 14-4 of SSR Part-I. For external plaster below DPC, WPC shall be mixed with the mortar and a groove of 10mm x 10mm shall be provided at DPC level. The quantity of WPC shall be as per manufacturer's instruction.

All exposed surfaces of beams, columns, lintels, cills, seismic bands and the like coming in conjunction with plastered surfaces shall be plastered as per adjoining surfaces and to the thickness required to bring them in the same plane as that of adjoining plaster.

All Concrete surfaces at ceiling, plain cement plaster will be 5mm and with 1:3 cement mortar.

### **8.3 Cement Dado / Skirting**

Cement skirting/dado where shown on drawings shall be 5mm thick in cement and sand mortar (1:2) over 10mm thick cement and sand mortar (1:4) screed trowelled even and smooth.

Height of skirting / dado shall be as indicated on drawings. Height of skirting / dado where not shown on drawings shall be 150mm in case of skirting and 2.0 m in case of dado. Dado/skirting shall be returned in jambs, openings, exposed edges, niches, etc.

### **8.4 Ceramic Tile Dado**

Tile skirting shall be of length matching with the floor tile. The cut edge shall not use on the top of the skirting. Where shown on drawing, this shall be of 300 x 450 mm size unless and otherwise shown in drawing and thickness will be as per IS standard. The joints shall be pointed with white cement mixed with matching pigment.

### **8.5 Screed for Skirting / Dado**

The wall surface shall be covered with about 10 mm thick plaster of cement sand mortar 1:3 (1 cement:3 coarse sand) as screed and shall be laid as described in para 13.39 & 13.40 on page 304-306 of SSR 2009 (Part-II).

### **8.6 Wall Care Putty**

Wall Care Putty, wherever specified shall be of minimum 3 mm total thickness in 02 coats and shall be of Birla White Wall Care Putty – SF or equal approve. The application of Wall Care Putty shall be as per manufacturer's printed instruction and as directed by the GE.

## **9 PAINTING**

### **9.1 White Washing / Colour Washing**

White wash / colour wash shall be provided where shown on drawings. All lime wash shall be done in 3 coats. The colour wash shall consist of 2 coats of colour wash (off white shade No. 3.033 or No. 4.05 as per IS-1650) over one coat of white lime wash where the finish on plastered surfaces is not indicated in schedule of finishes it shall be (colour wash as specified above). However, soffit of rooms shall be provided 3 coats of white (lime) wash. Lime / colour wash shall be carried out all as specified in 15.2 & 15.11 & 15.12 on

serial page No. 321-324 of SSR 2009 Part-I. Pigment for colour wash shall be as approved by GE. To achieve better finish of white wash zinc oxide shall be mixed with lime wash at the rate of 2 percent of slacked lime. In final coat of white wash fevicol DDL shall be mixed as per manufacturers' instructions. No ultramarine blue shall be mixed in any coat. However, sodium chloride, as specified in clause 15.12.3 on page 323 of SSR 2009 part I shall be mixed in first and second coats. Irrespective of what is shown on drawings, plastered surfaces inside the cupboards shall be given 2 coats of oil bound distemper white shade, after preparation of surfaces.

## 9.2 External Paint.

External paint shall be anti-algal weatherproof water based, modified acrylic smooth emulsion with silicon additives that shall give an anti-algal and high performance exterior wall finish (Weather coat or equivalent quality paint). It shall have colour stay technology to prevent tarnishing of the paint film and ensures brighter & cleaner shades. It shall have resistance against algal and fungal growth and shall give excellent dirt pick up resistance.

The paint shall have maximum 40% dilution percentage by volume with thinner (water) and shall have 35-45 (sec) viscosity when measured through a ford cup. When applied with brush, the first coat shall cover 10.5-11.5 sqm / ltr, while the second coat shall give 5-6 sqm/ltr. The paint shall have sheen level of 3-12 at 60 deg GH. The paint shall have surface drying time of approximate 30 minutes.

Before applying, it shall be ensured that the surface to be painted is free from any dust or grease. Any previous growth of fungus, algae or moss shall be removed thoroughly by virorous wire brushing and shall clean with water. surface imperfections such as holes, dents, fine crack shall be filled with putty or a mixture of white cement and fine sand (1:3). Minimum 2 coats Painting to be done over a coat of primer to give an even shade. Manufacturers' specification to be followed and with Camouflage pattern as approved by GE.

## 9.3 Paint of Steel Surface

If not mentioned otherwise, all Steel works to be painted as follows:

1. Surface Preparation: preparation of new or previously untreated surface thoroughly
2. Primer: one coat of primer (over shop primer also if any)
3. Paint: Two Coats of Synthetic Enamel Paint of approved brand as approved to give an even shade.

## 10 GLAZING

The glazing shall be done with selected quality float glass conforming to respective IS code, unless otherwise specified in particular specifications hereinafter. All glass shall be of good quality, free from specks, bubbles, smoke wanes, air holes and other defects.

Unless specified otherwise hereinafter, all glazing shall be with 5mm thick float glass for panes upto 0.5sqm. and 6mm thick for panes exceeding 0.5 square metre.

Glass shall be fixed to Aluminium window/ ventilators with steel Beads and to be fixed as described in para 16.10.2 on page No. 332 of SSR-2009 (Part-I).

Frosted glass 5mm thick shall be provided in windows/vents coming in toilets and in the locations as indicated in drawings. However, thickness of glass in the louvered windows shall be as shown on drawings.

The contractor shall produce vouchers / certificates from suppliers/manufacturers to the GE as a proof that the putty conforms to IS-419.

### 10.1 Single Glazing

Single glazing shall be 6mm thick float quality heat-strengthened transparent/ tinted or approved solar reflective soft coated glass of approved makes of the following required.

Single Glazing	
Characteristics	Blue or Light Blue tinted tempered and reflective.
Coated	Face # 2
Visible Light	
Day Light Transmission (LT)	30% approx.
Light Reflectance (LR)	
In	16% approx.
Out	11% approx.
Solar Energy	
Direct Energy Transmission (DET)	23% approx.
Direct Energy Reflectance(DER)	15% approx.
Energy Absorption (EA)	62% approx.
Solar Factor (SF)	37% approx.
Shading Co-efficient	0.42 approx.
U Value N/m <sup>2</sup> K	1.1 approx.

### 11 ALUMINIUM SECTIONS

Aluminium doors, windows etc. shall be fabricated from approved extruded sections and the manufacture & installation shall be carried out by an approved specialised agency and shall conform to IS 733 and IS 1285 for chemical composition and mechanical properties. The stainless steel screws shall be of grade AISI 304.. Unless otherwise specified the fabrication shall be done with heavy gauge extruded box sections. The sections free of scratches shall be of the sizes & details as shown on drawings. The details shown on the drawings indicate generally the sizes of the component parts and the general standards. These may be varied to some extent to suit the standards adopted by the manufacturers of the aluminium work. Powder coating shall be

done before fabrication in coating plants which ensures uniform coating in uniform colour and shades. The extrusions shall be coated up to 30 micron. The powder coating of extrusions shall be tested regularly under strict quality control adhering to Indian Standard.

All materials and details especially the weather-strip, gaskets and sealants shall be of approved high quality material capable of resisting the local climatical & environmental requirements.

The permissible dimensional tolerances of the extruded sections shall be as per IS 6477 and shall be such as not to impair the proper and smooth functioning/operation and appearance of door and windows.

### **11.1 Shop Drawings & Samples**

The contractor shall submit complete shop drawings and samples of each type of door, window, ventilators and other aluminium work, to the Architect / Engineer for his approval. The shop drawings shall show full size sections of doors, windows, etc. thickness of metal, details of construction, details of glazing, anchoring details, hardware as well as connection of curtain wall windows, doors and other metal work to adjacent work. Samples of all joints and methods of fastening and joining etc. also shall be submitted to the Architect / Engineer for approval well in advance of commencing the work. Samples of the actual work shall be installed at the site and got approved before proceeding with the work.

### **11.2 Sections**

The aluminium extrusions shall be of approved make. The sections shall be extruded from aluminium alloy of commercial quality and free from all defects impairing appearance, strength and durability. Hollow Box sections shall be extruded from Aluminium alloy as per IS:1285. The permissible dimensional tolerances of the extruded sections shall be such as not to impair the proper and smooth function/operation and appearance of doors and windows. For any excess weight of section used nothing extra shall be paid.

The sections shall also conform to the following parameters:

- a) Minimum tensile strength - 19 kg./mm<sup>2</sup>
- b) Maximum allowable deviation in length from straight line of 0.5mm/metre.
- c) Maximum allowable deviation from straight of 1 degree.
- d) Maximum permissible twist of 0.5mm metre.
- e) Maximum variation in flatness of not more than 0.125 x width/25.

**11.3 Protection & Handling**

All aluminium members shall be wrapped with approved self-adhesive non-staining PVC tapes. and crated in a suitable manner to protect the material against any damage during transportation. The loading, unloading, storing shall be carried out in an approved manner with utmost care.

**11.4 EPDM Gaskets**

EPDM gaskets of approved make, size and profile shall be provided and installed at all locations as shown and as called for to render the installation absolutely air and weather tight.

**11.5 Sealant**

The gaps between the Aluminium member and the perimeter and also any gaps in the door and window sections themselves shall be raked out as directed and filled with silicon sealant or any other sealant as specified of approved make and colour and make to ensure complete water-tightness.

The silicon sealant shall be of such colour, and composition that it would not stain the masonry/concrete work, shall receive paint without bleeding, will not sag or run and shall not set hard or dry out under any condition of weather. Silicon sealant shall be applied with a special gun as per manufacturers recommendation.

**11.6 Aluminium Doors & Windows****11.6.1 Doors**

The kick panel shall be of 1.25 mm aluminium alloy sheet conforming to IS Designation NS 3-1/2H of IS 737-1965. Specification for Wrought Aluminium and Aluminium Alloys Sheet and strip (for general engineering purposes) and shall be screwed to the frame and the glazing bar. The hinges shall be stainless steel frictional hinges of same type as

in windows but of larger size. The hinges shall normally be of 50mm projecting type. Non projecting type hinges may also be used if approved. The handles for door shall be of specified design and of same specifications as the windows. A suitable lock for door openable either from outside or inside shall be provided. In double shutter doors, the first closing shutter shall have a concealed aluminium alloy bolt at top and bottom. IT Shall be so constructed as not to work loose or drop by its own weight.

Single and double shutter doors shall be provided with a three way bolting device. Where this is provided in the case of double door, concealed aluminium bolts may not be provided.

### **11.6.2 Side-hung Windows & Ventilators**

For fixing stainless steel hinges, slots shall be cut in the fixed frame and the hinges inserted inside and may be rivetted to the frame. The hinges shall normally be of the projecting type not less than 65 mm and not more than 75 mm wide. The pins for hinges in case of non-oxidised work shall be of stainless steel of non-magnetic type or of suitable aluminium alloy. However, in the case of anodised work only suitable aluminium alloy for pins shall be used. Friction hinges shall be provided for side-hung shutter windows - in which case peg stay will not be required. In case of non-friction type hinges, peg stay which shall be either of cast aluminium conforming to IS Designation A.5.M of IS:617-1959 or folded from IS Designation NS4 aluminium alloy sheet conforming to IS:737-1955. It shall be 300 mm long complete with peg and locking bracket and shall have holes for keeping the shutter open in three different positions. The peg and locking bracket shall be rivetted or welded to the fixed frame.

The handle for side-hung shutters, shall be of cast aluminium conforming to IS Designation A.5.M of IS:617-1975 and mounted on a handle plate or welded or rivetted to the opening frame in such a way that it could be fixed before the shutter is glazed to match the window. The handle shall be anodised. The handle shall have a two-point nose which shall engage with an aluminium striking plate on the fixed frame in a slightly open as well as in a closed position.

For sliding window, the roller shall be of heavy duty type of approved by the GE. Framed section and proportion shall be as shown on drawing.

### **11.6.3 Fabrication**

All jointing shall be of mechanical type. The aluminium sections joints shall be designed to withstand a minimum wind load of 175 kg. per sqm. The designed shall also ensure that the maximum deflection of any framing shall not exceed  $L/175$  of the span of the member. All members shall be accurately machined and fitted to form hairline joints prior to assembly. The jointing accessories such as cleats, brackets, etc. shall be of such material as not to cause any bimetallic action. The design of the joint and accessories shall be such that the accessories are fully concealed. The fabrication shall be done in suitable sections to facilitate easy transportation, handling and installation. Adequate provision shall be made in the door and window members for anchoring to supports and fixing of hardware and other fixtures as approved by the Engineer. The fabricated frames shall be square and flat with corners in a true right angle.

### **11.6.4 Installation**

Just prior to installation, the doors, windows, etc. shall be stacked on edge on level bearers and supported evenly.

Unless otherwise shown window/door frames shall be fixed to openings with 20mm thick aluminium sub-frames. Width of sub-frame shall be exactly the

same width as the frames. The sub-frames shall be pre-fixed to the masonry surrounds with approved fasteners. The face of sub-frame shall be in true line, level and plumb.

When the sub-frame is properly secured and all major internal and external finishing works are completed, the assembled doors/windows shall be placed in correct final position in the opening and fixed to the sub-frame by cadmium plated machine screws of required size and spacing suited to the purpose.

Sizes, details, spacing, etc. given above are approximate and indicative only. They can be varied at the option of Engineer to suit particular sizes and situations and the contractor shall carry out the instructions of the Engineer in this regard at no extra cost to the owner. The contractor may suggest alternative methods of fixing and anchoring for consideration of the Engineer while the decision of the Engineer in this regard shall be final and binding.

In the case of composite windows and doors, the different units are to be assembled first. The assembled composite units shall be checked for line, level and plumb before final fixing is done. Units may have to be assembled in their final location if the situation so warrants.

Where aluminium comes into contact with masonry, concrete, plaster or some dissimilar metal, it shall be coated with an approved insulation lacquer or plastic tape to ensure that electro-chemical corrosion is avoided. Insulation material shall be trimmed off to a clean flush line on completion.

The contractor shall be responsible for assembling composite units, bedding and pointing with mastic inside and outside, at the transoms and mullions, placing the doors, windows, etc. in their respective openings. After the doors/windows have been fixed in their correct assigned position, the open hollow sections abutting masonry/concrete shall be filled with cement grout (1 cement: 3 coarse sand) densely packed and finished neat. Packing grout shall be of the expanding type made by approved additive.

#### **11.6.5 Protection & Final Cleaning**

The doors & windows shall be suitably protected from damage until handing over. Care shall be taken not to use the doors & windows for support, centering, etc. and no

scaffolding or other materials and devices shall rest on these. All the openable members shall be kept firmly closed. The PVC wrapping shall be retained till the glazing work is commenced. After the glazing and all work connected with installation of doors/windows is complete all aluminium work shall be cleaned with a suitable thinner and left in clean unblemished and in an openable condition.



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**12 ROAD AND PATH WORKS****12.1 Earth Work**

Excavation / earth work shall be in any type of soil (soft / loose / hard / dense) and shall be measured and paid for under respective items of Schedule 'A'.

Site Clearance shall be carried-out as per clause 3.6 on page 37 of SSR (Part-I) 2009.

Surface dressing shall be carried-out as per clause 3.10 on page 37-38 of SSR (Part-I) 2009.

Excavation shall be carried-out as per clause 3.12 & 3.13 on page 38-39 of SSR (Part-I) 2009.

Earth work in embankment shall be carried out all as specified in clause 20.A.15 on serial page 507-509 of SSR 2009 (Part I). However, the compaction of the earth shall be carried out with power road roller of capacity 8 to 12 tonne. All the earth work shall be carried out at Optimum Moisture Content of soil determined as per IS:2720 Part-8 and compacted to specified level as shown in the drawings.

Before commencement of earth work existing ground levels shall be taken jointly by the client and Contractor at an interval of not more than 10 m c/c or as instructed by the GE and cross sections shall be prepared showing existing ground levels, proposed formation levels, proposed gradient and camber on graph sheet which shall be signed by the GE and contractor. Ground levels shall be entered in MB as a record and earth work shall be computed by Simpson's Rule. The finished formation level shall also be taken jointly and shall also be recorded in MB and signed jointly. The earthwork payable shall be calculated on the basis of these levels.

**12.2 Granular Sub-base**

Granular sub-base for road pavement shall be as per the relevant clause under Pavement Works of these specifications.

**12.3 Dry Lean Concrete Base**

Dry Lean Concrete (DLC) Base for road pavement shall be as per the relevant clause under Pavement Works of these specifications.

**12.4 Pavement Quality Concrete Surfacing**

Pavement quality concrete (PQC) Surfacing for road pavement shall be as per the relevant clause under Pavement Works of these specifications.

**12.5 Wet Mix Macadam**

Wet Mix Macadam (WMM) base for road pavement shall be as per the relevant clause under Pavement Works of these specifications.

**12.6 Tack Coat / Prime Coat**

Tack coat, where required, shall be heated bitumen of VG-10 grade. The prime coat on granular base shall be bitumen emulsion complying with IS 8887 of a type and grade as directed by the Engineer or medium curing cutback as per IS 217. Kinematic Viscosity of Primer at 60°C shall be 30 – 60 Centistokes.

**12.7 Bituminous Works****12.7.1 Binder for Bituminous Works**

The binder for bituminous mixes shall be **VG-30 grade** bitumen complying with Indian Standard Specification for viscosity-graded paving bitumen, IS: 73 (latest Revision).

The bitumen to be procured from any of the following main producers:-

- i. M/s Indian Oil Corporation
- ii. M/s Bharat Petroleum Ltd
- iii. M/s Hindustan Petroleum Corporation Ltd

The contractor shall submit the original purchase vouchers along with manufacturers test certificate for the total quantity of bitumen supplied under each consignment to be incorporated in the work. All consignments received at the work shall be inspected by the GE along with the relevant document. Testing of bitumen shall be carried out as per Table 900-4 of MOR&TH specifications for road and bridge works of 2013 (5th Revision). The original purchase vouchers and the test certificate shall be checked and verified by the GE.

**12.7.2 Aggregate for Bituminous works**

Aggregates for bituminous works shall meet the requirements specified in clause 20.B.2.5.on pages 537 - 540 of SSR Part-I (2009); add the following:

- i) Combined Flakiness & Elongation Index of coarse aggregate as per IS 2386 (Part I) shall not exceed 25% for all the items of Bituminous works.
- ii) Stripping Value Test as per IS: 6241 of coarse aggregate shall result in retained coating not less than 95% for all the items of bituminous works.
- iii) Grading of Bituminous Macadam shall be Grading 2 with nominal size of aggregate 19 mm and minimum bitumen content 3.4% by weight of mix.

### 12.7.3 Construction of Bituminous works

Construction and quality control Dense Bituminous Macadam / Semi Dense Asphalt Concrete shall be carried-out specified in clause 20.B.4 on pages 548 - 553 of SSR Part-I (2009). Apart from this, the GE can instruct the contractor to carry out any other QC Tests as per the latest issue of relevant TIs and policies from E-in-C's Branch; however, the contractor shall not be eligible for any additional payment on this account.

Mix design criteria for bituminous mixes shall be as per 20.B.2.11 of the Specification. The optimum binder content for Dense Bituminous Macadam / Semi Dense Asphalt Concrete shall be determined by Marshall Design method corresponding to 4.0% air voids. The mix shall satisfy all mix design criteria such as Marshall Stability, flow value, voids in mineral aggregate and voids filled with binder at the optimum binder content. Minimum Bitumen content for Dense Bituminous Macadam / Semi Dense Asphalt Concrete shall be 4.5%. No extra payment shall be paid to the contractor for any higher percentage of bitumen content required to fulfill the design criteria given in clause 20.B.2.11.

Hydrated lime filler shall be used at a rate of 2 percent by weight of mix in Dense Bituminous Macadam / Semi Dense Asphalt Concrete mix.

### 12.8 Job Mix Formula

The Bituminous mixes shall be properly got designed in laboratories i.e. CRRI/IIT/SEMT Wing CME Pune/NIT as approved by the GE by Marshall method so as to satisfy the specification requirements.

The proposed job mix formula shall be finalized by the Zonal CE or approved person as authorized by him in writing at least 60 days before starting the work as per approved work schedule. The job-mix formula shall indicate the complete physical and mechanical properties for the mixes to be supplied for various courses, a single percentage of aggregate passing each sieve, mixing temperature and the temperature at which the mix shall be laid. The GE shall then approve the job-mix proposed by the Contractor for the course.

Job mix formula shall be based on truly representative sample of materials that will be actually used in the work. Along with the job mix formula proposed to be used in the work, the following details shall be recorded :-

- (a) Source and location of all materials.
- (b) Proportion of all materials expressed as follows where each is applicable
  - (i) Binder : As percentage of weight of total mix.
  - (ii) Coarse Aggregates : As percentage by weight of fine aggregate and total aggregates

- (iii) Test results of physical characteristics of the aggregates in the form of parameters specified.
- (iv) A single definite percentage passing each sieve for the mixed aggregate
- (v) The results of tests for Job mix formula.

The approved Job Mix Formula shall remain effective unless and until the same is modified and re-approved by the GE. More than one Job Mix proportion is permissible based upon the properties of actual material available during construction of the project.

Laboratory charges for the job-mix formula design, costs of materials, its cartage and other incidental expenses shall be borne by the Contractor.

Once the laboratory job-mix formula (JMF) is approved, Plant Trials for Dense Bitumenous Macadam / Semi Dense Asphalt Concrete shall be carried-out by the contractor as per clause 505.3.4 of MORT&H Specifications (fifth Revision). Permissible variations in the actual mix from the job mix formula shall be as per Table 500-12 of MORT&H Specification (fifth Revision). Laying Trials for Dense Bitumenous Macadam / Semi Dense Asphalt Concrete shall be carried-out by the contractor as per clause 505.3.5 of MORT&H Specifications (fifth Revision). Construction of Dense Bitumenous Macadam / Semi Dense Asphalt Concrete shall be started only after approval of final JMF and Laying Trials.

### **12.8.1 Trial Bay**

A trial bay of at least 30 metre x 7.5 metre (for Airfield Pavement) or width of Road (for road Pavement) should be laid and be approved by the GE before undertaking any layer. For each layer, separate test patch and separate approval will be accorded and record maintained. Test patch should be used to assess the roller passes and sequencing of static/vibratory roller to obtain optimum density of layers.

Surface regularity for Semi Dense Asphalt Concrete (SDAC) in surface course shall meet the requirements of clause 20.B.4.10 on pages 551 of SSR Part-I (2009).

### **12.8.2 Construction**

#### **12.8.2.1 Preparation of the Base**

The base of which Dense Bitumenous Macadam / Semi Dense Asphalt Concrete is to be laid shall be prepared, shaped and conditioned to the specified line, grade and cross-section. The surface shall be thoroughly swept and scraped clean and free from dust, caked mud and other deleterious materials, etc. Where the existing base is pot holed or rutted, the same shall be rectified by filling with pre-mixed bituminous material well rammed and compacted. If the existing base is irregular and wavy, it may be considered necessary to provide a suitable profile corrective course of adequate thickness

to rectify profile both longitudinally and transversely before laying the Dense Bitumenous Macadam / Semi Dense Asphalt Concrete .

### **12.8.2.2 Mixing**

#### **12.8.2.2.1 Weather and Seasonal Limitations**

Dense Bitumenous Macadam / Semi Dense Asphalt Concrete shall not be laid during rainy weather or when the surface is damp or wet or when the temperature at the surface on which is to be laid is below 10<sup>0</sup> C or when the wind speed at any temperature exceeds 40 Km/hour at 2 metre height.

### **12.8.2.3 Plant**

The hot mix plant employed at site will be a weigh batch plant having a minimum capacity of minimum 100 TPH. All plants used by the contractor for preparation of asphalt paving mixes should be equipped with the following :-

- (a) Means for accurately weighing each batch of aggregates with separate load cells in each bin.
- (b) Bitumen tanks with arrangement of heating under effective and positive control all the times.
- (c) A mixture unit capable of producing a uniform mixture.

### **12.8.2.4 Temperature**

The temperature of the binder at the time of mixing shall be in the range of 150<sup>0</sup> C – 165<sup>0</sup> C and shall be so maintained without overheating of the binder. The temperatures of the aggregates shall be in the range of 150<sup>0</sup> C – 170<sup>0</sup> C. At no time, however, shall the difference in temperature between the aggregates and the binder exceed 14<sup>0</sup> C. It shall be ensured bitumen or aggregates are not over heated.

The hot, combined aggregates and bitumen shall be measured separately and as accurately as practicable, to the proportions in which they are to be mixed. Mixing shall be done thoroughly at least for 30 seconds or layer after the addition of the binder, as required so that a homogenous mixture is obtained in which all the particles are uniformly coated.

### **12.8.2.5 Transporting Mixed Materials**

The mixed materials shall be transported from mixing plant to the site in clean insulated and unless otherwise agreed by the Engineer-in-Charge, shall be covered while in transit or awaiting tipping vehicles. Every precaution shall be taken to avoid segregation and to ensure that they do not become contaminated with dust or foreign matter. In order to maintain satisfactory temperature of materials in transit, particularly in cold weather, and to prevent undue loss of heat, adequate precautions shall be taken to ensure that the materials are properly protected/covered during transportation. Hauling over freshly laid material will not be permitted.

The temperature of the mix in every transporting vehicle shall be checked immediately prior to discharge into the spreader. If the temperature of any batch is below the laying temperature specified, the mix shall be rejected and shall be removed from site immediately.

#### **12.8.2.6 Laying**

The mix transported from the hot mix plant to the site shall be laid by means of a self-propelled mechanical paver finisher with electronic sensor taking signal from string laid with the help of total station as per given profile capable of laying to a minimum width of 9m or width finalized by GE and profile without causing segregation, dragging and irregularities or other surface effect. The paver shall be capable of being operated at a speed consistent with the character of the mix and the thickness of the course being laid, so as to produce a surface having a uniform density and surface texture. Where not operated on side forms the paver-finisher shall employ equalizing runners, evener arms or other devices to adjust the profiles and confine the edges of the courses to true lines. The temperature of the mix at the time of laying shall be in the range of 125°C to 160°C. The sequence of laying shall be decided by the Engineer-in-Charge preferably starting along the centre line of the pavement.

Only in confined space and areas when the paver finisher cannot operate, hand spreading may be permitted by the Engineer-in-Charge. Sub-base areas will meet the specified compaction standards and layer thickness. Generally, hand spreading is prohibited unless specifically authorized by the Engineer-in-Charge.

#### **12.8.2.7 General**

All joints shall present the same texture, density and smoothness as other sections of the layer. Special care shall be given to joints of sections laid at different time, to ensure a proper bond and a smooth surface between the old and new sections.

#### **12.8.2.8 Longitudinal Joints**

Longitudinal joints and edges shall be constructed true to the delineating line parallel to the centre line of pavement. The longitudinal joints shall be truly vertical in straight lines which are continuous for the full length of the pavement or in smooth curves around bends. Joints in successive asphaltic concrete layers above shall be staggered by 500mm from the underlying layers. The exposed vertical edges of the longitudinal lane joints shall be carefully cut back and trimmed to a dense vertical face in the compacted lane or for a minimum of 100mm, whichever is greater. All debris/loose material arising from this operation shall be removed from the pavement and the underlying surface cleaned. The exposed joints face shall then be cleaned and painted with hot bitumen at the rate of 1 kg/10sqm immediately before the laying of the adjacent lane. Nothing extra shall be paid on this account. Rolling of longitudinal joint shall be done with roller on hot side with 150mm overlap on the previously laid cold lane.

### 12.8.2.9 Transverse Joints

- (i) They shall be formed at right angles to the longitudinal joints and be truly vertical. Transverse joints shall be staggered from each other and in the layers above at least 500mm. The end of day's operations, the roller shall pass over the unprotected end of the freshly laid mix.
- (ii) The exposed vertical edges of the transverse joints shall be cut back and trimmed to firm material or for a distance 100mm the thickness of layer or upto meeting a dense material of full thickness, whichever is greater. All debris/loose material arising from this operation shall be removed from the pavement and the underlying surface cleaned. The exposed joints shall then be cleaned and painted with hot bitumen immediately at the rate of 1 kg/10 sqm before resumption of the laying operation. Nothing extra shall be paid on this account.

### 12.9 Rolling

After spreading of the mix, consolidation shall be done by an approved power driven roller or rollers weighting not less than 8 to 10 tonnes dead weight each. Rolling of longitudinally at the sides shall be done immediately behind the paving operation. After this, rolling shall commence at the edge and progress towards the centre. Rolling shall continue until all roller make has been removed from the surface. All deficiencies in the surface after laying shall be made good by the attendants behind the paver, before initial rolling is commenced. The initial or break down rolling shall be done with 8-10 tonnes dead weight smooth wheeled rollers. The intermediate rolling shall be done with vibratory roller of 12 to 15 tonnes weight having nine wheel. The final rolling shall be done with 6 to 8 tonnes smooth wheeled tandem roller.

The speed of the roller shall not exceed 5 km per hour and shall at all points be slow enough to avoid displacement of the mixture and displacement occurring as a result of reversing the direction of the roller or from any other cause, shall at once be corrected by the use of rakes and addition of fresh mixture where required.

When the roller has passed over the whole area once, any high spots or depressions which become apparent shall be corrected by removing or adding fresh material. Rolling shall then proceed continuously till no further compaction is possible. To prevent adhesion of the mixture to the wheels of the roller, the wheel shall be kept damp with water, but excess of water shall not be permitted. In no case shall fuel lubricating oil be used for this purpose. Rolling operations shall be completed in every respect before the temperature of the mix falls below 90°C.

### 12.10 Pavement Edge

Pavement shall be laid to correct width and alignment. To achieve straight and vertical edge, the contractor shall cut back the edges to correct width and

alignment by removing extra mix spread. Nothing extra shall be paid on this account.

#### **12.11 Quality Control**

Quality control of Dense Bitumenous Macadam / Semi Dense Asphalt Concrete shall be carried-out as per clause 20.B.4.9 of the Specification.

#### **12.12 Bitumen Content**

The bitumen content of the mix shall be tested periodically and as directed by the GE using centrifugal extraction method or such method approved by the GE. The test shall generally be carried out in accordance with established practices and as directed by the GE. Wherever, there is a deviation in the resultant, bitumen content from approved job-mix formula values, it shall be reported to the GE immediately and necessary correction shall be made at the job-mix plant as directed.

#### **12.13 Field Density Determination By Sand Replacement Method**

The metallic tray of the field density unit is kept on a level spot of the surface and a hole, 10cm in diameter is cut to the entire thickness of the layer.

All materials removed from the hole are carefully collected weighted. A known weight of dry standard sand, passed 1.0 mm IS sieve and retained on 600 micron IS sieve is taken in sand pouring cylinder. The cylinder is kept directly over the hole and the shutter of the cylinder is released without any jerk and closed when the hole is filled with the sand. The quality of the residual sand in the cylinder is weighted and the quantity filled the cone of the cylinder is determined.

#### **12.14 Acceptance criteria of field density**

- (i) The optimum density for the Dense Bitumenous Macadam / Semi Dense Asphalt Concrete (SDAC) on consolidation shall be taken as the density achieved in Marshall mould after compaction in laboratory with 75 blows on each end of the spectrum. The field density shall be at least 98% of lab density for SDAC.
- (ii) The work shall be accepted as of quality, measured and paid in full if the field density does not work out to be less than specified above. When the field density works out to be less than specified above, the surface shall be further consolidated till the required field density is achieved. If this is not found possible, the work represented by the sample shall be dismantled and redone by the contractor at his own cost.

#### **12.15 Rectification**

The surface accuracy shall be checked immediately after rolling. Surface irregularities which fall outside specified tolerance limits as laid in relevant Clause of MES SSR Part-I shall be rectified by removing to full depth. The



affected area which shall not be less than 10 sqm and relaying with fresh materials, in no case, shall depressions be filled up with screenings of binding material.

#### **12.16 Plants/Machinery to be Used**

Plants/Machinery to be used shall be as specified in Schedule A Note-10. (List of Major Plants & Equipments).

#### **12.17 Quality Assurance**

Adequate quality control at every stage of work is essential and the contractor shall establish field laboratory which shall be suitable staffed headed by Materials Engineer with sufficient experience in conducting day to quality control test as enumerated in Clause 7.10.1 hereinbefore. The laboratory in-charge shall work under the direction of GE and Engineer-in-Charge and tests are to be conducted as per their approval. Sufficient number of machines and equipment shall be installed by the contractor so that all control tests could be performed at site. The minimum equipment to be maintained in the field lab shall be as specified in Appendix 'E' to particular specifications A-116. This shall be in addition to any other tests which will be required by the GE and Engineer-in-Charge in laboratories i.e. CRRI/IIT/SEMT Wing CME Pune/NIT/Test House/Govt Engineering College Expense on all tests/procurement of machines or equipment, etc, shall be borne by the contractor.

The longitudinal profile of the finished surface shall be tested with a straight edge 4.5m long parallel to the centre line and the transverse profile with a camber plate. Any irregularity greater than 4mm shall be corrected.

Surface evenness requirements in respect of both the longitudinal and cross profiles should be simultaneously satisfied.

#### **12.18 Measurements**

Before commencement of laying of bitumen macadam, levels shall be taken jointly by the Engineer-in-Charge or his representative and the contractor at 3 metre intervals both ways or closer as directed by the Engineer-in-Charge. These levels shall be recorded in the level book and plotted on the plan on tracing of polyester film by the Contractor at his own cost and the same shall be signed by the Contractor. Proposed formation levels of the finished bitumen macadam surface shall be marked at corresponding points. Tack coat shall then be applied and bitumen macadam shall then be laid and consolidated bituminous surface shall be taken at grid points at which levels were recorded earlier in the level book and also plotted on the plan. Level books as well as the plan shall be signed by the Contractor as token of acceptance of the levels.

The volume of consolidated mix shall be worked out in cum. Correct to two places of a decimal as the product of the measured surface area and

thickness laid. Thickness shall be worked out on the basis of actual levels. The length and breadth shall be measured correct to cm.

#### **12.19 Edging of Road**

Brick edging for bituminous roads shall be well burnt, best locally available conforming to specifications given in brick work section in this tender and shall be embedded in ground all as shown in drawing. Bricks shall be burnt clay cement brick and laid as mentioned in respective item of Sch `A`.

#### **12.20 Kerb Stone**

Where shown in the drawings, Kerb stone shall of nominal mix (1:2:4). Kerb stone shall be laid in 1:4 cement mortar & on the prepared sub base as accordance with para 20.A.33 on page 531 of SSR (Part-I) 2009.

### **13 PAVEMENT WORKS**

#### **13.1 Recording of Existing Levels**

Finish levels of existing pavement surfaces under overlay shall be recoded jointly by the client and Contractor at an interval of not more than 10 m c/c in longitudinal direction and 1.5 m c/c in transverse direction to runway/ taxiway center line and not more than 10m c/c in both the directions in apron. Ground levels shall also be recorded at an interval of not more than 10 m c/c in both the directions in the entire work areas, extending upto boundary wall along the runway strip or as directed by the GE.

No payment shall be payable to the contractor for the above tasks, it shall be deemed to be included in his rates of other items.

#### **13.2 Grading Plan**

Based on the analysis of existing pavement levels, longitudinal and transverse profiles of runway and taxiways/aprons etc. shall be prepared by the contractor and got approved from the client, ensuring minimum quantity of profile correction course involved. Frequency of transverse profiles shall be 50m. The contractor shall be required to submit an area-wise statement of quantities of profile correction course (PCC) required corresponding to the above long and cross profiles for Client's review along with the drawings. If required, the Client may instruct the contractor to further optimize the quantity of PCC by making suitable amendments in the runway & taxiway profiles.

Longitudinal slope and slope changes of runway and shoulders shall meet the requirements of Code 4 as per ICAO Annex 14. Transverse slope of runway and shoulders shall meet the requirements of Code-D as per ICAO Annex 14. Longitudinal slope and slope changes and transverse slope of taxiways and shoulders shall meet the requirements of Code-D as per ICAO Annex 14. Slopes on apron surface shall be 0.50 - 1.0 %.

Based on the approved long and transverse profiles, detailed grading plan of pavements showing design finish levels of all the overlay and new pavements, shoulders and land beyond them upto the existing/ proposed storm water drains shall be prepared and got approved from the client before start of works.

Similarly, the longitudinal profiles of all the proposed new roads shall also be prepared and got approved by the contractor from the GE before start of works.

No separate payment shall be payable to the contractor for the above tasks, it shall be deemed to be included in his rates of other items.

### **13.3 Earth Work**

Excavation / earth work shall be in any type of soil (soft / loose / hard / dense) and shall be measured and paid for under respective items of Schedule 'A'.

Site Clearance shall be carried-out as per clause 3.6 on page 37 of SSR (Part-I) 2009.

Surface dressing shall be carried-out as per clause 3.10 on page 37-38 of SSR (Part-I) 2009.

Excavation shall be carried-out as per clause 3.12 & 3.13 on page 38-39 of SSR (Part-I) 2009.

Earth work in embankment shall be carried out all as specified in clause 20.A.15 on page 507-509 of SSR 2009 (Part I). However, the compaction of the earth for each layer shall be carried out with power road roller of capacity 8 to 12 tonne. All the earth work shall be carried out at Optimum Moisture Content (OMC) of soil determined as per IS:2720 Part-8 and upto compaction level specified in the drawings.

Before commencement of earth work existing ground levels shall be taken jointly by GE and Contractor at suitable intervals as instructed by the Engineer, not exceeding 10 m in longitudinal and across directions; cross sections shall be prepared showing existing ground levels, proposed formation levels, proposed gradient and camber on graph sheet/ drawings. Ground levels shall be entered in MB/ level book as a record and signed jointly by the Engineer and Contractor. The finished formation level shall also be taken jointly and shall also be recorded in MB/ level books and signed jointly. The quantity payable shall be calculated on the basis of these levels by Simpson's Rule.

The materials shall be soil, moorum, gravel, flyash, pond ash, a mixture of these or any other material approved by the Engineer. It shall be free of peat, logs, stumps, roots, rubbish or any other ingredient likely to deteriorate or

affect the stability of the embankment/ subgrade. The following types of material shall not be allowed in filling in subgrade of pavement works:

- a) Materials from swamps, marshes and bogs;
- b) Any soil that classifies as OL, OI, OH or Pt in accordance with IS: 1498;
- c) Materials susceptible to spontaneous combustion;
- d) Materials in a frozen condition;
- e) Materials with salt resulting in leaching in the embankment.
- f) Soils having liquid limit exceeding 40 or plasticity index exceeding 25;
- g) Soils with a total sulphate content (expressed as SO<sub>3</sub>) exceeding 0.5 per cent by mass, when tested in accordance with BS: 1377 Test 9.
- h) Soils with four day soaked CBR at 95% of Modified Maximum Dry Density (MMDD) determined as per IS: 2720 (Part 8) - less than 5%.

Soils to be used within 1.25m from subgrade top under the pavements shall meet, in addition to above, the following requirements:

- i) Soil shall be non-expansive in nature (free swell index = 0)
- ii) When tested as per IS: 2720 (Part 8), shall have Maximum laboratory dry unit weight not less than 17.5 kN/cu. m.
- iii) Four day soaked CBR at 95% of Modified Maximum Dry Density (MMDD) determined as per IS: 2720 (Part 8) – Not less than 8%.
- iv) Use of Flyash/ pond ash shall not be allowed in these locations.
- v) Shall be free from grass, wood, organic matter or any other deleterious material.

The layer of earth filling shall be compacted by the mechanical means such as sheep foot roller or by power roller to 90 – 98 percent (as shown in the drawing) of Modified Proctor Density determined in the laboratory as per IS: 2720 (Part VIII) under optimum moisture conditions

Earth obtained from external borrow-pits for earth filling in pavements/ shoulders shall fulfill the requirements for fill material described under section 18.1.4 above. If flyash/ pond ash is used as fill material it shall be used strictly in accordance with the guidelines of IRC: SP: 58-2001.

Where specified, the compaction of earth filling shall be carried-out under optimum moisture conditions, so as to obtain at least 95 percent of Modified Proctor Density for each layer. Dry density shall be determined in accordance with IS-2720 (Part VIII)- 1980 Method of test for soil (Part VIII) – Determination of water content dry density relation using Heavy compaction such as sheep foot roller or by power roller.

Besides grading, good earth for stabilization shall be non-plastic in nature and meet all the requirements for fill materials given under clause 3.19.1 of SSR 2009

### 13.4 Stabilized Subgrade Layer

Soil stabilization for stabilized subgrade layer shall be done in accordance with Para 20.A.15B on page 509 – 514 of SSR (Part-I) 2009.

Unconfined Compressive Strength (test method ASTM D 1633) of stabilized soil at seven days shall be not less than 14.0 kg/sqcm under field conditions. In addition, the stabilized materials shall meet the following minimum durability criteria:

- a) Maximum Weight Loss after 12 Wet-Dry cycles when tested as per ASTM D-559 or 12 Freeze-Thaw Cycles when tested as per ASTM D-560 shall not exceed the following:

Type of Soil Stabilized	Maximum Allowable Percent Loss by Weight of Initial Specimen
Granular, PI < 10	11
Granular, PI > 10	8
Silt	8
Clays	6

The mix design shall be done on the basis of 7-day unconfined compressive strength (UCS) and durability test under 12 cycles of wet-dry conditions. The quantity of cement to be added as per cent by weight of the dry soil shall be as per approved mix design so as to achieve the specified unconfined compressive strength under laboratory conditions. The target laboratory strength value for mix design shall be at least 1.5 times the minimum field UCS value stipulated for field conditions (i.e. 21 kg/sqcm). Minimum cement content in the soil cement mix shall be 2% by weight of dry soil.

Unconfined Compressive Strength - soaked CBR relationship shall be established for the final approved stabilized mix at design field density during design stage. Quality control of mix during execution stage shall be performed by conducting soaked CBR test on mix samples collected from material laid at the site

Construction operations, surface finish, alignment, profile and surface Evenness, quality control etc. of Stabilized Sub-grade shall conform to requirements as per clause 20.A.15B.6 on page 510- 514 of the SSR part-I (2009).

### 13.5 Granular Sub Base

Granular sub-base for pavements shall be natural sand, moorum, gravel, crushed stone, or combination thereof depending upon the grading required. It shall meet the grading and CBR value requirements for Graded Material Grading V as per Table: 400-1 of MORT&H Specifications. The material shall have a 10 per cent fines value of 50 kN or more (for sample in soaked condition) when tested as per BS: 812 (Part 111). The water absorption value of the coarse aggregate determined as per IS: 2386 (Part 3); shall be not

more than 2 percent. The material passing 425-micron sieve when tested according to IS: 2720 (Part 5) shall be non-plastic.

When sub-base material consists of combination of materials mentioned above, mixing shall be done mechanically by plant method. The mixed material shall be sampled, tested and approved in lots as per specifications before spreading and compacting at the site.

The sub-base material of grading specified in the Contract shall be spread on the prepared subgrade with the help of a motor grader of adequate capacity, its blade having hydraulic controls suitable for initial adjustment and for maintaining the required slope and grade during the operation or other means as approved by the Engineer.

Compaction of sub-base layer achieved in the field shall be at least 98 per cent of the Modified Maximum Dry Density (MMDD) determined as per IS: 2720 (Part 8).

If so desired by the Engineer, trial runs with the laying and compaction equipment proposed to be used by the contractor shall be carried out to establish its suitability for the work.

Moisture content of the loose material shall be checked in accordance with IS: 2720 (Part 2) and suitably adjusted by sprinkling additional water from a truck mounted or trailer mounted water tank and suitable for applying water uniformly and at controlled quantities to variable widths of surface or other means approved by the Engineer so that, at the time of compaction, it is from 1 per cent above to 2 per cent below the optimum moisture content corresponding to IS:2720 (Part 8). While adding water, due allowance shall be made for evaporation losses. After water has been added, the material shall be processed by mechanical or other approved means like disc harrows, rotavators until the layer is uniformly wet.

Immediately thereafter, rolling shall start. If the thickness of the compacted layer does not exceed 100 mm, a smooth wheeled roller of 80 to 100 kN weight may be used. For a compacted single layer upto 225 mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 kN static weight with plain drum or pad foot- drum or heavy pneumatic tyred roller of minimum 200 to 300 kN weight having a minimum tyre pressure of 0.7 MN/m<sup>2</sup> or equivalent capacity roller capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional crossfall and super- elevation and shall commence at the edges and progress towards the centre for portions having crossfall on both sides.

Each pass of the roller shall uniformly overlap not less than one- third of the track made in the preceding pass. During rolling, the grade and crossfall (camber) shall be checked and any high spots or depressions, which become apparent, corrected by removing or adding fresh material.

The speed of the roller shall not exceed 5 km per hour. Rolling shall be continued all the density achieved is at least 98 per cent of the maximum dry density for the material determined as per IS:2720 (Part 8). The surface of any layer of material on completion of compaction shall be well closed, free from movement under compaction equipment and from compaction planes, ridges, cracks or loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of layer and re-compacted.

The surface finish of construction of granular sub-base shall conform to the requirements of Clause 902 of MORT&H Specifications. Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900 of MORT&H Specifications.

### **13.6 Wet Mix Macadam (WMM)**

#### **13.6.1 Aggregate for WMM**

Aggregates for wet mix macadam shall meet the requirements specified in clause 20.B.2.5 on pages 537 - 540 of SSR Part-I (2009); add the following:

- i. Combined Flakiness & Elongation Index of coarse aggregate as per IS 2386 (Part I) shall not exceed 30% for WMM.
- ii. Grading of WMM shall be as per clause 20.B.2.5.4 on pages 538 of SSR Part-I (2009).
- iii. Material Passing 425-micron sieve shall be non-plastic in nature.

#### **13.6.2 Construction of WMM Base Course**

Construction of WMM base course and quality control shall be carried-out as specified under clause 20.B.5 on pages 553 - 556 of SSR Part-I (2009).

### **13.7 Dry Lean Concrete Sub-base**

#### **13.7.1 General**

The work shall consist of construction of dry lean concrete sub-base for cement concrete pavement in accordance with the requirements of these Specifications and in conformity with the lines, grades and cross-sections shown on the drawings or as directed by the Engineer. The work shall include furnishing of all plant and equipment, materials and labour and performing all operations, in connection with the work, as approved by the Engineer. The design parameters of dry lean concrete sub-base, viz., width, thickness, grade of concrete, details of joints, if any, etc. shall be as shown in the drawings

#### **13.7.2 Construction of Dry Lean Concrete (DLC) Sub-base**

Construction of Dry Lean Concrete (DLC) sub-base shall be carried-out as per clause 20.B.6 on pages 556 - 560 of SSR Part-I(2009) with following additional requirements:

- i. If the minimum specified cement content is not sufficient to produce concrete of specified strength, it shall be increased as necessary without additional cost compensation to the Contractor.
- ii. Control of Alignment, level and Surface Regularity for DLC sub-Base course layer shall meet the requirements of Section 902 of "MORT&H Specifications for Roads & Highways" for National Highways/ Expressways.
- iii. Use of Polyester triangular synthetic fibres is not required in DLC.

Method of measurement of quantity for payment purposes shall be similar to one as for earth work in filling described herein before.

The surface finish of construction of Dry Lean Concrete (DLC) sub-base shall conform to the requirements of Clause 902 of MORT&H Specifications.

Quality Control Tests on DLC during construction and their minimum frequency shall conform to the requirements of clause 903.5.1 of MORT&H Specifications.

### **13.8 Pavement Quality Concrete (PQC) Surfacing**

Pavement quality concrete shall be design mix concrete having characteristic flexural strength of 45 Kg/Cm<sup>2</sup> in field at 28 days' age as per IS 456-2000. Approved admixtures conforming to IS-9103 shall be permitted to be used in the concrete mix at contractor's option without any price adjustment. The total amount of chloride content in the admixture mixed concrete shall satisfy the requirement of IS 456-2000. The design criteria for pavement quality concrete shall be characteristic flexural strength of 45 Kg/Sqcm at 28 days, to be achieved at site.

The concrete mix design with or without admixture shall be carried out by the contractor through one of the following laboratories/ test houses which will be approved by GE:

- Any IIT
- Any approved NIT/Engineering College approved by CCE
- S E M T Pune
- CRRI, New Delhi

The various ingredients for mix design, laboratory tests shall be sent to the lab/test houses through the GE and the samples of such ingredients sent shall be preserved at site till completion of work or change in Design Mix whichever is earlier. The samples shall be taken from the approved materials, which are proposed to be used in the work.

The contractor shall submit the mix design report from approved laboratory for approval of Zonal Chief Engineers Office concerned through GE at least 60 days before the date of commencement of PQC work as per approved work schedule. The mix design submission shall be accompanied by the



external laboratory test results of all the materials used in the mix design and proposed to be used in the works at site.

Water to be used for concreting shall be tested as per relevant IS standard. All the sources of water proposed to be used for concrete shall be tested in a NABL accredited laboratory and got approved from the GE; the water quality shall meet all the test requirements as per IS 456.

For each change of source of quality/characteristic properties of the ingredients during the currency/progress of work, from that approved and used in the concrete mix, a fresh mix design shall be got done by the Contractor. Revised trial mix test shall be conducted and shall be submitted by the contractor. In case of any unforeseen eventuality, alternate mix design for different quarry to be got approved in advance and kept ready as reserve to avoid delay.

The cost of packing, sealing, transportation, loading, unloading cost of samples and the testing charges for mix design all cases shall be borne by the contractor.

The mix design shall be done considering the degree of quality control as "very good" (as mentioned in Table I under Section 20.B.7 of SSR (2009) Part-I) in all cases.

The item of design mix cement concrete shall be inclusive of all the ingredients including admixtures if required, labour, machinery, T&P etc including shuttering required for a design mix concrete of required strength and workability. The rate quoted by the contractor for the mix design items shall be net and nothing extra shall be payable on account of change in quantities of concrete ingredients like cement, sand, aggregates and admixtures etc as per the approved mix design. Minimum cement content of mix corresponding to 4.5 MPa flexural strength should not be less than 400 kgs/cum of OPC. The OPC content shall not exceed 425 kgs/cum of concrete.

Cement to be used shall be Ordinary Portland Cement 43 Grade IS: 8112 or 53 Grade IS: 12269 as approved by the Engineer. If the subgrade is found to consist of soluble sulphates in a concentration more than 0.5%, cement used shall be sulphate resistant and shall conform to IS 12330.

Cement shall be subjected to acceptance testing for each batch received at the site before being allowed in the works. Manufacturer's certificates shall be required for each batch of cement delivered to the site.

Cement older than two (02) months from date of manufacture or containing lumps shall not be allowed in the works. Two different types/ brands of cement shall not be mixed together or used in a single days' work.

Cement to be used may preferably be obtained in bulk form. If cement in paper bags is proposed to be used, there shall be bag-splitters with the facility to separate pieces of paper bags and dispose them of suitably.

Admixtures conforming to IS:6925 and IS:9103 shall be permitted to improve workability of the concrete or extension of setting time, on satisfactory evidence that they will not have any adverse effect on the properties of concrete with respect to strength, volume change, durability and have no deleterious effect on steel bars. The particulars of the admixture and the quantity to be used must be furnished to the Engineer in advance to obtain his approval before use. Satisfactory performance of the admixtures should be proved both on the laboratory concrete trial mixes and in the trial length paving. If air entraining admixture is used, the total quantity of air in air-entrained concrete as a percentage of the volume of the mix shall be  $5 \pm 1.5$  per cent for 25 mm nominal size aggregate

Minimum cement content in pavement quality concrete required for achieving specified strength is 400 Kg/Cum. However, in case quality of cement proposed to be used in design mix fails to achieve specified properties, the contractor shall provide increased quantity of cement including admixture if any, and nothing extra shall be payable to the contractor on this account.

A separate mix design / JMF shall be prepared with suitable adjustment in mix workability requirements for reinforced concrete slabs.

Final mix design of pavement quality concrete (PQC) shall be got approved from the Zonal Chief Engineers Office concerned.

### **13.8.1 Production of Concrete**

The concrete shall be produced in fully automatic central batching and mixing plant installed at site producing at least 25 cum mixed concrete per hour. The site for installation of batching and mixing plant and storage of aggregate shall be as shown in the drawing attached/ directed by the DEPMC in consultation with GE, which shall be cleaned and prepared by the contractor at his own cost. The batching plant shall be of fully automatic type of slanted single starter switch will automatically start the weighing operation of each material and stop automatically when the designated weight of each material has been reached. A batching plant essentially shall consist of the following components:-

- Storage bins for different sizes of aggregates and cement
- Batching equipment
- Mixers
- Control Panels
- Mechanical material feeding and elevating arrangements
- Computer printing facility

The compartment of storage bins shall be approximately of equal size. The cement compartment shall be centrally located in the batching plant. It shall be water tight and provided with necessary air vent, aeration fittings for proper flow of cement, emergency cement cut off gate. The aggregate and sand shall be charged by powder operated centrally revolving chute. The entire plant from mixer floor upwards shall be enclosed and insulated. The batch

bins shall be constructed so as to be self-cleaning during draw-down. The batch bins shall in general conform to the requirement of IS-4925.

Batching equipment shall be capable of determining and controlling the prescribed amounts of various constituent materials for concrete accurately. i.e. water, cement, sand individual size of coarse aggregates, etc. A daily record of consumption of different constituents of PQC as an output of computerized plants shall be maintained for each day for record and verification.

The mixer in the batching plant shall be also arranged that mixing action in the mixers can be observed from the operator's station. The mixer shall be equipped with mechanically or electrically operated timing, signing and metering device that will indicate and assure completion of the required mixing period. The mixer shall have all other components as specified in IS 4925.

The batching, mixing plant and other accessories shall always be available at site and should be removed only on completion of work with the approval of GE.

### **13.9 Work Strength Test**

#### **13.9.1 Test Specimen**

Work Strength test shall be conducted in accordance with IS 516 on random sampling. Each test shall be conducted on nine specimens, three of which shall be tested at 7 days, three at 28 days and remaining three be kept for future reference. If required, additional samples shall be prepared as per direction of GE for testing samples cured by accelerated method as described in IS:9103

#### **13.9.2 Frequency**

The minimum frequency of Quality Control Tests for pavement concrete shall be in accordance with table 900-6 of MORT&H Specifications for Road and Bridge Works (fifth Revision):

#### **13.9.3 Acceptable Criteria**

Acceptance of pavement quality concrete:-

Concrete shall only be accepted if it satisfies the following main conditions:-

- LCL of every lot (at least 30 samples) is not less than specified value.
- Coefficient of variation is not greater than 10%
- Tolerance level factor is 1.5
- There is no honey combing the concrete.

For determination of LCL at least 3 beams for every slab will be cast and tested for flexure as per IS:516 of 1959. After at least 30 samples have been

cast for slab laid in similar conditions their results should be tabulated and LCL determined as follows:

$$LCL = x - t.v$$

Where LCL = Lower Control Limit (minimum flexural strength)

x= average flexural strength

t = Tolerance level

v = Standard deviation of the samples tested

LCL so determined should not be less than specified value i.e. 45 Kg/Sqcm. Along with the beams, cubes will also be cast and tested for compression as IS 516 of 1959. The compressive strength will be tabulated along with the corresponding flexural strength to establish correlation between flexural and compressive strength.

**Critical examination of test data:-**

In case LCL of a lot is less, then the following procedure shall be adopted before core tests are undertaken:-

Omit the slab having lowest average strength and reevaluate the remaining test data of the samples.

If the revaluated data confirms to the above acceptance criteria, accept the lot less the slab omitted

In case of unsatisfactory result, repeat the process by omitting the next lowest till all weak slabs are segregated for further testing by core cutting and the part lot gets specified value.

**Core tests:-**

In case the concrete fails in flexure test, i.e. the LCL is less than specified for particular lot, then concrete shall not be rejected unless it also fails in core test. In core test, at least two cores of the same will cut for the slab. The crushing strength of this core is then determined. The crushing strength should not be less than 0.8 times the corresponding crushing strength of 15 cm cubes. The crushing strength determination will be as per IS 516 of 1959. In case the H/D ratio of the core is between 1 and 2 then the crushing strength of the cube will be reduced. The correction will be carried out as per the formulae given below:-

$$f = 0.11n + 0.78$$

f = correction factor

n = H/D ratio

In case these concrete fails the flexure (LCL) test, but is found satisfactory in core test, it shall be accepted as the core test takes the precedence over the flexure test. However, in case the concrete fails both flexure as well as core test then it shall be rejected and replaced

#### **13.9.4 Pavement Uniformity**

The finished cement concrete pavement surface shall be such that when tested with 3 m long straight edge placed anywhere within the same or adjoining slab in any direction on the surface, there is no gap greater than 3 mm between the bottom of the surface of pavement. Surface irregularity exceeding 3 mm, but not great than 6 mm, may be rectified by bump cutting or scrubbling or grinding using approved equipment. When required by the GE areas which have been reduced in level by the above operations shall be retextured in approved manner either by cutting grooves (5 mm deep) or roughening the surface by hacking the surface. If areas in excess of 3 mm occur, if the contractor cannot rectify, the slab shall be demolished and reconstructed at the contractor's expenditure and in no case the area removed shall be less than the full width of the lane in which the irregularities occurs and full length of the slab.

If deemed necessary by the GE, any section of the slab, which deviates from the specified levels and tolerances shall be demolished and reconstructed at the contractor's expense.

#### **13.10 Production of Pavement Quality Concrete**

Pavement quality concrete (design mix) shall be produced using fully automated central Batching and Mixing Plant installed at site. Pavement quality concrete shall be produced with computerized printed batch report for every batch & report shall be submitted to the concerned JE/Engg-in-Charge on the same day.

#### **13.11 Material for Pavement Quality Concrete**

##### **13.11.1 Cement**

Cement required shall be as specified herein before.

##### **13.11.2 Aggregates**

Quality of coarse and fine aggregate shall be as specified under clause 2.1 and 2.2 of these specifications. Grading of aggregates shall be as specified hereinafter in Clause below. The maximum size of coarse aggregate shall, however, be 40 mm.

##### **13.11.3 Handling of Aggregate**

Stock piles shall be made immediately on supply of aggregate at the site of work. Aggregate of each nominal size shall be stacked separately. For the aggregate, separate stacks shall be made.

Aggregate shall be stacked on a hard surface so as to exclude the possibility of soil or grass being got mixed up. When stacks are in close proximity, the stock piles shall be separated by bulk heads. Special care shall be taken to

clean and wash the bottom layer of aggregate in contact with ground surface, before use.

Before batching, the aggregate shall be stocked/piled for at least 24 hours to allow for drainage of water, if any. Contractor shall make adequate provision for stock piling work taking into account the availability of supplies and rate of delivery, etc and he shall include in his tender for necessary handling and transportation of materials from stock piles to mixing plant etc.

#### 13.11.4 Grading of Aggregate For Final Mix

The grading of single size aggregate shall be in accordance with IS-383 and shall conform to the following gradings.

#### 13.11.5 Is Sieve % Passing for Single Sized Aggregate for Nominal Size

Seive/Size	40mm	20mm	16mm	12.5mm	10 mm
80 mm	-	-	-	-	-
63 mm	100	-	-	-	-
40 mm	85-100	100	-	-	-
20 mm	0-20	85-100	100	-	-
16 mm	-	-	85-100	100	-
12.5 mm	-	-	-	85-100	100
10 mm	0-5	0-20	0-5	0-10	0-20
4.75 mm	-	0-30	0-5	0-10	0-20
2.36 mm	-	-	-	-	0-5

Aggregate shall be stored in single size in separate bins or piles on area covered with lightly laid on wooden planks, sheet metal or hard clean surfaces, which shall be self-draining.

The grading of fine aggregate shall conform to zone II of table IV of IS 383-1970 which is as shown below.

IS SIEVE	% PASSING BY WEIGHT
10 mm	100
4.75 mm	90-00
2.36 mm	75-100
1.18 mm	55-90
600 microns	35-59
300 microns	8-30
150 microns	0-10

The grading coarse and fine aggregate to be used in the work shall be determined. The coarse aggregate and fine aggregate shall be mixed in suitable proportion so that the grading of the mix shall be in the range indicated in the following table for each size of IS Sieve.

IS SIEVE	% PASSING BY WEIGHT
31.5 mm	100
426.5 mm	85-95
19 mm	68-88
9.5 mm	45-65
4.75 mm	30-55
600 microns	8-30
150 microns	5-15
75 microns	0-5

This sieve analysis test of the mixed aggregate shall be carried out at random and results recorded to ensure that the grading lies within the specified percentage for each size as given above. The proportioning of coarse and fine aggregate require adjustment in case it does not satisfy this grading for any subsequent change grading the contractor shall have no claim whatsoever on this account.

#### 13.11.6 Water

Water shall be clear and free from injurious substances, and shall meet the requirements given in IS 456.

#### 13.11.7 Test on Constituent Materials of Concrete (PQC)

Test shall be carried out as laid down hereinafter.

#### 13.11.8 Mix Proportion And Strength

The strength of pavement quality concrete shall be as specified hereinafter.

a.	The strength to be achieved	Not less than 45 kg per Sq cm flexural strength for pavement quality concrete
b.	Aggregate/cement ratio by weight	As per mix design
c.	Water/cement ratio	As per mix design
d.	Slump for concrete	Not more than 50mm + or – 100 mm (except PQC)
e.	Compacting factor test	0.78 + or – 0.02 for PQC
f.	Coefficient of variation	10%
g.	Degree of quality control	High (for PCC), very good (except PQC)
h.	Exposure	Moderate
i.	The design mix shall be carried out without adding synthetic fiber	

At the time of tendering, the contractor after taking into account the type of aggregate, plant and method of laying concrete he intends to use/adopt, shall allow in his tender for aggregate/and water cement ratio which he considers will achieve the strength required/ specified.

As soon as possible after receiving the order to commence work, the contractor shall make trial mixes to satisfy the GE that the strength specified is obtained.

From approved design mix, nine numbers of preliminary test beams and 9 cubes shall be made and tested in accordance with IS-516 and IS-1 199, for the flexural strength and compressive strength. For compaction in moulds for beams, the following procedure shall be adopted. The test specimens shall be made as soon as practicable after mixing and in such a way as to produce full compaction of the concrete with neither segregations nor excessive laitance. The concrete shall be filled in the mould in layers of 5 cm. While filling the scoop shall be moved around the tip edge of the mould to distribute the concrete uniformly. Each layer of concrete shall be compacted fully by the use of the tapping bar/vibrator all as per IS 516. The number of strokes per layer required to produce the specified condition will vary according to the type of concrete, but in no case shall the concrete be subjected to less than 15 strokes per layer for 10 cm specimens. The strokes shall penetrate into the underlying layer and the bottom layer shall be rodded throughout its depth. Three of these beams shall be tested at seven days (i.e. on the 8<sup>th</sup> day) from the date of casting and another set of three beams at 28 days (i.e. 29<sup>th</sup> day) from the date of casting. The remaining three beams shall be preserved by the GE for one year after certified date of completion of the work for any subsequent check. The test after 7 days (i.e. on the 8<sup>th</sup> day) is intended only to give early indication of the strength likely to be achieved. The strength achieved should be 70 to 75% of the 28 days strength specified hereinbefore. In case the strength achieved is less than 75% the mix shall be suitably re-designed.

Acceptance criteria for PQC shall be as per relevant clause of these Specifications.

Whenever there is any change in the types of grading or material or change in quality of cement or method of laying etc, the tests as enumerated above shall again be conducted for ascertaining the suitable design mix for obtaining the specified flexural strength.

On the results of the above tests, the mix actually to be used shall be agreed to and approved by the GE. The approval of GE shall not relieve the contractor of his responsibility of obtaining the required minimum strength of the quality concrete in the work.

#### **13.11.9 Non Circular Synthetic Fibre**

Use of non-circular synthetic fibres shall be made in PQC to prevent development of shrinkage cracks in the concrete surface.

Non circular synthetic fibre shall be Recorn "3 S" type CT 2012 (12 mm) or similar approved and shall have tensile strength 4000 – 6000 Kg/Sqcm and melting point >250C.



### **13.11.10 Testing of Non Circular Synthetic Fibre**

The contractor shall submit manufacturer's test certificate in original for verification or GE/Engineer-in-Charge. One copy of defeated Test Certificate shall be kept by GE for record please.

Besides manufacturer's Test Certificate, at least 3 samples from each lot (brought at site) selected randomly will be got tested for tensile strength and melting point independently by GE from any IIT/SEMT Wing Pune/National Testing House or any other NABL lab specially approved by the Accepting Officer in writing.

### **13.12 Trial Length**

The trial length shall be constructed at least 30 days in advance of the proposed date of commencement of work. At least 30 days prior to the construction of the trial length, the contractor shall submit for the GE's approval a "Method Statement" giving detailed description of the proposed material, plant. Equipment, mix proportion, and procedure of batching, mixing and laying, compaction and other construction procedures. The GE shall also approve the location and length of trial construction which shall be minimum 30 m length and full width of the paver. The trial length shall contain the construction of at-least one transverse contraction, construction and expansion joint each, involving surface concrete and freshly laid stabilized sub-base. The construction of trial length shall be repeated till the achievement of acceptance criteria. No measurement & payment shall be made for the trial bay.

After the construction of trial length, the in-situ density of freshly laid material shall be determined by sand replacement method with 20 cm diameter density cone. Three density holes shall be made at locations equally along a diagonal that bisects the trial length; average of these densities shall be determined. These main density holes shall not be made in the strip 50 cm from the edges. The average density obtained from the three samples collected shall be the reference density and is considered as 100 per cent. The field density of regular work will be compared with this reference density. A few cores may be cut as per the instructions of the Engineer to check segregation or any other deficiency.

The hardened concrete shall be cut over 3 m width and reversed to inspect the bottom surface for any segregation taking place. The trial length shall be constructed after making necessary changes in the gradation of the mix to eliminate segregation of the mix. The lower surface shall not have honeycombing and the aggregate shall not be loosely held at the edges.

The trial length shall be outside the main works. The main work shall not start until the trial length has been approved by the GE. After approval has been given, the materials, mix proportions, moisture content, mixing, laying, compaction, plant and construction procedures shall not be changed without the approval of the GE.

Tolerances for the Surface Regularity, level, thickness, density, and strength shall conform to the requirements. Control of quality of materials and work shall be exercised by the GE as per table 900-6 of MORT&H Specifications for Road and Bridge Works (fifth revision).

### 13.13 Form Work

All side forms shall be of mild steel, except for curves having radius of the less than 45 m which may be timber. The steel shall be of standard "ACRO" or similar type or any other steel forms approved by GE. The depth of side forms shall be equal to the thickness of the pavement adopted at any location.

Rates quoted in Schedule 'A' for concrete pavement shall be deemed to include provision of form work.

A side form shall have a length of at least 3 m in case of longitudinal joints, except on curves of less than 45m radius where shorter lengths may be used. In case of transverse joints a full length of the bulk head shall act as form work. When set of grade and staked in place, no deviation for the top surface from the specified level shall be allowed.

The method of connection between the two lengths of forms shall be such that the joints formed are rigid and free from play in any direction. Use of bent, twisted or worn forms shall not be permitted. Drilling of holes in the existing base course from form work is not permitted. Aid shall be taken for slabs already cast and edge blocks with lateral displacement. The bracing and forms should be sufficiently robust and rigid to support the weight and pressure caused by paving equipment and concrete. Separate rails are to be provided with adequate fixing slabs. While removing the steel forms, care should be taken to withdraw them gradually. Any damage to the bull nosed edges shall be made good while the concrete is still green.

Timber forms may be used only for curves having a radius of less than 45m. Timber forms shall be wrought on inner side and shall have a minimum width of 10 cm for slabs of 10 to 20 cm thick and 15 m for slabs over 20 cm thick and their depth shall be equal to thickness of pavement at the edges.

Timber forms shall be firmly secured as necessary to ensure that no movement results from the pressure of the finishing of the surface. The forms shall be screwed with counter sunk screws along the inside upper edge with slab plan subject to the in 5 cm angle iron. The edge shall be suitably recessed so that the other faces of the angle form are flush with the upper and inner face of the wooden forms.

Setting of forms shall be according to the approval of the GE and concreting shall not commence until the setting of forms is approved.

Forms shall be set in advance to a length sufficient for at least one day before concreting and shall not be removed until at least 12 hours after the laying of the concrete. Care must be taken in setting out the side forms to ensure that

the bay width as directed by GE is strictly adhered to. The gaps between the bottom of the work and the uneven surface shall be filled with wooden fillets or sealed with putty to avoid leakage. Proper shuttering oil shall be applied to the forms to get good finish. Rates quoted in Schedule 'A' for concrete pavement shall be deemed to include provision of form work described here-in-before.

#### **13.14 Placing and Compaction of Concrete**

Concrete shall be transported without delay and incorporated in work at the position of laying within 20 minutes from the time of the discharge from the transit mixer. Concrete shall be deposited and spread to such depths that when compacted and finished, it shall conform to the grade and cross section required and to ensure the thickness required. Contractor is free to use dumper at his discretion.

Concrete shall be deposited in such a manner as to require as little handling as possible. Spreading, compacting and finishing shall be completed within a period not exceeding one hour from the time the mixing starts. In case of dry and hot weather, this time shall not exceed 45 minutes.

Weather and Seasonal Limitations for concreting shall be as under:

When concrete is being placed during monsoon months and when it may be expected to rain, sufficient supply of tarpaulin or other water proof cloth shall be provided along the line of the work. Any time when it rains, all freshly laid concrete which had not been covered for curing purposes shall be adequately protected. Any concrete damaged by rain shall be removed and replaced. If the damage is limited to texture, it shall be retextured in accordance with the directives of die Engineer.

No concreting shall be done when the concrete temperature is above 30 degree Centigrade or in adverse weather conditions like high temperature, low relative humidity, excessive wind velocity, imminence of rains etc. If so desired by the Engineer, tents on mobile trusses may be provided over the freshly laid concrete for a minimum period of 3 hours as directed by the Engineer. To bring down the temperature of concrete, if necessary, chilled water or ice flakes should be made use of. No concreting shall be done when the concrete temperature is below 5 degree Centigrade and the temperature is descending. Site executives will ensure that there is no sharp drop / rise in atmospheric temperature immediately after the concreting operation.

Concrete shall, be spread paved, compacted and finished by approved mechanical plant. The contractor shall use Slip form paver to commensurate with overall period of completion of the work. Fixed form paver shall only be used for odd shape area where fixed form can't work with approval of GE. Compaction of top layer shall be carried out mechanically by means of approved mechanical paver in accordance with the instructions of the manufacturer of paver. Needle vibrators shall be used all over the area for obtaining initial compaction of concrete. These should be of diameter not less than 40 mm. If the vibrators are pneumatic, the pressure shall not be below 4

kg/ Sqcm. If electrically operate, they shall have a minimum frequency of 3,500 to 4,500 vibrations per minute and amplitude under no load state (operation in air) measured in accordance with IS-2506, shall not be less than 1.5 mm and forward speed travel 60 cm per minute. The initial compaction shall be carried out by manual labour employing needle vibrator all as specified hereinafter.

There shall be at least three needle vibrators working for each area under concreting. Vibrating screed consisting of a steel section, or timber section weighing not less than 15 Kg/m with a tapering edge of not less than 7 cm width and having a vibrator mounted there, may be used in addition to needle vibrators to obtain full compaction. The face of the timber tapering edge of the screed shall be lined with a mild steel plate rigidly fixed by means of counter sunk screws. The final compaction final finish and levels shall however be obtained by rollers and vibrators mounted on concrete paver which will follow and run over initially compacted concrete mass.

Mounted vibrators, on mechanical paver and vibrating screed paver shall be of a frequency of not less than 3600 impulses per minute and an amplitude not less than 0.4 mm and be of sufficient capacity to agitate the concrete for a width of 25 cm on either side of its position. Where screed vibrators are used for compaction, a standby unit shall always be kept ready for use, should the other one go out order. At the discretion of the GE for compaction of edges and joint, vibrators may be supplemented by hand tamping and routing for securing satisfactory results. In no circumstances honey combing of concrete at joints or elsewhere shall be permitted.

Concreting shall be laid in one portion between the expansion joint and construction joints without any break at the dummy joints.

Workmen shall not be allowed to walk on freshly laid concrete.

A minimum of one day shall be allowed to harden the poured concrete slab, before adjacent slabs are laid. Otherwise, the vibration caused by the equipment used for the concreting on unhardened concrete may disturb the edges.

### **13.15 Separation Membrane**

A separation membrane shall be used between DLC and PQC. Separation membrane shall be impermeable polyethylene sheet, 400 micron thick, duly approved by the GE, laid flat without creases. The other construction details and specification shall be as per MORT&H Specifications for Road and Bridge works (fifth revision). A 10mm thick layer of coarse sand cushion shall be provided under the polyethylene sheet before fixing it to the base.

### **13.16 Joints In Concrete**

Joints in concrete pavements shall be provided/formed in accordance with IS-6509-1972. Joints shall be of the type of dimensions and spacing specified in drawings and shall be located in all cases as indicated in the drawing or as directed.

The contractor shall be responsible for preparation of a detailed joint layout plan for entire rigid pavement areas based on the typical details shown on Tender/GFC drawings, specifications, and construction plant/machinery & methodology proposed to be used by the contractor, and get it approved from the GE at least 60 days before the start of paving operations. No separate payment shall be payable to the contractor for the above tasks, it shall be deemed to be included in his rates of other items.

Sealing compound shall be as detailed in Schedule 'A'. Being specialized work the priming, filling the sealing compound to be carried out under the supervision of manufacturer or his authorized agents/ applicator/ representative. All joints shall be sealed after minimum 28 days of placing of the concrete in the slabs.

### **13.17 Cutting Joint**

Joints should be cut as soon as concrete is strong enough to withstand edge spalling. This would be between 24 to 36 hours depending on weather conditions. First cut in above time frame should be by using 3-5 mm circular diamond blade to depth as shown on drawing across the width (for dummy joint). Second cut should be given using 8 mm circular diamond blade within 6 days of completion of curing. Construction joints should also be cut with widening of dummy joints.

#### **13.17.1 Transverse Contraction Joints or Dummy Joints**

These are the dummy groove type and the width of dummy joint shall be described in Schedule 'A' and shall be extended vertically from the surface of slab to a depth as detailed in Schedule 'A'/drawings. The joint shall be formed by sawing the concrete with diamond saw joint cutting machine of the approved design within 6 hours of placing under moderate climatic conditions and when concrete has sufficiently hardened. In all cases, except where cutting is done with saw the joint edge shall be bull nosed. Care shall be taken that the edges of the joints are not damaged. The edge will not stand proud of the concrete slab.

#### **13.17.2 Construction Joints**

The construction joints shall be straight and vertical through the full thickness of the slab. The vertical edge of the concrete on the side of the joint shall be treated with a coat of lime wash or bitumen before the adjacent bay is concreted. A groove of size as mentioned in Schedule 'A' shall be cut at the type surface of the joint to receive the sealing compound. The groove will be formed in the same manner as that for a dummy joint using diamond saw cutting machine.

The construction operation shall be so planned that the location of the construction joint coincides with either an expansion joint or a dummy joint. Construction joints shall be provided at locations where concreting has to be

suspended due to unforeseen reasons. If the joint is at the location of expansion joint, regular expansion joint shall suffice.

### **13.17.3 Expansion Joint**

Expansion joints shall be provided both in longitudinal and transverse directions at spacing as shown on the drawings.

The expansion joint shall be straight and extend through the full thickness of the slab and shall be of the shape and dimension as shown on the drawings and specified. The slab edges adjacent to the joint shall be formed truly vertical. The joint shall be filled as described in Schedule 'A'. The groove to receive the sealing compound may be formed by keeping the depth of filler board 25 mm more than the thickness of slab at the time of casting of adjacent slab and tearing off the excess depth (including 25 mm protruding out portion and groove required) before joint filling. A cut in filler board should be made at appropriate height just before placing the same between two slabs to facilitate easy and accurate tearing off the same as described above. Care should be taken that the edges of the grooves are not damaged and that no bridging or plugging of the joint with concrete occurs, also that joint is of uniform width from top of slab to top of the joint filler. In case of any ambiguity, drawings may be referred to.

For longitudinal expansion joint, the same procedure as followed for transverse expansion joint shall be adopted.

### **13.17.4 Joint Sealing Compound**

Joint sealing compound shall be polyurethane joint sealant. The cold applied joint sealant shall meet the requirement as per BS-5212, BS-4254 and EN-141875-2003 (for hydrolysis/water resistance test). In addition, the movement accommodation factor (MAF) of the sealant should be minimum +/- 30%. It shall be procured from any one of the manufacturers specified in the List of Approved Vendors given in the Particular Specifications.

The joint sealant with primer shall be applied on ground by engaging specialist agency's authorized applicator from whom the joint sealant has been procured. The frequency of testing for hydrolysis/water resistance test and movement accommodation shall be done for every 5 MT and got tested from any IIT/SEMT Wing or any reputed testing laboratory possessing NABL accreditation. Test reports, test certificates and original purchase vouchers shall be submitted to the Department for the payment purpose.

The following procedure shall be adopted while execution :-

The joint shall be made dry and free of dirt and vacuum cleaned by a mechanical device as well as free of oil, vegetation and other debris.

Two coats of primer should be applied with a thin brush by the forward and backward movement at an interval of 30 of minutes before pouring the sealant. (i.e. one side will be brushed twice forward and backward) with adequate quantity of primer as per manufacturer's instruction.

The application temperature of the sealants should be strictly adhered to as per the manufacturer's Instructions.

The pneumatic pressure, while application should not be too high which causes high speed flow and results in over filled of joints. Too low pressure forms small bubbles, which can be a starting point of cohesive failure. Every air bubble that appears on the surface should be immediately popped with a leveling tool.

#### **13.17.5 Primer :**

Primer shall be procured from the same manufacturer of joint sealant procured as mentioned in Clause 19.13.1 hereinbefore.

#### **13.17.6 Polyethylene Back up Rod**

Alkali resistant and non-staining polythene back up rod of make of M/s Elcon products or equivalent approved by E-in-Cs branch shall be used in the joints. The diameter of rod should be  $\frac{1}{4}$  times more than the joint width. It should be placed mechanically so that the depth is uniform. The backup rod should conform to ASTM C 1016-1994A, ASTM D 3575-1993 and ASTM D 5249-1992. Before placing the backup rod it should be free from moisture, dampness, oil stains paint and any type of loose aggregate.

#### **13.17.7 Pre-moulded Joint Filler**

The joint filler shall be pre-moulded, compressive filler board with high performance closed cell PE foam available in board form (HD 100 of M/s Elcon Products or equivalent approved by E-in-C's Branch) and shall comply with the requirements of ASTM D3575/IS Standards (latest revision). Pre-moulded joint filler shall be of the thickness as stated within a tolerance of  $\pm 1.5$ mm. It shall be provided for the full width of slab between form-work.

#### **13.18 Guarantee**

The contractor shall obtain Guarantee for joint sealing materials for 10 years from the manufacturer and submit to the GE after completion. Any defect observed during this period notified by the GE in writing shall be made good by the contractor through the manufacturer or their authorized applicator to the entire satisfaction of GE within a reasonable period, failing which, the defects shall be got rectified at the contractor risk and cost. The defects liability period shall mention the purpose of this condition. All the expenditure incurred in getting the defects rectified shall be borne by the Contractor.

#### **13.19 Finishing on Concrete**

##### **13.19.1 Floating**

As soon as practicable after the concrete has been struck off and compacted, it shall be further smoothed and compacted by means of floating system

provided with the paver finisher. If any manual correction is required, it shall be carried out from a bridge between the rails generally part of these paving machines. A longitudinal float 1,200 mm long 75mm wide may be used.

### **13.19.2 Straight Edging**

After the longitudinal floating has been completed, the excess water has disappeared, but while the concrete is still plastic, the slab surface shall be tested for trueness with a 3 metre (10 ft) straight edge swung from handles. The straight edge shall be held in successive positions parallel to the pavement centre line in contact with the surface and the whole area gone over from one side of the slab to the other. Advance along the pavement be in successive stages are not more than one half length of the straight edge. Any depressions found shall be filled immediately with freshly mixed concrete, struck compacted and refinished. High areas shall be cut down and refinished. The straight edging and re-floating shall continue until the entire surface is found to be free from observable departures from the straight edge and the slab has the required grade and cambers.

The slab surfaces shall be retested from trueness before the concrete begins to set with in the 3 metre master straight edge and the wedge gauge (as per IRC 43/72). The straight edge shall be placed on the surface in successive positions, parallel to the centre line. Irregularities shall be measured with the help of the edge more transversely at various points until it touches both the straight edge and the concrete surface. At any point tested, the concrete shall not show a departure from the true surface, greater than 3mm if at any place the said departure is greater than 3 mm, not more than 3 passes of the vibrating machine shall be allowed and the surface tested again in the specified manner, if the irregularity still exceeds the limit aforesaid, the concrete shall be removed to depth of 50mm.

The area of concrete to be removed shall be that represented by the length of the straight edge in the position of measurement across the full width of the slab. Where the point of measurement in default is less than 4.5mm from the transverse expansion joint, the whole area up to the joint shall be removed to the required depth. The concrete so removed shall not be removed to depth of 50mm.

The area of concrete to be removed shall be that represented by the length of the straight edge measurement in default is less than 4.5mm from the transverse expansion joint, the whole area up to the joint shall be removed to the required depth. The concrete so removed shall not be reused in the work.

Fresh concrete shall be placed compacted and finished in the manner already described in these specifications and shall again be subjected to test for accuracy of finish.

The foregoing procedure shall be adopted at each shifting of the straight edge and the whole area shall be done over from one side of the slab to the other.



The straight edge shall advance longitudinally in successive stages of not more than one half the length of the straight edge.

No extra payment shall be made for the removal of the rejected concrete and for laying fresh concrete. Although the concrete is to be removed immediately following measurement of the irregularity and while it is still wet, this shall not mean any waiver from complying with the requirements of this clause, if for any reasons the concrete to be removed, has hardened.

After straight edging of the surface, it shall be finished by belting or brooming or by combination of both, in manner specified hereinafter.

### **13.19.3 Belting**

Just before the concrete becomes non-plastic, the surface shall be belted with a two ply canvas belt not less than 20cm wide and at least 1-meter-long than the width of the slab. Hand belts shall have suitable handles to permit controlled uniform manipulation. The belt shall be operated with short strokes transverse to centre line of the pavement and with a rapid advance parallel to the centre line. In case of paver finishers if this system is built in, the manual belting procedure is not to be adopted.

### **13.19.4 Brooming**

After belting and as soon as surface water, if any, has risen to the surface the pavement shall be given a broom finish with an approved steel or fiber broom not less than 45 cm wide. The broom shall be pulled gently over the surface of the pavement from edge to edge. Adjacent strokes shall be slightly overlapped. Brooming shall be perpendicular to the corrugations, thus produced uniform in character and width and not more than 1.5mm deep.

Brooming shall be completed before concrete reaches such stage that surface is likely to be unduly roughened by the operation. The broomed surface shall be free from porous or rough spots, irregularities, depression and all pockets such as, may be caused by accidental disturbing particles of coarse aggregate embodied near the surface.

### **13.19.5 Edging**

After belting/ brooming has been completed but before the initial set of the concrete, the edges of the slabs shall be carefully finished with a edging tool of 6mm radius and the edges left smooth and true to alignment.

### **13.19.6 Honey Combing**

As soon as the side forms are removed, any minor honey combed area shall be filled with mortar composed of one part of cement and to parts of fine aggregate. Major honey combed areas or segregated concrete or other defective work or areas damaged by rain or any other reasons, whatsoever, shall be considered as defective work and the entire affected slab shall be removed and replaced by the Contractor at his own expense. The total area of honey combed patches, each more than 2.5 sq.m area, shall not exceed 4

percent of the area of the slab thickness. This decision as to what constitute major honey combing shall rest entirely with the GE but in any case honey combing exceeding 300 sq.cm in area at any of the one location, shall be considered as major honey combing. GE's decision whether the concrete is defective or not shall be final and abiding.

### **13.20 Marking Of Slabs**

Every slab shall bear an impression on top the slab not exceeding 3mm in depth comprising the number allotted to the slab and the date on which it was cast. This impression shall be formed by the Contractor when the concrete is green so as to leave permanent mark on setting, after the surface texturing, but before the curing compound is applied. No additional payment shall be payable to the contractor on this account and the cost of these items and any other item necessary to complete the work as per these specifications, which has not been included as a separate item under Bill of Quantities, shall be deemed to be included in the rates of PQC quoted by the contractor

### **13.21 Curing and Protection of Concrete**

#### **13.21.1 Initial Curing**

Immediately after the surface texturing, the surface and sides shall be cured by the application of approved resin-based aluminized reflective curing compound which hardens into impervious film or membrane with the help of a mechanical sprayer. Curing compound shall contain sufficient flake Aluminium in finely divided dispersion to produce a complete coverage of the sprayed surface with a metallic finish. The compound shall become stable and impervious to evaporation of water from the surface of the concrete within 60 minutes of application and shall be approved type. The curing compounds shall have a water retention efficiency index of 90% in accordance with BS Specification No.7542 or ASTM C-309-81, Type II / relevant IS/ IRC code. Curing compound shall be of make as specified in the PS.

The curing compound shall not react chemically with the concrete and the film or membrane shall not crack, peel or disintegrate within three weeks after in its containers. The rate of spread shall be in accordance with the manufacturer's instructions and should be checked during the construction of the trial length and subsequently whenever required by the GE. The mechanical sprayer shall incorporate an efficient mechanical device for continuous agitation and mixing of the compound during spraying. To give continuous covering, curing compound may be spread in two layers.

In addition to spraying of curing compound, the fresh concrete surface shall be protected from rain as described in Clause 602.7.1 of MORT&H Specifications for Road & bridge works (fifth revision) during adverse weather conditions. After three hours, the pavement surface and edges shall be covered with moist hessian cloth in two layers and the same then be kept moist for the entire period of curing. After initial curing, the concrete shall subsequently be cured by making mortar bunds of 8 to 10 cm high at the edges as well as longitudinally and transversely at about one-meter interval to

form ponds to cover the pavement surface with water up to 28 days. After completion of 28 days' period, the contractor shall clean and sweep the surface so that it is dirt free.

The workmen shall not be allowed to walk over the prepared clean surface either prior to or during the concreting operation. Walking over concrete being laid, compacted or finished, shall also be prohibited. All operations on prepared cleaned surface including laying, compacting with needle vibrators, floating and straight edging shall be done from appropriate wooden bridge spanning the width of the slab being laid. Adequate number of such wooden bridge shall be provided.

The Contractor shall appoint chowkidars at his own expense to prevent workmen, cattle, etc., straying on to the pavement concrete for a minimum of three days after laying concrete.

### **13.22 Testing of Pavement Quality Concrete**

Testing of controlled concrete (pavement quality concrete) shall be done as per frequency specified. Expenses for samples, supply and transporting of samples, etc., including assistance in testing shall be borne by the Contractor. The following tests shall be carried out during the progress of work in addition, if any, to these specified hereinafter.

The Contractor at his own expenses will establish a lab at site to conduct all relevant tests. The lab equipment shall be calibrated and certificate should be made available along with equipment.

#### **13.22.1 Compacting Factor Test as Per IS-1199**

A compaction factor test shall be taken at frequencies as specified hereinafter. Any batch from which compacting factor is being made shall not be transferred to the pace of laying until the compacting factor test has been completed. Any batch which gives compacting factor that is in excess of the specified shall be rejected and removed from the site.

Testing of Pavement Quality Concrete shall be done as per frequency specified under Section 900-6 of MORT&H Specifications for Road & bridge works (fifth revision). Expenses for samples supply and transportation etc, including assistance in testing shall be borne by the contractor. The following tests shall be carried-out in addition to those specified above.

#### **13.22.2 Flexural Test**

The concrete shall be sampled at the place of deposit. Sampling and testing shall be as per IS:1199 and IS:516. The frequency of sampling shall be as specified in IS. One sample consists of 9 (nine) beams. All the 9 (nine) beams of the same sample shall be cast at the same time. Samples shall be made at well-spaced intervals so as to represent entire slab from different

batches. A slab shall mean the pavement bounded by expansion and construction joints.

For the purpose of subsequent identification, the test beam samples and the slab to which these pertain to, shall be cross referred and record of this maintained, duly signed by the GE and Contractor.

Moulds for the test beams conform to IS-516 and shall be supplied by the Contractor. Beams shall be prepared by the Contractor as specified/as directed. The size of the moulds for the test beam shall be 15cm x 15cm x 70cm. The test beam samples shall be maintained and cured under conditions as specified in IS-516. The compaction will be done as specified. Flexural strength test results shall be signed both by the GE and the Contractor.

The slab shall stand rejected if the average flexural strength of three specimen of any sample is less than specified.

### **13.23 Preparation of Existing Pavement Surface for Overlay**

Before proceeding with the construction of overlay steps shall be taken to correct all the defective areas in the existing PCC surface, base, sub-base, and subgrade. In addition to clause 20.B 18 of SSR 2009, the following steps shall be taken for preparation of the existing rigid pavement for overlay.

#### **13.23.1 Identification and Stabilization of Unstable Slabs**

Whole of the existing pavement area under proposed overlay shall be checked for identification of unstable concrete slabs by moving a heavily loaded vehicle (axle load min. 40 ton or as instructed by the GE) and observing the pavement surface for any visible settlement/ rocking movement under tyre load. The exercise shall be carried-out jointly with the client staff available at the site and any unstable slabs shall be marked with red paint marking. If a slab is unstable, its subgrade/base support shall be improved.

Where improvement in subgrade/base support is required, it shall be brought-about by using free flowing cementitious grout or any specialized material approved by the GE under the pavement to fill the voids. Special care shall be taken during grouting to avoid creating uneven support conditions for the slabs.

Pressure grouting, if instructed by the GE, shall be carried out by a specialized agency employing skilled manpower under expert supervision.

Where the pavement slabs are badly broken and subject to rocking because of uneven bearing on the subgrade/base, if instructed by the GE, the rocking slabs can be broken into smaller slabs to obtain a firmer seating.

Badly broken slabs that do not rock will not require any special repairs except crack sealing.

Partial or full depth reconstruction of damaged slabs, if and when instructed by the GE, shall not be covered under this item of work and shall be paid separately.

#### **13.23.2 Treatment of Narrow Cracks**

Narrow (<10mm width) transverse, longitudinal and corner cracks in the existing PCC surface will need no treatment unless there is an appreciable amount of displacement and faulting between the separate slabs.

#### **13.23.3 Treatment of Wide Cracks**

Cracks and joints 10mm or more in width shall be filled with a lean mixture of sand and liquid bituminous material. This mixture shall be tamped firmly in place, leveled with the pavement surface and any excess removed.

#### **13.23.4 Cleaning of Pavement Surface**

After all repairs have been completed, prior to placement of overlay, the surface shall be swept clean of all dirt, dust, tire rubber and foreign material by rubbing with steel wire brushes and brooms. Any extruding joint-sealing material shall be trimmed from rigid pavements.

#### **13.23.5 Application of Tack Coat**

Just before start of overlaying operations, the cleaned concrete surface shall be applied a uniform layer of VG-10 Grade bituminous tack coat at specified rate of application to ensure proper bond between the old surface and new layer. Rate of application of tack coat over concrete pavement surface shall be 1.0 kg/ sqm.

#### **13.23.6 Profile Correction Course on Existing Pavements**

Profile correction course over the existing pavements for concrete overlay shall be **Dense Bitumenous Macadam Grading 2 (DBM Gr-2)** as per the Specification.

Design finish levels of profile correction course shall be calculated from the pavement finish levels based on the approved longitudinal and transverse profiles as per clause above. Finish levels of Profile correction course (PCC) shall be again recoded jointly by the client and Contractor at exactly the same grid points which were used for recording the existing pavement levels. Quantity of PCC shall be computed by Simpson's Rule.

#### **13.23.7 Miscellenious item of pavement**

Any item of work necessary to complete the work as per drawing and specifications, which is not included in the bill of quantities as a separately payable item, shall be deemed to be included in the rates of other items and no separate payment shall be made on these account.

**A. PLUMBING WORKS****1 GENERAL**

1.1 The execution of works and materials used except non schedule items in general shall be as per latest relevant MES specification as corrected up to date and relevant I.S. Codes.

Wherever reference has been made to Indian Standard or any other specifications, the same shall mean to refer to the latest specification irrespective of any particular edition of such specification being mentioned in the specifications below or Schedule of Quantities.

The work of internal and external water supply sanitary, and Sewerage etc. shall be carried out as per bye laws of the local body nothing extra is payable in this account. All Mechanical works related to Public Health Engineering will conform to the requirements of manual of Water Supply by the Ministry of Urban Development and various Indian Standards as listed their- in. All items shall be executed as per BOQ / specification / drawings. For items not covered under the specification / BOQ/ approved drawings as stated above, the work shall be executed by the contractor by following the SSR / BOQ / relevant IS codes of practice as per the direction of Engineer in Charge.

1.2 Water supply and sanitary installation shall cover the followings:

- The contractor shall submit completion plans for water supply, internal sanitary installations and building drainage work on drawings prepared preferably through computers (1 original copy plus 3 Photostat) on suitable scales to show the general arrangement and desired details. In case the contractor fails to submit the completion plans as aforesaid, security deposit shall not be released.

1.3 General Requirements

- Sanitary fixtures shall be of the best quality and shall be of approved make and manufacture (wherever specified) as defined in the item of work or defined anywhere in this document otherwise shall be as mentioned in the MES specifications failing which the same shall be of ISI mark duly approved by the Engineer-in-Charge.
- All fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the schedule of quantities, specifications, elsewhere in this tender document & drawings. The quoted rates shall be deemed to be all inclusive for a complete item fit for use including all materials, labour, T & P, specials, equipments, testing & commissioning etc. Accessories shall include proper fixing arrangement, brackets, nuts bolts, screws and required connection pieces. All the accessories shall be of the quality and make as per manufacture's specifications except otherwise specified in specifications schedule of quantities and elsewhere in this tender

document. Nothing extra whatsoever shall be payable on aforesaid account.

- Fixing screws shall be half round head chromium plated brass screws with C.P. washers where necessary or otherwise as provided in the item.
- Porcelain sanitary ware shall be glazed vitreous china of first quality free from warps, cracks and glazing defects and shall conform to I.S. 2556-1967. Colour of sanitary ware shall be specified or as selected by the Engineer-in-Charge. Nothing extra shall be payable on this account.
- All fittings and fixtures shall be fixed in a neat workmanlike manner true to required level and heights and in accordance with the manufacturer's recommendations and directions of Engineer-in-Charge. Care shall be taken to fix all inlet and outlet pipes at correct positions.
- Horizontal pipes running along ceiling shall be fixed on structural adjustable clamps of approved design. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them and are properly secured.
- All holes or chases shall be properly made good by C.C 1:2:4 (in brick wall) or the concrete mix of RCC element as directed by the Engineer-in-Charge. Nothing extra shall be payable on this account.
- Brick bats used in soak pit shall be of 50-100mm in size.
- Total Station and Auto level

#### 1.4 DRAWINGS

- 1.4.1 Plumbing drawings are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be conformity with the architectural and other services drawings.
- 1.4.2 Architectural drawings shall take precedence over plumbing or other services drawings as to all dimensions.
- 1.4.3 Contractor shall verify all dimensions at site and bring to the notice of the Engineer-in-Charge all discrepancies or deviations noticed. Decision of Engineer-in-charge shall be final.
- 1.4.4 All equipment/materials dimensions to be incorporated and shall take precedence over small scale drawings.
- 1.4.5 Any drawings supplied with the tender shall be returned in good conditions along with the tender.

1.4.6 Any drawings issued by the Engineer-in-charge for the works are the property of the engineer/consultant and shall not be lent, reproduced or used on any works other than intended without the written permission of the engineer.

## 1.5 INSPECTION AND TESTING OF MATERIALS

1.5.1 Contractor shall be required, if requested, to produce manufacturers test certificate for the particular batch of equipment/materials supplied to owner. The tests carried out shall be as per the relevant Indian standards.

1.5.2 For examination and testing of equipment/materials and works at the site contractor shall provide all testing and gauging equipment necessary but not limited to the followings:

- Theodolite
- Dumpy level
- Weighing machine
- Plumb bobs, spirit levels, hammers
- Steel tapes
- Micrometers/Vernier Caliper
- Thermometers, stoves
- Hydraulic test machine
- Smoke test machine

1.5.3 All such equipment/measuring instrument shall be tested for calibration at any approved laboratory, if required by the Engineer-in-charge.

1.5.4 All testing equipment shall be preferably located in special room meant for the purpose.

## 1.6 COMPLETION DRAWINGS

1.6.1 On completion of work, contractor shall submit one complete set of poly tracings and two prints of completion plan "as built" drawings to the Engineer-in-charge. These drawings shall have the following information :

- a) Run of all piping and diameters on all floors and vertical stacks.
- b) Ground and invert levels of all drainage pipes together with location of all manholes and connections up to outfall.
- c) Run of all water supply lines with diameters, locations of control valve, access panels.
- d) Location of all mechanical/electrical equipment with layout and piping connections.

1.6.2 Contractor shall provide four sets of catalogues, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment to owner.



1.6.3 All "Warranty cards" given by the manufacturers shall be handed over to the Engineer-in- Charge.

1.6.4 Contractor shall submit 5 copies of O&M manual.

## 1.7 **TESTING**

1.7.1 Piping and drainage works shall be tested as specified under the relevant clauses of the MES Specifications / IS Code.

1.7.2 Tests shall be performed in the presence of the Engineer-in-charge.

1.7.3 All equipment and materials found defective shall be replaced and the whole work tested to meet the specifications required in presence of owner/owner's representative.

1.7.4 Contractor shall perform all such tests as may be necessary and required by the local authorities to meet Municipal or other bye-laws in force.

1.7.5 Contractor shall check the feasibility of making water, sewer and storm drainage connection to the authorities' existing water, sewer and storm drainage system providing exact location & invert levels of the existing services as required for execution of the work. They are also to prepare & provide necessary documents and drawings and to obtain necessary approval from the concerned authorities for execution of the services as required.

1.7.6 Contractor shall provide all labour, equipment/instruments and materials for the performance of the tests.

## 1.8 **LICENSE AND PERMITS**

1.8.1 Contractor must hold a valid plumbing license issued by the Municipal authority or other competent authority under whose jurisdiction the work falls.

1.8.2 Contractor shall obtain, from the municipal authority, completion certificate with respect to his work as required without any extra cost.

## 1.9 **WORKMANSHIP**

The workmanship shall be best of its kind and shall conform to the specifications, as below or Indian Standard Specifications in every respect or latest trade practices and shall be subjected to approval of the Engineer's Representative. All materials and/or Workmanship which in the opinion of the Engineer's Representative is defective or unsuitable shall be removed immediately from the site and shall be substituted with proper materials and/or workmanship forthwith without any extra cost.

## 1.10 **MATERIALS**

All materials shall be best of their kind and shall conform to the latest Indian Standards.

All materials shall be of approved quality as per samples and origins approved by the Engineer's Representative.

As and when required by the Engineer's Representative, the contractor shall arrange to test the materials and/or portions of works at his own cost to prove their soundness and efficiency. If after tests any materials, work or portions of work are found defective or unsound by the Engineer's Representative, the contractor shall remove the defective material from the site, pull down and re-execute the works at his own cost to the satisfaction of the Engineer's Representative. To prove that the materials used are as specified, the contractor shall furnish the Engineer's Representative with original vouchers on demand.

#### 1.11 **SHIFTING OF EXCAVATED SURPLUS MATERIAL**

Contractor shall make his own arrangement to shift the surplus excavated material as directed by Engineer's Representative.

### **2 SANITARY FIXTURES & C.P.FITTINGS**

#### 2.1 **Vitreous China Sanitary ware**

All glazed Vitreous China Sanitary ware fixtures shall conform to IS:2556. The details, make and type to be provided are given in the Schedule of Quantities. The Vitreous China Sanitary ware shall be of first quality only. They shall be non-porous and fully vitreous, with all the visible portions perfectly glazed and should absolutely be free from hairline cracks pin-holes and local depressions. It shall be perfectly symmetrical, uniform and smooth curves. All sanitary fixtures and fittings shall be stored under covered roof and handled carefully to prevent any damage.

#### 2.2 **Chromium Plated Fittings**

All Chrome plated fittings shall be of brass/copper, heavy chromium plated, of the make and design approved by the Engineer's Representative. The fittings shall be cast fittings of screw type, machined and threaded properly for fixing to the supply pipes.

The plating shall conform to IS:482 (Electroplated coating of nickel and chromium of copper and copper alloys).

The fittings shall be supplied complete with chromium plated matching flanges, wall cover plates, nuts and extension pieces of required lengths. Metallic washers where required shall also be of chromium plated brass. All bib cocks and stop cocks shall conform to IS:781. Brass screw down pillar taps shall conform to IS:1701 and all other fittings shall match the supply fitting in construction and appearance. All fixing accessories and screws shall be similar to fittings. All washers shall conform to IS:4346.

All waste fittings (Waste, Chain, Overflow, Spreaders Caps etc.) shall be of brass/copper heavy chromium plated of the make and design specified and match the supply fittings. They shall conform to IS:2963.

Bottle traps (for wash basins, sinks, urinals etc) shall be deep seal (Min. 6 cm seal) cast brass bottle traps, heavy chromium plated. All bottle traps shall be provided with suitable cleaning eye, extension piece, flare nuts of all chromium plated.

Wall flanges shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pierce through them. These wall caps shall be of chrome plated brass fittings and the receiving pipes shall be large enough to cover the punctures properly.

## 2.3 **Installation of Sanitary Fixtures and Fittings**

### 2.3.1 **General Requirement**

The fixtures and fittings shall be provided with all such accessories as are required to complete the item in satisfactory working conditions, whether specifically mentioned or not in the schedule of quantities, Specifications and drawings. As stipulated in the General Specification the contractor shall prepare detailed shop drawings showing the details such as adjoining services, levels etc.

The sanitary fixtures and fittings shall be installed at the correct assigned position as shown on the drawings and as directed by the Engineer's Representative, and shall fully meet with the aesthetic and symmetrical requirements as demanded by the Engineer's Representative.

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Engineer's Representative requirements. Wherever necessary, the fittings shall be centered to dimensions and pattern as called for.

Fixtures shall be installed by skilled workmen with appropriate tools according to the best trade practice. Manufacturer's instructions shall be followed for the installation of fixtures. Fixtures in all toilets shall be of standard height mounting as called for on the drawings. Fixtures shall be mounted rigid, plumb, and true to alignment.

#### **Note :-**

- a) All the Items described below shall be included in the lump sum cost of buildings .
- b) All the CP Fittings shall be of Jaquar make Kubix- F model or approved equivalent.

- c) Rate for providing and fixing of sanitary fixtures, accessories, urinal partitions shall include all items and operations stated in the respective specifications and nothing extra will be paid.
- d) Rates for all the below items under this specifications shall be inclusive of cutting holes in brick wall, RCC slab or wall and chases and making good the same.
- e) The rate includes cost of all labour, materials, tools and plant, etc., required for satisfactory completion of this item.
- f) Rates for all the below items under this specification shall be inclusive of C.P. screws, nuts, bolts and any fixing arrangement required.

### 2.3.2 **European type water closet**

European W.C. of glazed vitreous china shall be wash down, single or double symphonic type, wall mounted or pedestal set, flushed by means of flush tank (low flow 3 / 6 LPF). Flush pipe / bend shall be connected to the W.C. by means of suitable rubber adopter. Wall hung W.C. shall be supported by C.I. floor mounted chair. Each W.C. seat cover shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C. Seat cover shall be of white solid plastic, elongated open front with heavy duty hinges. Exposed fixture trims shall be Chrome plated, and trims of similar function shall be of the same manufacturer. Flushing cistern shall conform to the requirements of IS: 774-1971. The cisterns shall be mosquito proof & shall fulfil the requirements of the local Authority. The levels of the WC should be checked by placing spirit level on the W.C. W.C. should be tested on completion of fixing by putting small paper balls and flushing out. If all the paper balls are not flushed out. The fixing will have to be rectified / re-aligned.

- A) Wall Mounted EWC:- White glazed vitreous china extended wall mounted European type water closet (Hindware Cat. No. 92064) complete with slow falling seat cover and dual type flushing cistern (3/6 litres capacity) ( Hindware, Cat. No. 92124 or approved equivalent). with all necessary C.P fittings i.e .Angle valve, Two way bib cock, Hand shower (health Faucet) with 8mm dia. one meter flexible tube ,Toilet paper holder complete with wall hook, CP brass hinges and rubber buffers etc.
- B) Floor Mounted EWC:- White glazed vitreous china European type Pedestal pattern water closet (Hindware Cat. No. 20050) complete with slow falling seat cover and dual type flushing cistern(3/6 litres capacity) ( Hindware Cat. No. 21034 or approved equivalent) with all necessary C.P fittings i.e. Angle valve, Two way bib cock, Hand shower (health Faucet) with 8mm dia.one meter flexible tube or jet spray, toilet paper holder complete with wall hook, CP brass hinges and rubber buffers etc.

### 2.3.3 Indian type water closet

Orissa type white or coloured glazed WC of the first quality shall conform to IS:2556 (PartIII) except that the pan shall be with the integral squatting pan of size 580 mm x 440 mm, or 530 mm x 410 mm with raised foot rests. The pan shall be sunk into the floor or raised above the floor and embedded in a cushion of average 15 cm thick CC 1:2:4 as specified. This concrete shall be left 115mm below the top level of the pan so as to allow for flooring and its bed concrete. The floor should be suitably sloped so that the waste water is drained into the pan. The pan shall be provided with 100mm 'P' or 'S' trap with approximately 50mm seal.

White glazed Vitreous china squatting pan, 'Orissa' pattern, size 580 x 440 mm white, with integral foot rests water closet (Hindware Cat. No. 20042) complete with pvc low level flushing cistern (3/6 litres capacity) (Hindware or approved equivalent) with all necessary C.P. fittings i.e. Angle valve, bib cock, CP brass hinges and rubber buffers etc. The above items shall be fixed with proper cutting and making good the walls and floors etc.

### 2.3.4 Wash basin

- A) Counter Top WB:- White glazed vitreous china counter top ( oval type) wash basins - size (560 x 450mm) (Hindware Cat. No. 10049) complete with CP single lever basin mixer without popup waste system with 450 mm long braided hoses, Brass chromium plated 32mm bottle traps with inlet and outlet screwed for pipe or connections including necessary packing, union and cap, M & L rubber or vulcanite 32 mm plugs (waste) with rings including chromium plated brass or bronze chain and stay ( chain not exceeding 50 cm in length). Automatic liquid soap dispensers ABS including chromium plated brass screws and wooden/ plastic shall be provided, each in between the two Wash basins or each whenever single wash basin is installed.
- B) Flat Back WB :- White Vitreous china wash basin, white flat back, size 550 x 400 mm (Hindware) complete with brackets, porcelain stopper, CP single lever basin mixer without popup waste system with 450 mm long braided hoses or Pillar Tap, Brass chromium plated 32mm bottle traps for wash basins with inlet and outlet screwed for pipe or connections including 32mm waste and necessary packing, union and cap, M & L rubber or vulcanite plugs (waste) with rings including chromium plated brass or bronze chain and stay ( chain not exceeding 50 cm in length). Automatic liquid soap dispensers ABS including chromium plated brass screws and wooden/ plastic shall be provided, each in between the two Wash basins or each whenever single wash basin is installed.
- C) White bathroom cabinet (PVC) size 600 x 460 x 440mm inclusive of wash basin and mirror.(Make Pompeo Model No. GS/BC/12026.complete with CP single lever basin mixer without popup waste system with 450 mm long braided hoses, Brass chromium plated 32mm bottle traps with inlet and outlet screwed for

pipe or connections including 32mm waste and necessary packing, union and cap, M & L rubber or vulcanite plugs (waste) with rings including chromium plated brass or bronze chain and stay ( chain not exceeding 50 cm in length). Automatic liquid soap dispensers ABS including chromium plated brass screws and wooden/ plastic shall be provided, each in between the two Wash basins or each whenever single wash basin is installed.

### 2.3.5 **Urinal system**

- A) White glazed vitreous china flat back lipped urinals ( H.S.I. Cat. No. 60007 or approved equivalent ) hangers with inbuilt electronic solenoid valve operated auto flushing system comprising solenoid valve, electronic control unit, etc., complete with all electrical works required for completion of work, with fittings concealed in chase, C.P. spreaders, 32mm C.P. brass domical waste, 32mm C.P. cast brass screws and washers complete including cutting and making the walls and floors where required. Including Vitreous china urinal partition white of size 310 x 700mm.
- B) Vitreous china urinals, bowl type (flat back or corner back type size 590 x 390 x 375mm (minimum) ( H.S.I. Cat. No. 60002 or approved equivalent ) complete including providing and fixing plugs , bedding urinal against wall in cement mortar 1:2 securing urinal to plugs with and including 60mm long brass screws, pointing around urinal back in cement. Including urinal valve auto closing system with built-in control cock, with fittings concealed in chase, C.P. spreaders, 32mm C.P. brass domical waste, 32mm C.P. cast brass screws and washers complete including cutting and making the walls and floors where required. Including Vitreous china urinal partition white of size 310 x 700mm.

### 2.3.6 **Shower System**

CP single lever concealed divertor for bath and shower system Jaquare make Kubix model or approved equivalent including CP Bath spout with button attachment for telephone shower, CP brass shower with revolving ball joint with shower. CP/SS Soap dish or Soap tray shall be provided/fixed to the wall in each shower room as per the direction of Engineer-In-Chagre.

### 2.3.7 **Mirror**

The mirror shall be by the Engineer-In-Charge, with the edges rounded off as specified. The mirror shall be float glass, electroplated with silver. The mirror shall be free from waviness or distortion, from all angles of vision. Its thickness shall not be less than 6mm The back of the mirror shall be free from any silvering defects. Silvering shall have a protective uniform covering of red lead paint. The 12mm thick marine plywood shall conform to relevant specification of civil materials and IS:710. Teakwood shall conform to relevant specification of civil materials.

The mirror of specified size, shall be mounted on wooden frame comprising of 12mm thick marine plywood and teak beading, as per drawing and as directed by the Engineer-in-charge.

The wooden frame shall be fixed in position by fixing wooden plugs in wall and the work shall be carried out in form of the best workmanship. For teakwood beading relevant civil work item specification shall be followed. The teakwood beading shall be of 20mm x 32mm size.

The above described mirrors shall be fixed wall to wall for counter top or under counter wash basin and the height of mirror shall be 900mm. Mirror for single shall Rectangular wash basin will be 600x450mm size.

#### 2.3.8 **Towel Ring**

CP brass towel ring fixed to rawl plug of approved design with CP brass screws. These shall be provided/fixed to the wall as shown on plumbing/Architect drawing or as per the direction of Engineer-In-Charge.

#### 2.3.9 **Towel Rail**

C.P brass towel rails complete with C.P. brass brackets fixed to rawl plug of approved design with C.P. brass screws. These shall be provided/fixed to the wall as shown on plumbing/Architect drawing or as per the direction of Engineer-In-Charge.

#### 2.3.10 **Towel Dispenser**

Multi-functional wall mounted recess panel stainless steel, satin finish, comprising paper towel dispenser, stainless steel automatic hand drier, waste container with 23 litres capacity size 1650mm x 370mm x 160mm. These shall be provided/fixed to the wall as shown on plumbing/Architect drawing or as per the direction of Engineer-In-Charge.

#### 2.3.11 **Towel Dispenser**

### 2.4 **Mock up and Trial Assembly**

The installation of the Sanitary fixtures and fittings shall be as per the shop drawings approved by the Engineer's Representative.

The contractor shall have to assemble at least one set of each type of sanitary fixtures and fittings in order to determine precisely the required supply and disposal connections. Relevant instructions from manufacturers shall be followed as applicable. This trial assembly shall be developed to determine the location of puncture holes, holding devices etc. which will be required for final installation of all sanitary fixtures and fittings. The above assembly shall be subject to final approval by the Engineer's Representative.

The fixtures in the trial assembly can be re-used for final installation without any additional payments for fixing or dismantling of the fixtures.

## 2.5 **Supporting and Fixing Devices**

The contractor shall provide all the necessary supporting and fixing devices to install the sanitary fixtures and fittings securely in position. The fixing devices shall be rigidly anchored into the building structure. The devices shall be rust resistant and shall be so fixed that they do not represent an unsightly appearance in the final assembly. Where the location demands, the Engineer's Representative may instruct the contractor to provide chromium plated or other similarly finished fixing devices. In such circumstances the contractor shall arrange to supply the fixing devices and shall install these complete with appropriate vibration isolating pads, washers and gaskets.

## 2.6 **Final Installation**

The contractor shall install all sanitary fixtures and fittings in their final position in accordance with approved trial assemblies and as shown on drawings. The installation shall be completed with all supply and waste connections. The connections between building and piping system and the sanitary fixtures shall be through proper unions and flanges to facilitate removal/replacement of sanitary fixtures without disturbing the built in piping system. All unions and flanges shall match in appearance with other exposed fittings.

Fixtures shall be mounted rigid, plumb and to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are butting on the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. Overflows shall be made to ensure that necessary anchoring devices have been provided for supporting water closets, wash basins, sinks and other appliances.

## 2.7 **Protection Against Damage**

The contractor shall take every precaution to protect all sanitary fixtures against damage, misuse, cracking, staining, breakage and pilferage by providing proper wrapping and locking arrangement till the completion of the installation. At the time of handing over, the contractor shall clean, disinfect and polish all the fixtures and fittings. Any fixtures and fittings found damaged, cracked chipped stained or scratched shall be removed and new fixtures and fittings free from defects shall be installed without any extra cost

# 3 **WATER SUPPLY**

## 3.1 **SCOPE**

The scope of this section comprises the supply, installation, testing and commissioning of piping network and making relevant shop drawings for water supply (hot and cold water) for internal and external services.



The Contractor shall make all necessary application and arrangements for his work to be inspected by the Local Authorities, Consultants and Site personnel. The Contractor shall be solely responsible for obtaining the Authorities approval of his works prior to the handing over of the complete water supply / distribution installation to the Owner including cutting chases and making good the wall etc. all complete.

### 3.2 **WATER SUPPLY SYSTEM**

The water supply system installed for the Ground run point is by direct supply from the existing water Tank in the area to the Ground Run building toilet. The water supply piping system for internal buildings consists of chlorinated PVC pipes and fittings conforming to IS: 15778 & for external water supply consists of G.I pipes medium class conforming to IS: 1239:2004. The sizes and makes are specified in the Schedule of Quantities and relevant drawings.

Inside the building, the chlorinated PVC pipes and fittings shall be embedded in the wall, chase or run on the floor/ceiling unless otherwise specified. No unsightly exposed runs shall be permitted. Outside the building the GI piping shall be installed at least 650 mm below the finished grade level.

### 3.3 **PIPING MATERIAL**

All materials including fittings, accessories, etc., shall be of approved make and shall comply with appropriate Indian standards and ISI marked.

### 3.4 **CPVC/GI Pipes**

The CPVC pipes shall be socketed conforming to the requirements of IS 15778 & G I medium class pipes shall be screwed as per IS 1239 as per requirement of BOQ. The pipes and sockets shall be cleanly finished and free from cracks, surface flaws, laminations and other defects. The ends shall be cut cleanly and square with the axis of the pipe.

All internal water supply pipes shall be CPVC pipes and fittings. The pipes and fittings chemically known as Chlorinated Poly Vinyl Chloride[CPVC] shall be produced in Copper Tube Size[CTS] from ½” to 2” with standard dimensional ratios – SDR 11. The fittings shall be produced as per SDR 11. All the CPVC pipes and fittings in SDR 11. Pipes and fitting shall be produced as per SDR 11 & shall meet the requirement of ASTM D 2846 and F441.

The fittings shall comply with all the requirements that of pipes. The sizes of pipes and fitting are specified in the schedule of quantities.

### 3.5 **PIPING INSTALLATION SUPPORT**

Architectural and Services Consultant drawings indicate the schematic Line diagram for the size and location of the pipes. The Services Consultant /Architect before the perusal of actual work on site by the contractor shall prepare the detailed working drawings, showing the cross-sections, longitudinal sections, fittings details, locations of control valves and all pipe

supports. The consideration while doing all this designing part is to keep in view the specific openings in buildings and other structure through which the pipes are desired to pass.

Piping shall be properly supported by means of wall support clamps as specified and as required, keeping in view the proper designing for expansion and contraction. Risers shall be supported at each floor with Clamps.

All pipe work shall be carried out in a proper workman like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation with other agencies work, so that all works can be carried out in one stretch.

Cut-outs in the floor slab for installing the various pipes are indicated in the drawings. The Contractor should carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the drawings, do not meet with the requirements.

Automatic air valves shall be provided at all high points in the piping system for venting. Automatic air valves shall also be provided on hot water risers if any. Discharge from the air valves shall be piped to the nearest drain or sump. All pipes shall be pitched towards the drain points.

Pressure gauges and other instrument shall be provided as per the approved drawings and included in the Bill of quantities. Care should be taken to prevent these during Pressure testing.

### 3.6

#### **VALVES & CONTROLS**

All valves (gate, globe, check, safety) shall be of gun metal, non-rising spindle, suitable for the particular service as called for. All valves shall be of the particular duty and design as called for. Valves shall either be of screwed type or flanged type, with suitable flanges and non-corrosive bolts and gaskets. Tail pieces as required shall be supplied along with valves. Gate, globe and check valves shall conform to IS:776 and non-return valves and swing check type reflux to IS:5312.

Sluice valves, where called for shall be flanged sluice valves of cast iron body. The spindle, wall seat and wedge nuts shall be gunmetal. They shall generally have non-rising spindle and shall be of the particular duty and design called for. The valves shall be supplied with suitable flanges, non-corrosive bolts and asbestos fiber gaskets. Sluice valves shall conform to IS:780 and IS:2906.

Ball valves with floats to be fixed in storage tanks shall consist of cast brass lever arm having copper balls (26 SWG) screwed to the arm integrally. The copper ball shall have bronze welded seams. The closing/opening mechanism incorporating the position and cylinder shall be non-corrosive metal and include washers. The size and construction of ball valves and float shall be suitable for desired working pressure operating the supply system.

Where called for brass valves shall be supplied with brass hexagonal back nuts to secure them to the tanks and a socket to connect to supply pipe.

### 3.7 **LOFT WATER TANK**

Loft water tanks shall be provided in the toilet and material of tank shall be LDPE with suitable locking arrangement and capacity as shown on drawings/boq. The tanks shall be provided over suitable supports in the toilet. Ball valves for tanks shall be provided. Overflow pipe shall be provided which shall be taken up to the nearest floor drain outlet. All other pipes such as inlet and outlet pipes shall be included. LDPE loft tanks shall be from the list of approved makes.

### 3.8 **LAYING AND JOINTING OF CPVC PIPES**

All pipes and fittings shall be fixed truly vertical and horizontal unless unavoidable. The pipes shall be fixed to walls with standard slotted angles 'U' shape threaded bolts, nuts for clamping pipes to angles. Slotted angles shall be grouted to R.C.C. work with dash fasteners of size so as to fit tightly on the pipes when tightened with screwed bolts. These slotted angles shall be spaced at regular intervals in straight lengths and heights at 1.8m C/C.

The CPVC pipes and fittings shall run in wall chase or ceiling or as specified. The fixing shall be done by means of standard pattern holder bat clamps keeping the pipes about 1.5 cm clear of the wall where to be laid on surface. Where it is specified to conceal the pipes, chasing may be adopted or pipes fixed in the shafts, ducts etc. provided there is a sufficient space to work on the pipes with the usual tools. As far as possible, pipes may be buried for short distances provided adequate protection is given against damage and where so required special care to be taken at joints. Where directed by the Engineer's Representative, pipe sleeves shall be fixed at a place where the pipe is passing through a wall or floor for reception of the pipe and allow freedom for expansion and contraction and other movements. CPVC pipes and fittings shall be jointed with suitable solvent cement as per the manufacturer recommendation as approved by Engineer in charge. In case of solvent welded joints solvent cements are applied on the surfaces to the jointed and the joint is made at ambient temperature. Solvent recommended by the manufacturers of the pipes shall be used and full load on the joints applied only after 24 hours. The pipe shall be cut perpendicular to the axis of the pipe length. Pipe ends have to be beveled slightly with a reamer at an angle of about 30 degree. Total length of insertion socket shall be marked on the pipe and checked how far the pipe end could be inserted into the fitting socket. Attempts shall be made to push the pipes to the marked distance, if not possible it shall at least be pushed for 2/3 of this distance. Dust, oil, water, grease etc. shall be wiped cut with a dry cloth from the surface. Generous coatings of the solvent cement shall be evenly applied on the inside of the fitting all-round the circumference for the full length of insertion and the outside of the pipe end up to the mark line with non-synthetic brush of suitable dimension. The pipe shall be pushed into the fitting socket and held for one or two minutes as otherwise the pipe may come out of the fitting due

the slippery quality of cement and the tapering inside bore of the fitting. The surplus cement shall be wiped out. In summer months joints shall be made preferably early in the morning or in the evening when it is cooler. Where the pipeline crosses a road or drain, it shall be through RCC pipe.

### 3.9 PIPING INSTALLATION

Tender drawings indicate schematically the size and location of pipes. The Contractor, on the award of the work, shall prepare detailed shop drawings, showing the cross-section, longitudinal sections, details of fittings, locations of isolating and control valves, drain and air valves, and all pipe supports. He must keep in view the specific openings in buildings and other structures through which pipes are designed to pass.

Piping shall be properly supported on stands or clamps or suspended from hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchor, clamps and hangers, and be responsible for their structural stability. All these pipes crossing through walls/floor slab shall pass through sleeves/ cutouts with proper sealing.

Piping supports shall be plastic clamps adjustable for the height. Horizontal Spacing between the supports shall not exceed the following:

Pipe Dia (mm)	Spacing between supports(mm).
20	700
25	750
32	825
40	975
50	975

This spacing may be increased by 50% for vertical runs support. For bigger diameter pipes horizontal spacing between pipe supports shall be followed as 1500 mm minimum or as approved by Engineer in charge.

Vertical risers shall be parallel to walls and column lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor by clamps or collars attached to pipe and with a 15 mm thick rubber pad or any resilient material. Where pipes pass through the terrace floor, suitable flashing shall be provided to prevent water leakage. Risers shall have a suitable drain out in the valve at the lowest point and air vent at the highest point.

Pipe sleeves, 50 mm larger diameter than pipes, shall be provided wherever pipes pass through walls and slabs, and annular space filled with fiberglass and finished with retainer rings.

All pipe work shall be carried out in a proper workman like manner, causing minimum disturbance to the existing services, buildings, roads and structure.

Cut-outs in the floor slab for installing the various pipes area are indicated in the drawings. Contractor shall carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the drawings, do not meet with the requirements.

The contractor shall make sure that the clamps, brackets, saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.

All pipes shall be accurately cut to the required sizes in accordance with relevant IS codes. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reduces shall be used for the piping to drain freely. In other locations, concentric reduces may be used.

All buried pipes for water supply main shall be of GI medium class as per IS 1239 and inside building, the pipes shall be cPVC unless otherwise specified.

Automatic air vent valves shall be provided at high points in the piping system for venting.

Discharge from the air vent valves shall be piped through equal sized mild steel; or galvanized steel pipe to the nearest drain or sump. All pipes shall be pitched towards drain points.

### 3.10 **Cutting Chases in Masonry Walls**

The chases up to 7.5 x 7.5 cm shall be made in the walls for housing pipes. These shall be provided in correct positions as shown in the drawings or directed by the Engineer's Representative. Chases shall be made by chiseling out the masonry to proper line and depth. After GI pipes are fixed in chases, the chases shall be filled with cement mortar 1:4 or as specified may be made flush with the masonry surface. The concrete surface shall be roughened with wire brush to provide a key for plastering.

### 3.11 **Water supply pipe Fittings**

Unless otherwise specified, all gunmetal fittings such as gate, ball, globe, check & safety valves shall be fitted in pipe line in a proper workman like manner. Necessary unions shall be provided on both ends of the valves for easy replacement. The joints between fittings and pipes shall be leak-proof when tested to a pressure of 1.5 times working pressure. The defective fittings and joints shall be replaced or redone.

**3.12 Making Water Connection**

A pit of suitable dimension shall be dug at the point where the connection is to be made with ring main and earth removed upto 150 mm below the main. The flow of water in main shall be disconnected by operating the nearest sluice valve on the main. The main shall be drilled and slopped at 45° to the vertical and the ferrule of required size shall be screwed in. The ferrule shall be fitted in a manner so that no portion of projection of the shank shall be left projecting within the main into which it is fitted. Ferrule shall be non-ferrous material with a C.I bell mouth cover and shall be of nominal bore as required.

**3.13 Connections to various Mechanical Equipment Supplied by Other Agencies**

All inlets, outlets, valves, piping and other incidental work connected with installation of mechanical equipment supplied by M & P supplier shall be carried out by the contractor in accordance with the drawings, requirements for proper performance of equipment, manufacturer's instructions and the directions of the Engineer's Representative. The connections to the various equipment shall be made through proper unions and isolating valves. The work of making connections shall be made in consultation with and according to the requirement of equipment suppliers, under the directions of the Engineer's Representative. The various aspects of connection work shall be executed in a similar way to the work of respective trade mentioned elsewhere in these specifications.

**3.14 DISINFECTION OF PIPING SYSTEM AND STORAGE TANKS**

Before commissioning the water supply system, the contractor shall arrange to disinfect the entire system as described in the succeeding paragraph.

The water storage tanks and pipes shall first be filled with water and thoroughly flushed out. The storage tanks shall be filled with water again and disinfecting chemical containing chlorine shall be added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give water a dose of 50 parts of chlorine to one million parts of water. If ordinary bleaching powder is used, the proportions will be 150 gms of powder to 1000 liters of water. The powder shall be mixed with water in the storage tank. If a proprietary brand of chemical is used, the proportions shall be specified by the makers. When the storage tank is full, the supply shall be stopped and all the taps on the distributing pipes are opened successively. Each tap shall be closed when the water discharged begins to smell of chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and pipe shall then remain charged at least for three hours. Finally the tank and pipes shall be thoroughly flushed out before any water is used for domestic purpose.

### 3.15 TESTING

- a) Solvent welded pipe shall not be pressure tested until at least 24 hours after the last solvent cemented joint has been done.
- b) All control valves shall be positioned open for the duration of the test and open end closed with water tight fittings. The testing pressure on completion of work shall not be less than one and half times the working pressure of the pipes.
- c) Pressure shall be applied either by hand pump or power driven pump. Pressure gauges shall be correctly positioned and closely observed to ensure that at no time are the test pressure exceeded. The systems shall be slowly and carefully filled with water to avoid surge pressure or water hammer. Air vents shall be open at high points so that air may be expelled from the system during filling.
- d) When the system has been fully charged with water and air displaced from the line air vent shall be closed and the line initially inspected for seepage at joints and firmness of supports under load Pressure may then be applied until the required test pressure is reached.
- e) Without any additional requirement of make-up-water the test pressure should not fall more than 0.2kg/sq.cm. at the end of one hour test duration

## 4 INTERNAL DRAINAGE (SOIL, WASTE, VENT AND RAIN WATER PIPES)

### 4.1 SCOPE

The scope of this section comprises the supply, installation, testing and commissioning of piping network and making relevant shop drawings for internal drainage system.

The Contractor shall make all necessary application and arrangements for his work to be inspected by the Local Authorities, Consultants and Site personnel.

The Contractor shall be solely responsible for obtaining the Authorities approval of his works prior to the handing over of the complete drainage system to the Owner.

### 4.2 BASIC PIPING SYSTEM

Soil, waste and vent pipes in shafts, ducts and in concealed areas i.e. false ceilings etc. shall consist of cast iron pipes & fittings as called for. In general wastes and vents smaller than 50mm dia shall be of heavy class Galvanized Iron.

The soil pipes shall be circular with a minimum diameter of 100mm. Pipes shall be fixed by means of stout MS / GI clamps in two sections, bolted together, built into the walls, ceiling, wedged and neatly jointed as directed and approved by the Engineer's Representative. All bends, branches, swan neck and other parts shall conform to the requirement and standards as described for the pipes. Pipes shall be rested against the walls on suitable cradles. Local authority regulations applicable to the installations shall be strictly followed.

Where indicated, the soil pipes shall be continued upwards without any diminution in its diameter, without any bend or angle to the height shown in the drawings. Joints throughout shall be made with molten lead as described under jointing of cast iron pipes. Soil pipes shall be painted as provided under 'painting'. The soil pipes shall be covered on top with cast iron terminal outlets as directed and approved. All vertical soil pipes shall be firmly fixed to the walls with properly fixed clamps, and shall as far as possible be kept 50mm clear of wall. Waste pipes and fittings shall be of cast iron or galvanized mild steel pipes. Pipes shall be fixed. Jointed and painted as described in installation of soil, waste & vent pipes.

Every waste pipe shall discharge above the grating of properly trapped gully. The contractor will ensure that this requirement is adequately met with. Wherever floor traps are provided, it shall be ensured that at least one wash is connected to such floor traps to avoid drying of water seal in the trap. Ventilating pipes shall be of cast iron or galvanised mild steel pipes, conforming to the requirements laid down earlier. Anti-siphon vent pipes/relief vent pipes where called for on the drawings shall be of cast iron or galvanised mild steel pipes as specified. The pipes shall be of the diameter shown on the drawings.

All traps on branch soil and waste pipes shall also be ventilated at a point not less than 75mm or more than 300mm from their highest part and on the side nearest to the soil pipe or waste pipes.

All the fittings used for connections between soil, waste and ventilation pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. The doors shall be provided with 3mm thick rubber insertion packing and when closed and bolted shall be air and water tight.

Where soil, waste and ventilating pipes are accommodated in shafts ducts, adequate access to cleaning eyes shall be provided.

#### 4.3 **PIPING MATERIALS**

##### 4.3.1 **Cast Iron Pipes**

Cast iron pipes and fittings shall be of good and tough quality and dark grey on fracture. The pipes and fittings shall be true to shape, smooth and cylindrical, their inner and outer surface being as nearly as practicable concentric. They shall be sound and nicely cast, shall be free from cracks, taps, pinholes and other manufacturing defects.



The cast iron pipes and fittings shall conform to IS: 3989 as called for. Fittings shall be of required degree with or without access door. All access doors shall be made up with 3mm thick insertion rubber gasket of white lead and tightly bolted to make the fittings air and water tight. The fittings shall be of the same manufacture as the pipes used for soil and waste.

All cast iron pipes and fittings shall bear the manufacturer's name and IS specification to which it conforms.

All pipes and fittings shall be coated internally and externally with the same material at the factory, the fittings being preheated prior to total immersion in a bath containing a uniformly heated composition having a tar/other suitable base. The coating material shall have good adherence and shall not scale off. The coating shall be smooth and tenacious and hard enough not to flow when exposed to a temperature of 77 degree C but not so brittle at a temperature of '0' degree C as to chip off when scratched lightly with a pen knife.

All pipes and fittings before installation at site shall be tested hydrostatically to a pressure of 0.45 Kg/sq. cm without showing any sign of leakage, sweating or other defects of any kind. The pressure shall be applied internally and shall be maintained for not less than 30 minutes. All these tests shall be carried out in the presence of the Engineer's Representative. Alternatively a test certificate from manufacturers be obtained before dispatch of material to site.

#### 4.3.2 **Cast Iron Specialities**

Cast iron specialty items such as deep seal floor traps, urinal traps, trap integral pieces with integral inlet/outlet connections manhole cover with frame, chamber cover etc. shall be fabricated to suit individual location requirements. The contractor shall arrange the fabrication of these items from an approved source. All traps shall have minimum 6cm deep seal shall be supplied with cast iron caps and collar capable of receiving a screwed grating.

#### 4.3.3 **Galvanised Iron Pipes**

Waste pipes 50mm diameter below and where called for shall be galvanized iron pipes screwed and socketed conforming to the requirements of IS:1239 of heavy grade. The pipes and sockets shall be cleanly finished, well galvanized in and out and free from cracks, surface flaws, laminations and other defects. All screw thread shall be clean and well cut. All pipes and fittings shall bear manufacturer's trade mark and conform to the IS as specified.

#### 4.4 **INSTALLATION OF SOIL, WASTE & VENT PIPES**

Soil, waste & vent pipes in shafts under the floors shall consist of cast iron pipes as described earlier. Waste pipes from bottle trap to floor/urinal traps for wash basin, urinal and sink shall be of heavy class GI pipes and fittings.

All Horizontal pipes running below the slab and along the ceiling shall be fixed on structural adjustable clamps, sturdy hangers of the design as called for in the drawings. The pipes shall be laid in uniform slope and proper levels. All vertical pipes shall be truly vertical fixed by means of stout clamps in two sections, bolted together, built into the walls, wedged and neatly jointed. The branch pipes shall be connected to the stack at the same angle as that of fittings. All connections between soil, waste and ventilating pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts. Where the horizontal run off the pipe is long or where the pipes cross over building expansion joints etc. suitable allowance shall be provided for any movements in the pipes by means of expansion joint etc. such that any such movement does not damage the installation in any way.

All cast iron pipes and fittings shall be jointed with best quality soft pig lead free from all impurities.

Before jointing, the interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of threaded spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and alignment. The remainder of the socket is left for the lead caulking. Where the gasket has been tightly held, a jointing ring shall be placed round the barrel against the face of the socket. Molten pig lead shall be poured to fill the remainder of the socket in one pouring. The lead then shall be solidly caulked with suitable tools by hammering right round the joints to make up for the shrinkage of the molten metal on cooling and preferably finish 3mm behind the socket face.

The depth of the lead joints for the cast iron pipes shall be 45mm for the pipes up to 100mm dia and 50mm for the pipes beyond 100mm dia respectively. Twenty percent variations shall be permissible in accordance with IS:3114.

The joint shall not be covered till the pipe line has been tested under pressure. Rest of pipe line shall be covered so as to prevent the expansion and contraction due to variation in temperature.

#### 4.5

#### **INSPECTION AND TESTING**

Before the appliances are connected all opening of pipes shall be inspected and tested. All opening of pipes shall be sealed with plugs and water test in small sections of pipes shall be carried out to a static head of 4.5 meters.

The contractor shall give a smoke test to the drains and sewers at his own expense and charges as directed by the Engineer's Representative.

After installation of all the appliances, discharge test shall be conducted individually and collectively. Obstruction in any of the pipe lines shall be

traced and whole system is examined for hydraulic performance, including the retention of any adequate water seal in each trap. Any defect revealed by the tests shall be made good and the tests are repeated until a satisfactory result is obtained.

#### 4.6 **PIPE PROTECTION**

Where pipes are embedded in floors, slabs, columns, beams etc., they shall be given a protection by encasing them with 100mm thick 1:3:6 cement concrete all-round the pipes and fittings or as specified in Schedule of Quantities.

#### 4.7 **RAIN WATER PIPES & FITTINGS**

Rain water pipes and fittings shall be uPVC pipe as shown in the drawing. The pipes and fittings shall be ISI marked , IS- 4985, 6 kg/sq. cm. for rain water pipes sizes 160mm OD or above and IS-13592 for pipe sizes upto 110mm OD. Pipe shall be fixed as shown on the drawings. Where the pipes are to be fixed on walls, these shall be fixed with suitable holder bat clamp and shall be embedded in PCC 1:2:4 block of size 150x150x150mm and as directed by the Engineer-In-Charge.

All rain water pipe inlets shall be provided with 450 x 450mm Khurra as shown in the drawing.

Rain water pipes outlet from Gutters of sloped roof shall be properly fixed so that there is no leakage.

In sunken portion of RCC slab and in RCC chajja, a PVC pipe of suitable length and dia shall be inserted during casting wherever outlets of any types of pipes are to pass. No cutting /chiselling of RCC work after casting shall be permitted.

All exposed rain water pipes shall be paint to match the exterior finish of wall as per the instruction of the Engineer-In-Charge.

### 5 **EXTERNAL STORM WATER DRAINAGE & SEWAGE DISPOSAL**

#### 5.1 **SCOPE**

The scope of this section comprises the supply, installation, testing and commissioning of piping network and making relevant shop drawings for Sewage and storm water drainage system as per MES Standard Schedule of Rate.

The Contractor shall make all necessary application and arrangements for his work to be inspected by the Local Authorities, Consultants and Site personnel.

The Contractor shall be solely responsible for obtaining the Authorities approval, if any, of his works prior to the handing over of the complete sewage and storm water installation to the Owner.

## 5.2 **GENERAL SCHEME**

The contractor shall install a drainage system to effectively collect drain and dispose all soil and waste water from various parts of the buildings, appurtenances and equipment. The piping system shall finally terminate and discharge into the septic tank. The piping work mainly consists of laying of stoneware pipes, reinforced cement concrete pipes and cast iron soil pipes as called for on the drawings. The disposal system shall include construction of gully traps, manholes & intercepting chambers as indicated. The piping system shall be vented suitably at the starting point of all branch drains, main drains and the highest/lowest point of drain and at intervals as shown. All ventilating arrangements shall be unobstructed and concealed. The work shall be executed strictly in accordance with IS:1742. The sewage system shall be subject to smoke test for its soundness as directed by the Engineer's Representative. Wherever the sewerage pipes run above water supply lines, same shall be completely encased in cement concrete 1:2:4 all round with the prior approval of the Engineer's Representative.

## 5.3 **PIPING MATERIAL**

5.3.1 All sewer and storm water drainage pipes shall be centrifugally spun S&S, RCC class NP3/ Stone Ware pipes as per Standard schedule of Rate 2010 and as shown in drawing.

## 5.4 **Stone Ware Gully Trap**

Gully trap shall be stone ware conforming to indoor standard. These shall be sound and free from visible defects or hair cracks. They shall give a sharp clear note when struck with light hammer. There shall be no broken blisters. Each gully trap shall have one cast iron grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight cast iron cover with frame inside dimensions 300 x 300mm the cover weighing not less than 4.5 kg and the frame not less than 2.7kg. The grating cover and frame shall be of good casting and shall have truly square machined seating faces all complete as per BOQ and drawing.

## 5.5 **Cast Iron Pipes**

Cast iron pipes and fittings shall conform to IS:3989 as called for in the documents.

## 5.6 **Cast Iron Manhole Cover and Frame**

The Cast Iron Manhole Cover and Frame shall conform to IS:1726 and the grade and types have been specified in the schedule of quantities. The cover and frames shall be cleanly cast and they shall be free from air and sand holes and from cold shuts. They shall be neatly dressed and carefully

trimmed. All castings shall be free from voids whether due to shrinkage, gas inclusion or other causes. Covers shall have a raised checkered design on the top surface to provide an adequate non-slip grip.

The sizes of covers specified shall be taken as the clear internal dimensions of the frame.

The covers and frames shall be coated with a black bituminous composition. The coating shall be smooth and tenacious. It shall not flow when exposed to a temperature of 63° C and shall not brittle as to chip off at a temperature of 0°C.

## 5.7 **Floor Trap**

The Floor trap shall conform to IS-3989 and shall be of cast iron and outlet with nominal diameter of 75mm OR 100mm shall be provided in the situations where shown on drawings. For kitchen & urinals the trap shall be of 100mm and for other areas it shall be of 75mm. The outlet of floor trap shall be with long arm and shall be jointed to connecting pipe / branch pieces with lead joint. Floor traps shall be deep seal with an effective seal of 50 mm.

The trap and waste pipes in ground floor shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1:2:3 mix (1 cement: 2 coarse sand: stone aggregate 20 mm nominal size) mixed with water proof compound and extended to 40 mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30 x 30 cms of the required depth.

### 5.7.1 **Floor Trap Inlet**

The Contractor shall provide a special type galvanised iron inlet fitting without or with one, two or three inlet sockets to receive the waste from wash basins, urinals, sinks or floor drains and shall be connected to a C.I. 'P' or 'S' trap. In ground floor, the trap inlet fittings and the trap shall be set in cement concrete blocks.

## 5.8 **C.P. / Stainless Steel Cockroach Trap / Gratings**

Floor and Urinal traps shall be provided with 100-150mm square or round C.P./Stainless steel cockroach trap/grating as approved by the Engineer-In-charger, of approved design and shape. Minimum thickness of gratings shall be 4-5mm.

## 5.9 **Cleanout Plugs**

Contractor shall provide cast brass cleanout plugs in suspended pipes at ceiling level or wherever shown in the drawing. Cleanout plugs shall be threaded and provided with key holes for opening. Cleanout plugs shall be fixed to the pipe by a G.I. socket with lead caulked joint.

### 5.10 **Pipe Sleeves / Cutout**

Pipe sleeves 50mm larger diameter shall be provided wherever pipes pass through RCC walls and slabs and annular space filled with fire proof materials like putty, fire seal etc. All sleeves shall be accurately kept to the required sizes in accordance with relevant BIS codes and burrs removed before laying. Open ends of the pipe shall be closed as the pipe is installed to avoid entrance of foreign matters. Vertical sleeve shall finish 50mm above finish floor level.

### 5.11 **LAYING AND JOINTING OF PIPES**

#### 5.11.1 **General**

All the material shall be new of best quality conforming to specifications and subject to the approval of the Engineer's Representative. Drainage lines shall be laid to the required gradients and profiles. All drainage work shall be done in accordance with the local municipal by-laws.

Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority. Location of all manholes, catch basins etc. shall be confirmed by the Engineer's Representative before the actual execution of work at site. All work shall be executed as directed by the Engineer's Representative.

#### 5.11.2 **Alignment and Grade**

The sewer and storm water drainage pipes shall be carefully laid to levels and gradients shown in the plans and sections but subject to modifications as shall be ordered by the Engineer's Representative from time to time to meet the requirements of the works. Great care shall be taken to prevent sand etc. from entering the pipes. The pipes between two manholes shall be laid truly in straight lines without vertical or horizontal undulations. The body of the pipes shall rest on an even bed in the trench for its length and places shall be excavated to receive collar for the purpose of jointing. No deviations from the lines, depths of cuttings or gradients as called for on the drawings shall be permitted without the written approval of the Engineer's Representative. All pipes shall be laid at least 60cms below the finished ground level or as called for on the drawings.

#### 5.11.3 **Setting out Trenches**

The contractor shall set out all trenches, manholes, chambers and such other works to true grades and alignments as called for. He shall provide the necessary instruments for setting out and verification for the same. All trenches shall be laid to true grade and in straight lines and as shown on the drawings. The trenches shall be laid to proper levels by the assistance of boning rods and sight rails which shall be fixed at intervals not exceeding 10 meters or as directed by the Engineer's Representative.

**5.11.4 Trench Excavation**

The trenches for the pipes shall be excavated with bottoms formed to level and gradients as shown on the drawings or as directed by the Engineer's Representative. In soft and filled in ground, the Engineer's Representative may require the trenches to be excavated to a greater depth than the shown on the drawings and to fill up such additional excavation with concrete (1:4:8) consolidated to bring the excavation to the required levels as shown on the drawings.

All excavations shall be properly protected where necessary by suitable timbering, piling and sheeting as approved by the Engineer's Representative. All timbering and sheeting when withdrawn shall be done gradually to avoid falls. All cavities be adequately filled and consolidated. No blasting shall be allowed without prior approval in writing from the Engineer's Representative. It shall be carried out under thorough and competent supervision, with the written permission of the appropriate authorities taking full precautions connected with the blasting operations. All excavated earth shall be kept clear of the trenches to a distance equal to 75 cms.

**5.11.5 Obstruction of Roads**

The contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street and sufficient space shall then be left for public and private transit. He shall remove the materials excavated and bring them back again when the trench is required to be refilled. The contractor shall obtain the consent of the Engineer's Representative in writing before closing any road to vehicular traffic and the foot walks must be clear at all times.

**5.11.6 Protection of Pipes etc.**

All pipes, water mains, cables etc. met in the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the cables, the removal of which shall be arranged by the contractor with the written consent from the Engineer's Representative.

**5.11.7 Trench Back Filling**

Refilling of the trenches shall not be commenced until the length of pipes therein has been tested and approved. All timbering which may be withdrawn safely shall be removed as filling proceeds. Where the pipes are unprotected by concreted haunching, selected fine material shall be carefully hand-packed around the lower half of the pipes so as to buttress them to the sides of the trench.

The refilling shall then be continued to 150mm over the top of the pipe using selected fine hand packed material, watered and rammed on both sides of the pipes with a wooden hammer. The process of filling and tamping shall proceed evenly in layers not exceeding 150mm thickness, each layer being watered and consolidated so as to maintain an equal pressure on both sides

of the pipe line. In gardens and fields the top solid and turf if any, shall be carefully replaced. Contractor shall provide protection of deep trenches in such a way that nobody hurt particularly during night.

#### 5.11.8 **Contractor to ensure Settlement and Damages**

The contractor shall at his own costs and expenses, make good promptly during the whole period for the works in hand if any settlement occurs in the surfaces of roads, beams, footpaths, gardens, open spaces etc. in the public or private areas caused by his trenches or by his other excavations and he shall be liable for any accident caused thereby. He shall also, at his own expense and charges, repair (and make good) any damage done to building and other property. If in the opinion of the Engineer's Representative he fails to make good such works with all practicable dispatch, the Engineer's Representative shall be at his liberty to get the work done by other means and the expenses thereof shall be paid by the contractor or deducted from any money that may be or become due to him or recovered from him by any other manner according to the laws of land.

The contractor shall at his own costs and charges provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled, surplus soil shall be immediately removed, the surface shall be properly restored and roadways and sides shall be left clear.

#### 5.11.9 **Removal of water from Sewer, trench etc.**

The contractor shall at all times during the progress of work keep the excavations free from water which shall be disposed by him in a manner as will neither cause injury to the public health nor to the public or private property nor to the work completed or in progress nor to the surface of any road or streets, nor cause any interference with the use of the same by the public.

If any excavation is carried out at any point or points to a greater width of the specified cross section of the sewer with its cover, the full width of the trench shall be filled with concrete by the contractor at his own expense and charges to the requirements of the Engineer's Representative.

#### 5.11.10 **Route Markers**

Markers indicating the particular service shall be provided along with the routes of pipe trenches. Markers shall be of mild steel indicating the type of service installed and the direction of flow painted on it. The markers shall be set firmly in a concrete base and installed at all corner and turning points. Over straight runs, markers shall be spaced centre to centre at 50 metre centre (generally).

#### 5.12 **LAYING AND JOINTING OF CEMENT CONCRETE PIPES**

Cement concrete pipes shall be laid and jointed as described in IS:783.



After setting out the pipes, the collar shall be centered over the joint and a few skins of spun yarn soaked in a neat cement wash shall be inserted in the groove at the end of the pipe and two adjoining pipes butted against each other. After setting out the pipes, the collar shall then be slipped over the joint, covering equally both the pipes. Spun yarn soaked in neat cement wash shall be passed round the pipes and inserted in the joint by means of caulking tools from the ends of the collar. More skins of yarn shall be added and well rammed above. The object of the yarn is to centre the two ends of pipes within the collar and to prevent the cement mortar of the joints penetrating into the pipes.

Cement mortar with one part of cement and two parts of sand shall be slightly moistened and must in no account be soft or sloppy and shall be carefully inserted mechanically into the joint and more cement mortar be added until the space of the joint has been filled completely with tightly caulked mortar. The joint shall be finished off neatly outside the collar on both side at an angle of 45 degree, any surplus mortar projecting inside the joint is to be removed and to guard against any such projection, sack or gunny bags shall be drawn past each joint after completion. Cement mortar joint shall be cured for seven days.

#### 5.13 **FIXING OF GULLY TRAP**

The excavation for gully traps shall be done true to dimensions and levels as indicated on plans or as directed by the Engineer's Representative. The gully traps shall be fixed on cement concrete foundation 65cm square and not less than 10cm thick. The mix for the concrete will be 1:4:8. The jointing of gully outlet to the branch drain shall be done similar to the jointing of pipes described earlier. After fixing and testing gully and branch drain, a brick work of specified class in cement mortar 1:5 shall be built with a half brick masonry work round the gully trap from the top of the bed concrete up to ground level. The space between the chamber and trap shall be filled in with cement concrete 1:3:6. The upper portion of the chamber i.e. above the top level of the trap shall be plastered inside the cement mortar 1:3 finish with a floating coat of neat cement. The corners and bottom of the chamber shall be rounded off so as to slope towards the grating.

Cast iron cover with frame 300 x 300 mm (inside) shall then be fixed on the top of the brick masonry with cement concrete 1:2:4 and rendered smooth. The finished top cover shall be so as to prevent the surface water from entering the gully trap.

#### 5.14 **CONSTRUCTION OF MANHOLE**

Where manholes are to be constructed, the excavation, filling back and ramming, disposal of surplus earth, preparation of bottom and sides etc. shall be carried out as described earlier under trench excavation. Manhole shall be sized and depths as called for in the drawings and Schedule of Quantities.

The manhole shall be built on a base concrete 1:2:4 of 150mm thickness for manholes up to 1500mm depth and 250mm thickness for manholes from 1500 to 2500mm depth and 300mm thickness manholes of depth greater than

2500mm. Reinforcement as shown shall be provided in the base slabs. The walls shall be of brick work of thickness as shown in drawings built in cement mortar 1:5. The joints of brick work shall be raked and plastered internally and externally with cement plaster 1:3 to a thickness of 20mm and finished with a coat of neat cement shall be provided in the bottom of the manholes, semicircular channels of the same diameter as the pipes.

Above the horizontal diameter, the sides of channel shall be extended vertically to the same level as the crown of the outgoing pipe and the top edge shall be suitably rounded off. The branch channels shall also be similarly constructed with respect to the benching but at their junction with the main channel an appropriate fall suitably rounded off in the direction of flow in the main channel shall be given. Rungs of cast iron or mild steel of suitable dimensions shall be provided in all manholes over 800mm depth. These rungs shall be set at 30cms interval in two vertical runs at 380mm apart horizontally. The top rung shall be 450mm below the manhole cover. Unless otherwise mentioned, manholes shall be constructed to the requirements of IS:4111 (Part I). All manholes shall be constructed so as to be water tight under test. All angles shall be rounded to a 75mm radius with cement plaster 20mm thick. The benching at the side shall be carried out in such a manner so as to provide no lodgment for any splashing in case of accidental flooding. Manhole cover with frame shall be cast iron of an approved make. The covers and frame shall generally be double seal as specified in the Schedule of Quantities.

The top level of all new constructed manholes shall be 50mm above finished ground level at all ends and the level of the cover frame shall be 10-15mm above from all ends to avoid stagnant of water over manhole area and its smooth working. This slope shall be maintained during casting of top cover slab.

#### 5.15 **DROP CONNECTION**

Drop connection shall be provided between branch sewer and main sewer in the main sewer itself in steep ground when the difference in invert level of two exceeds 45cms of the required sizes. Drop connections from gully traps to main sewer in rectangular shall be made inside the manholes and shall have cast iron special types door bend on to top and heel rest bend at bottom connected by a cast iron pipe. The pipe shall be supported by holder bat clamps at 180 cms intervals with at least one clamp for each drop connection.

Drop connections from branch sewer to main sewer shall be made outside the manhole wall with cast iron/cast iron class LA pipe, connection, vertical pipe and bend at the bottoms. The top of the tee shall be finished up to the surface level and provided with a cast iron hinges type frame and cover 30cms x 30cms. The connection and tee up to the surface chamber of the tee.

Drop connection made from vertical stacks directly into manholes shall not be considered as drop connections. They shall be paid for under the relevant soil and waste pipes.

**5.16 GREASE TRAP:****a. Size of Grease Trap :**

The size given in Schedule of Quantities and drawings shall be internal size of chamber. The work shall be done strictly as per standard drawing and following specifications.

**b. Bed Concrete :**

Shall be in 1:4:8 cement concrete 150 mm thick unless specified.

**c. Brick work :**

Brick work shall be with best quality table moulded bricks in 1:6 cement mortar unless specified.

d. Baffle walls shall be of R.C.C and of size as mentioned in schedule of quantities. Brick partition constructed of best quality table moulded bricks in cement mortar 1:6 shall be provided for the entire height of chamber.

**e. Plaster :**

The walls of chamber shall be plastered from inside with 15 mm thick cement plaster 1:3 and finished smooth with a floating coat of neat cement.

**f. Chamber Covers :**

Covers shall be of size and duty as mentioned in schedule of quantities. Covers shall be of cast iron as per the details given in the drawing and shall be fixed on M S frame embedded in concrete.

g. Cast iron steps shall be provided at tow corners of the chamber.

h. All Cast Iron and MS items shall be painted with two coats of bitumastic paint.

**5.17 TESTING**

All lengths of the sewer and drain shall be carefully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subject to a test pressure of equivalent metre head of water as depth of manhole. The test pressure will however, not exceed 4.5 metres head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both sides, the upper end shall, however, be connected to a pipe for filling with water and getting the required head poured at one time permit.

The contractor shall give a smoke test to the drains and sewer lines at his own expenses and charges if directed by the Engineer's Representative.

Sewer lines shall be tested for straightness by:

- a) Inserting a smooth ball 12mm less than the internal diameter of the pipe. In the absence of obstructions such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe and emerge at the lower end.
- b) Means of a mirror at one end and a lamp at the other end. If the pipe is straight the full circle of light will be seen otherwise obstructions or deviations will be apparent.
- c) The contractor shall give a smoke test to the drain and sewer at his own expense and charges, if directed by the Engineer's Representative.
- d) A test register shall be maintained which shall be signed and dated by contractor and Engineer's Representative.

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#### **Packaged Type Septic Tank**

Supply, Installation, Testing and commissioning of PWTS AM series Polyethylene Tank of Sintex make or any other approved make which shall be an advance version of Septic Tank with minimum capacity of 1600 liter per day, diameter of 1440 mm and height of 1550 mm suitable for 10 users or as per BOQ whichever is of higher dimension with 150 lpcd of residential category. Tank shall consist of three zones. First zone shall comprise of septic zone where sludge is stabilized by anaerobic digestion. Second zone shall be sedimentation zone and the third zone shall be pall ring media zone having surface area of 190 Sq.mt / Cum and retain micro-organism long enough to digest the organic waste resulting in 70% of BOD reduction from final out let. It shall be provided with inlet & outlet pipe of 100 mm diameter, Vent pipe of 50 mm diameter, Internal piping, manhole cover of 400 mm diameter all complete as required.

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## **B. ELECTRICAL WORKS**

### **1 GENERAL CONDITIONS**

1. The works will be executed to comply with the General Specifications for Electrical works and conforming to the Indian Electricity Act & rules, BIS & Direction of Engineer-in-charge.
2. The items of work shall be executed as per detailed technical specifications and scheme. In case of contradiction between schedule of work with its Additional Specification and the General Specification, the former shall prevail.
3. The work will be executed as per general arrangement drawing and detailed fabrication drawings duly approved by the Engineer-in-charge. The various items of equipment will be ordered only after the drawings are approved and quantities in detail of various items are ascertained as per actual requirements. Therefore, the actual quantities / measurement may vary from the stipulated quantities, which are only estimate.
4. The contractor/agency will engage suitable qualified/experienced/licensed engineering supervisor for the work and suitable skilled personnel with required license for doing the erection work. Required special tools to be operated in the execution of the job.
5. The work will be performed as per the day to day instruction and approval of the engineer-in-charge. All materials/ equipment will be used after taking approval of the Engineer-in-charge.
6. Equipment will be duly inspected in the manufacturer's works / premises before dispatch to the site, as per instructions of Engineer-in charge.
7. The rates are to be inclusive of all taxes, levies, insurance, freight, octroi etc. except service tax which will be reimbursed by the department, in full, on presentation of receipted original deposit slip, against the work. Nothing extra will be paid.
8. The work will be executed as per the programme of completion of the project. The delivery & erection schedule of various materials/ equipment will be as per approval of Engineer-in-charge.
9. This contract holds the contractor responsible for the entire job as per relevant specifications. If any item is left out within the schedule of work but if it is considered essential for the completion of the job, the contractor has to carry out the items within tendered amount & nothing extra shall be paid.

10. The contractor shall have to make arrangements, at his own risk and cost, for transportation of materials from the point of issue of stores to site of work, if any.
11. The contractor shall ensure that the staff employed by him for execution of the electrical work, possess the valid electrical license issued by competent authority. Consequences arising due to the default of the contractor in not complying with the above condition shall be the entire responsibility of the contractor.
12. All concealed work and earthing shall be done in the presence of the Engineer-in-charge or his authorized representative.
13. The schematic diagram/dimensional drawings of the various electrical cubical panels shall be got approved from the Engineer-in-charge before fabrication and shall comply with specifications and Indian Electricity Rules. The panels shall conform to IS: 8623/1993. All panels shall be powder coated inside out, in shade approved by the Engineer-in-charge.
14. All panels/DB shall be suitable for 45°C ambient temperature.
15. The MCB shall be of the same make as that of MCB DB's. Contractor shall obtain approval of the Engineer-in-charge before procurement of MCB DB's. All DB's shall be double door type conforming to minimum IP-43 degree of protection.
16. Miniature Circuit Breaker shall comply with IS –8828-1996 / IEC 898. Miniature Circuit Breakers shall be quick make and break type for 230 / 415 V A.C., 50Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10KA at 415V A.C. The MCB shall be DIN mounted. The MCB shall be current limiting type (Class – 3).
17. MCB shall be classified (B, C, D ref. IS standard) as per their tripping characteristics curves defined by the manufacturer. The MCB shall have the minimum power loss (watts) per pole defined as per the IS / IEC and the manufacturer shall publish the values.
18. The MCB housing shall be heat resistant and having high impact strength. The terminal shall be protected against finger contact to IP20 degree of protection.
19. All model of modular accessories required for the work shall be got approved from the Engineer-in-charge among the approved makes. The base plate shall be preferably in sheet steel or otherwise in unbreakable polycarbonate. The cover plates shall be screw less type in shade approved by the Engineer-in-charge. The GI box shall be of the same make as the modular accessories.

20. Contractor shall have to check the site order Book for any instructions of Engineer-in-charge or his authorized representative and sign the site order book. He shall be bound to ensure compliance with the instructions recorded their in.
21. All the MCCB's shall have microprocessor based trip unit for reliable protection and accurate measurement. The rated Service breaking capacity (kArms) shall be 100% of Ultimate breaking capacity (kArms). All MCCB's shall be current limiting type with features as per relevant IS codes and specification. All MCCB's shall be rated for minimum operating voltage of 690 V and minimum insulation voltage of 750 V. There has to be total discrimination between the incoming and outgoing MCCB's and MCB's, as required, at the MDB's and DB's level.
22. MCCB's shall be used with rotary handle and terminal spreaders and all terminals shall be shrouded to avoid direct contact.
23. All measuring CT's, unless otherwise specified shall be cast resin CT's with class 0.5 accuracy. All digital measuring meter shall be with class 0.5 accuracy unless specified otherwise.
24. Mechanical Castle key interlock shall be provided among the incomer MCCB's, wherever, as applicable, two different incomer sources are provided in the panel as per the directions of the Engineer in charge. The same is deemed included in the scope of work.
25. All measuring and indicating instruments shall be protected through MCB's of 0.5 Amps rating.
26. General arrangement drawing of the switchboard shall be got approved by the Engineer-in-Charge before commencement of manufacturing.
27. Conduit layout as per switching arrangement shall be prepared by contractor and got approved from the Engineer-in-Charge before slab casting. At all expansion joints in the building suitable arrangement shall be ensured during conduiting.
28. Ratings, sizes and quantities shall be checked and considered for satisfactory operation of electrical system complete in all respect. Ratings, sizes and quantities mentioned in Bill of Quantities and drawings are indicative and minimum.
29. Conduits, Switchboards, Sockets to be provided on walls shall be recessed type unless specifically approved by Engineer-In-Charge.
30. Conduits on ceiling in existing system may be provided on surface and in new construction shall be recessed type.

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31. Inspection / acceptance, in no way shall absolve the contractor from supplying material as per standards / codes and warranty or other obligations under the contract.
  32. The agency shall have the following testing/measuring equipment in addition to standard tools.
    1. Insulation Tester, 500V, 1000V, 5000V
    2. Earth tester with kit, 0, 10,100 ohms with selector switch
    3. Tong tester with (1) Ammeter 0-800 A with different ranges and selector switch.
    4. Voltmeter 0/300V/600V with different ranges and selector switches.
    5. Phase sequence tester
    6. Multimeter / Avometer: - Digital to measure 0/10/100 mV, mA, ohm, Kilo ohm resistance.
    7. Frequency meter 45 to 55 Hz.
    8. Portable PF meter (0.5 lag-unity-0.5 lead).
    9. Lux meter to measure upto 2000 lux with selector switches.
    10. Micrometer (digital)
    11. Vernier Caliper(digital)
  33. All electrical works shall be tested by the contractor in the presence and to the entire satisfaction of Engineer-in-Charge and IE Rules.
  34. Documents to be submitted along with the tender:
    - A. All technical literature / pamphlets for various equipment offered.
    - B. Type test certificates as per IS for package substation and HT/LT switchgears, transformer, Dg set, etc.
  35. Data to be furnished by the bidder after award of work.
    - A. The contractor shall submit following detail shop/fabrication/layout drawings, datasheets and calculations.
      - a. Internal Electrical Works
        - 1) Conduit layout with number of wires in each conduit, circuiting.
        - 2) Phase balancing calculation
        - 3) DB, SDB load calculation
        - 4) Cable and submain wire sizing
        - 5) Equipment datasheet and GA drawing
          - i) MDB
          - ii) Floor DB
          - iii) SDB
          - iv) Light Fittings
          - v) Wires and cables
          - vi) Switches and sockets
          - vii) Conduit, Junction box
          - viii) Lux level calculation



- ix) Datasheet and catalogue.
  - x) Light fitting fixing arrangement
  - xi) Earthing Layout
- b. External Electrical Works
- 1) External lighting layout
  - 2) Circuiting and phase balancing of external illumination scheme
  - 3) Power feeding arrangement
  - 4) Lux level calculation based on final lighting fitting
  - 5) Datasheet and catalogue of light fittings
  - 6) Datasheet, catalogue structural calculation and GA /foundation drawings
- c. Drawings
- 1) Cable laying arrangement
  - 2) Equipment layout
  - 3) Earthing layout with soil resistivity test report
  - 4) Lighting layout
  - 5) Duct layout
  - 6) Trench Layout

**Note:** For complete execution and satisfactory performance of installation, drawings / documents for all items whether or not mentioned above shall be submitted for approval.

B. Six Set of copies of installation, operation and maintenance manuals, descriptive bulletins etc., shall be furnished prior to / at the time of despatch of all materials. Manuals shall include the following aspects:

- i) Outline dimension drawing showing relevant cross sectional views, earthing details and constructional features including foundation drawing.
- ii) Rated voltage, current, duty cycle and all other technical information which may be necessary for correct operation of the switchgear.
- iii) Storage details for prolonged duration.
- iv) Unpacking.
- v) Handling at site.
- vi) Erection
- vii) Pre-commissioning test.
- viii) Operating procedure.
- ix) Maintenance procedures.
- x) Precaution to be taken during operation and maintenance work.
- xi) List of spares for two years trouble free operation.

C. Test Certificates

- i) Type/Routine test certificate for all types of equipment, cables, etc. included in the order.
  - ii) Specified number of copies of the approved test certificates shall be furnished to the Engineer-in-Charge before despatch of all materials / equipment and cables, etc.
- D. On completion of work the contractor shall submit six sets of all drawings, manuals and test certificates, etc. for all equipment / materials ordered and as specified by the Engineer-in-Charge.

## **2.0 INTERNAL ELECTRIFICATIONS**

### **2.1 GENERAL**

Refer clause 19.2 of MES Schedule (Part-I), 2009.

The contract covers complete internal electrifications upto and including main switches, MCBs and distribution boards as specified and shown in drawings and as mentioned in respective schedules.

The general layout and wiring points and fittings are as shown in the drawings. The exact position of fittings, etc., may be altered by the GE to suit local requirement.

“Loop in” system of wiring shall invariably be followed throughout the electrical wiring. Where it is absolutely necessary, junction boxes of approved make may be used as permitted by GE. Soldered or taped joints are not permitted for jointing under any circumstances. Porcelain connector with metal parts of brass shall be used.

The rates of point wiring shall include for all the necessary provisions made in SSR (Part II) as applicable to surface wiring on wooden battens / concealed conduit wiring unless otherwise specified elsewhere in the tender document.

#### **2.1.1 System of Wiring**

Wiring shall be PVC insulated (Unsheathed/Sheathed) stranded copper conductor cable in approved PVC/ Steel conduit wiring as shown on drawings or as described in schedule of internal electrification in para 19.125 to 19.132 on page 476-479 to of SSR (Part I). Wiring is to be terminated in pressed steel terminal GI boxes for mounting Modular type / Flush type fittings like switches, sockets and regulators, etc., with modular boxes and cover plate / 3mm thick plastic laminated sheet (Formica) or hylam sheet top cover and the unit rate of point wiring for flush type switch shall be deemed to include for the same. Cable for lighting and power circuit shall run separately.

Not more than 8 (eight) light points should run on one circuit and no more than two power points on one circuit. There shall be independent circuits for AC and Geyser points.

### 2.1.2 Point Wiring

Whenever asked for, if installation is to be carried out on point wiring basis, the supply of following shall be deemed to be included as part of the installation work.

- a) 650/1100V lighting wires for conduit wiring, minimum size of 1.5 sq.mm PVC insulated copper conductor.
- b) PVC medium grade/Steel conduit stove enamelled 16 gauge with all relevant accessories and junction/inspection boxes. Minimum size 25 mm for exposed/concealed conduits respectively.
- c) 650/1100V, PVC, copper conductor, armoured cables (when wiring without conduits).
- d) Ceiling rose or connector (in case of ceiling/exhaust fan points).
- e) Back plate (in case of suspended light fixtures).

Wiring of each lighting fitting/receptacle unit/ceiling fan/bell point/exhaust fan, etc. shall be considered as one point.

### 2.1.3 Concealed Conduit Wiring

For installations requiring concealed conduit wiring, the supply, routing and laying of PVC conduit medium grade of minimum size 25mm in walls/ceiling, from lighting panels upto fittings, receptacles, inspection/junction boxes etc. shall be in the Contractor's scope.

The Contractor shall closely co-ordinate his work with that of the Civil Contractor. The contractor shall prepare detailed shop drawing & submit for the approval of the Project Manager well before commencing the work. The shop drawings shall show setting out details for all components such as conduits and cable routes indicating the number and size of wires in each section of conduit.

The layout of conduits shall be such that any condensation or sweating inside the conduit is drained out. Suitable precaution shall be taken to prevent entry of insects inside the conduit. No cable or wire shall be installed until the inside of conduit has been cleaned.

Suitable junction/inspection boxes according to requirements shall be provided to permit periodical inspection and to facilitate replacement of wires, if necessary. The boxes shall be mounted flush with the wall or ceiling. Junction boxes with minimum 75 mm depth shall be used in roof slabs and depth of boxes in other places shall be as per IS:2667, 1977.

Pull boxes shall not be located in a conspicuous manner. Number and location of pull boxes shall be clearly indicated on shop drawings and shall be got approved by the Project Manager before commencing the work.

The chases in the wall shall be neatly made and with ample dimensions to permit the conduit to be fixed in the manner desired.

All the cuttings and chasings in the brick work/RCC Work/Block work shall be carried out using electrically operated Hilti or Fishcher make casing tool. Further all the drillings and cuttings in the RCC work shall be carried out using core-cutting machine. The rate shall include all these and no. separate rates towards the same shall be paid to the contractor.

Fixing of standard bends of elbows shall be avoided as far as practicable & all curves maintained by bending the conduit pipe itself with a long radius which will permit easy drawing in of conductors. All threaded joints of conduits pipes shall be treated with some approved 'preservative compound' to secure protection against rust. Open conduit ends shall be properly protected to prevent the ingress of dirt and rubbish.

Provisions shall be made at expansion joints, where they occur in the building structure, PVC pipe with coupling to be installed to prevent damage to structure/conduits and finishes. Continuity through all such joints shall be maintained.

All conduits shall be kept clear of other services, except where intentionally earthed or bonded. Conduits shall be fixed to prevent contact with same at the following minimum spacing:

- a) 150 mm away from hot water services
- b) 50 mm away from all other services.

#### **2.1.4 Conduit Capacity**

Maximum number of PVC insulated cables conforming to IS:694, 1977 that can be drawn in one conduit shall be as follows: -

Nominal Cross Sectional Area of Conductor in Sq.mm	SIZE OF CONDUIT											
	20 mm		25 mm		32 mm		38 mm		51 mm		64 mm	
	S	B	S	B	S	B	S	B	S	B	S	B
1.5	5	4	10	8	18	12	-	-	-	-	-	-
2.5	5	3	8	6	12	10	-	-	-	-	-	-
4	3	2	6	3	10	8	-	-	-	-	-	-
6	2	-	5	4	8	7	-	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	2	3	3	6	5	10	7	12	8
25	-	-	-	-	3	2	5	3	8	6	9	7
35	-	-	-	-	-	-	3	2	6	5	8	6
50	-	-	-	-	-	-	-	-	5	3	6	5
70	-	-	-	-	-	-	-	-	4	3	5	4

- Note: 1. The above table shows the maximum capacity of conduits for a simultaneous drawing of cables.
2. The columns headed 'S' applies to runs of conduit which have distance not exceeding 4.25m between draw in boxes & which do not deflect from the straight by an angle of more than 15°. The columns headed 'B' apply to runs of conduit which deflect from the straight by a angle of more than 15°.

### 2.1.5 Materials

The cable shall be of PVC insulated of approved make/ grade ISI marked. All materials for fittings / accessories, cable, etc., to be incorporated in this work shall strictly comply with latest appropriate Indian Standards/MES SSR-Part 1. If Indian standards have not been issued relevant current British Standards may be used. Aluminium link clips of width 6mm to 8mm shall be acceptable without any price adjustment.

The contractor shall produce sample within one month from the date of acceptance of all such articles of fittings that he proposes to use and get them approved in writing by the GE. The samples shall be displayed in the GE office and as directed by GE. The articles so approved shall be labeled as such and signed by both the contractor and GE. These approved samples shall be kept in custody by GE till the payment of final bill. The samples shall be fitted on a board as approved by the GE.

The rates for point wiring (power / light) in Bill of Material are with the provision of stranded copper conductor instead of "solid drawn" copper conductor specified in MES Schedule.

#### **2.1.6 Porcelain Connectors**

Porcelain connectors shall be provided inside the box for fan and utility fittings. The wiring shall be done in such a way that wires from connectors to the fan are not visible. In situations where ceiling rose is proposed for fan and tube light fittings, the porcelain connector need not be provided.

### **2.2 DISTRIBUTION BOARDS**

#### **2.2.1 Main Distribution Boards/Distribution Board (MDB/DB)**

Boards and panels shall be indoor type cold rolled and 2mm thick sheet steel enclosed and shall be fully dust and vermin proof, providing a degree of protection of IP:52.

All boards and panels shall be provided with all round neoprene gasketed hinged doors for access to equipment. Wall mounting, 3-phase main distribution boards shall be provided with MCBs and energy meters as specified in Schedule-A or as per drawing. A hinged, latched front door shall be provided with key-locking facility and a slotted bakelite sheet shall be provided inside. Only the MCBs operating knobs or the fuse cap covers shall project out of the bakelite sheet slots for safe operation and neat appearance.

All accessible live connections/metals shall be shrouded and it shall be possible to change individual fuses, switches, MCBs from the front of the boards/panels without danger of contact with live metal.

Adequate interior cabling space/cable alley and suitable removable cable entry plates shall be provided for top/bottom entry of cables through glands and or conduits. Necessary number of glands to suit the specified cable sizes shall be provided. Cable glands shall be screwed on type and made of brass.

Wherever required suitable terminal blocks shall be provided in the switchgear for terminating required sizes of cables.

Two earthing terminals shall be provided to connect the MDB with earthing conductor.

All sheet steel parts shall undergo rust-proofing process which should include degreasing, de-scaling and a recognised phosphating process. The steel works shall then be painted with two coats of Zinc-chromate primer and two coats of final stove-enameled finish paint of colour. For chemical/corrosive areas, epoxy paint shall be used.

### **2.2.2 Sub-distribution Boards (SDB)**

Sub-distribution boards shall not be mounted at a height exceeding 180 cm from finished level. The sub distribution board shall be double door as per approved makes

Sub distribution boards shall be double door made out of 1.6mm thick CRCA sheet steel, ready for installation at site. The DB shall be properly phosphatised and with powder coated finish incorporating accessories such as din channel, tinned copper bus bar, earthing studs alongwith detachable plate bearing knock out at top and in built space for loose wires of suitable size. All incoming and outgoing wiring to be prewired MCB DB shall be terminated only in the terminal blocks made of flame retardant polyimide material to be provided for phase, neutral and earth (ground) connections. Wiring should be done with FRLS PVC insulated stranded copper conductor cable of suitable size duly fitted with copper lugs / thimbles DB alongwith all fitment shall be as per IS-8623.

Terminal blocks should be suitable for termination of conductor/cable of required size but minimum rated cross section of the Terminal Blocks should be 6 sqmm.

Terminal connectors from the DB without loosening the internal cable connections of phases & neutral circuits and shall have peelable poly layer on the cover for protection from cement, plaster, paints etc. during the construction period.

### **2.3 MINIATURE CIRCUIT BREAKERS (MCB)**

All MCBs B & C series shall be as per IS-8828 having rupturing capacity of 10 KA.

MCBs shall be hand operated, air break, quick make, quick break type conforming to applicable standards.

All wiring connections required to be made with MCBs and insulators shall be carried out by providing necessary thimbles / lugs duly crimped.

MCBs shall have silver inlay moving contact for better conductivity.

MCB shall have arrangement of air cooling when mounted together.

### **2.4 LED LIGHT FITTINGS**

#### **STANDARDS**

The equipment and accessories covered in this Specification shall be designed, manufactured and tested in accordance with the latest standards and codes of practice published by the Bureau of Indian Standards (BIS) wherever available, in order that specific aspects under Indian conditions are taken care of.

In case where Indian Standards and codes of practice are not available, the equipment and accessories shall conform to the latest standards and codes of practice published by any other recognized National Standards Institutions or latest Publications of International Electro Technical Commission (IEC).

All electrical equipment shall also conform to the requirement specified in relevant Inter Plant Steel Standard (IPSS) wherever available.

The installation, testing and commissioning of various electrical, electronics and field equipment covered by this specification shall conform to the Indian Electricity Rules as regards safety, earthing and other essential provisions specified therein for installation and operation of plants as well as latest amendment of the Bureau of Indian Standards.

#### CONSTRUCTION:

CRCA Powder Coated, extruded aluminum and Single Piece pressure die cast aluminum (sand/gravity casting not to be considered). Aluminum grade LM 6063 or LM 6 as applicable or above high conductivity heat sink material shall be used or housing of luminaire.

SMD Technology based LED Luminaires shall be used to ensure suitable system output and power consumption.

Its highly recommended that the control gear should be of same luminaire manufacturer & shall be designed in such a way that the all critical electronic components temperature rise is restricted to 35 to 45 Deg. C above ambient temperature.

Control gear and LED shall have two separate physical compartments and shall have separate heat sink so that the heat from either should not add to other.

The luminaries shall be such that the glare from individual LED is restricted and shall not cause inconvenience to the user.

The fixture should be impact resistant with suitable protection by cover for driver and LED's based on application need.

The fixture should have designed suitable ingress protection as per application requirements.

#### HIGH POWER AND HIGH LUMEN EFFICIENT LED'S SUITABLE FOR FOLLOWING FEATURES SHALL BE USED:

LED Chips of Nichia /Philips Lumileds /LG /CREE shall be used. The manufacture shall submit the proof of procurement of LEDs from above OEMs at the time of supply along with letter of association for minimum three year.

The working life of the LED fixture at ambient temperature from 35Deg C to 45deg C shall be more than or equal to 50,000 burning hours of accumulative operation and shall be suitable for continuous operation of 12 hours per day these shall be supported with the suitable section of the LM80 report in relation to TM21 standard from the manufacturer of LED.

Color temperature of the proposed white color LED shall be 4000K / 5700K / 6500K ANSI Rated Bin only.

LEDs used in the products shall be tested for photo biological safety as per IEC / EN62471 and the test report from OEM shall be attached for this.



The output of LED shall be more than 110 lumen (+/-5%) per watt at maximum rated operating current.

The color rendering index (CRI) shall be of-nominal 70 (or more) for R1 to R15 colour shades as per CRI standard.

Variation in illumination level shall be + - 2% is allowed in input voltage range from 140VAC to 270VAC

The illumination shall not have infra-red and ultra-violet emission. The test certificate from the in house laboratory or OEM shall be submitted.

Electronic efficiency of LED driver circuit shall be more than 85%

#### ELECTICAL/TECHNICAL SPECIFICATIONS

Supply of LED luminaries complete with housing and adhering to the following specifications and lighting design requirements will be as per the actual application:

LED Driver shall be made up of IC with APFC Circuit having Multi Stage Isolated topology with Constant Current Driving stage.

The driver card shall cut off at 270 V and shall resume normal working when nominal voltage is applied again. This is to ensure protection of luminaries from neutral faults and error in connection at sites.

Efficiency of driver electronics shall be more than 85%

The LEDs should be driven at the suitable current and within the permissible limits specified by the LED chip/lamp manufacturer.

The luminaries should be operable with auto adjustable 140-270V +/-5% supply Voltage using the same driver.

Power Factor of the electronic driver should be at least > 0.90 with THD <20%.

LED Driver shall be made in India for easy availability and service.

**CONFORMANCE STANDARDS:** Product Certification should be obtained from UL lab. The following test reports should be provided:

NABL accredited Lab-LM-79	Luminaries efficiency (photometry data) for any one wattage shall be submitted from the same product family
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\* LED Chip manufacturer / Luminaire data will be required for this certification

LM-80*	Measuring LED Lumen Maintenance
EN62471	Photo biological Safety for Humans
LUMINAIRE TYPE TEST	As per Applicable standards- IS10322(Part5/Sec1):2012 & IED60598-2-1
	Certificate of Association from LED Manufacturer
IP 65	Luminaries Ingress Protection for Outdoor Luminaires

Manufacturer shall have their own testing / R&D lab.

### **2.4.1 Ceiling Fans**

Ceiling fans shall be suitable for operating on 240V, 1 phase, 50 Hz supply and shall be complete with standard mounting accessories such as suspension rods, top and bottom caps etc. The fans shall be of approved shade. The ceiling fans shall conform to relevant Indian standards.

### **2.4.2 Exhaust Fans**

The exhaust fans shall be suitable for operating on 240V, 1 phase, 50 Hz supply and shall be complete with standard mounting accessories including louvers. The exhaust fans shall also be of approved shade and make.

### **2.4.3 Lighting Wires**

The wires for wiring in lighting system shall be 650/1100V, PVC insulated, unarmoured with stranded copper conductors, unless otherwise specified. The wires shall conform to IS:694 and ISI marked.

The minimum area of conductors shall be 1.5 sq.mm for light fittings and 5A receptacles and 4.0 sq.mm for receptacles rated 15A and above.

The wires shall be coated red, yellow, blue for R, Y, B phase and black for neutral.

Unless otherwise specified, lighting cables shall be of 650/1100V grade, 3, 3½ and 4C, PVC insulated and armoured type for main distribution boards.

### **2.4.4 Ceiling Roses**

Ceiling rose shall be of bakelite and shall comply with IS-371 specification for ceiling roses having two or three terminal plates and of out side diameter not less than 63.5mm. The flexible cord shall be fixed to ceiling rose in such a way that no weight is carried by the clamping screws. The flexible cord shall be of 23/.076 dia cord with copper conductor.

### **2.4.5 Cast Iron / Mild Steel Boxes / GI Box (Modular)**

The boxes having various fittings such as switches, sockets, fan regulators, etc, shall be of cast iron / MS / GI Box of required size and flush mounting type (Refer clause 6.52 of IS-782). Average thickness of cast iron boxes should not be less than 2.5mm and that of GI / MS boxes not less than 1.6mm thick. The cast iron GI / MS boxes shall be embedded in the wall and need not be fixed to wooden plugs. The contractor may at his discretion provide galvanized screws without any adjustment.

## **2.5 EARTHING**

Refer clause 19.137 to 19.145 on pages 19-481 to 19-483 of MES Bill of Material Part I.

The contractor shall execute installation of earth plate in the presence of GE. Charcoal dust, salt and return filling shall be done in layers not exceeding 25 cm depth, properly watered and rammed. Surplus soil shall be carried away to distance exceeding 50 m and the site left clean and tidy.

Portion of earth wire between earth plate to main control panel shall be enclosed in 15mm bore galvanized pipe, light grade. The rate against respective item of earthing of Bill of Material Section III shall be deemed to include the cost of the aforesaid pipe.

Extension of earthing shall be provided as required by the GE and shall consist of galvanized iron 8 SWG wire.

Pipes carrying gas/water etc. shall not be used as means of earthing on installation.

The distance between two earth electrode / earthing shall be as per IS.

The distance between Building wall & Earthing pits shall not be less than 1.55 metre.

## **2.6 ELECTRICAL TESTS**

The following tests as specified in IS-732, code of practice for electric wiring and fittings in building shall be complied with before the complete installation is taken over. The contractor shall carry out the tests in the presence of GE and results recorded in triplicate on form IAFW-404. Electrical wiring test sheet shall be signed both by the contractor's representative and the GE. All testing equipment shall be arranged by contractor without any extra cost of the department.

Insulation resistance shall be measured by 500 volts meggar. The insulation resistance in mega ohm of the installation shall not be less than 50 divided by the number of points on the circuit and the resistance of the whole installation shall not exceed one ohm and resistance including earth mass as 5 ohms.

### **2.6.1 Testing Polarity of Switches**

A test shall be made to verify that all non-linked single pole switches have been fitted in the same conductor throughout and that such conductor has been connected to another or phase conductor or to the non-earthed conductor of the supply.

## **2.7 TERMINAL BOXES**

In surface type wiring and concealed conduit wiring the terminal point for power / light sockets, outlets, switching, etc., shall terminate in recessed cast iron or galvanized mild steel boxes fitted flush with wall surface. The cover of boxes for surface type wiring shall be of Hylam Sheet 3mm thick. Rates for point wiring shall be deemed to be included for the above provision. All such terminal boxes shall be properly earthed and connected to earth dolly.

**2.8 RECORD DRAWINGS AND WIRING TEST SHEET**

On completion of work, wiring diagrams and wiring test sheet duly authenticated shall be prepared and submitted to the GE in triplicate. Wiring diagrams shall indicate clearly the main switch board the runs of various sub-mains and the positions of all points shall be given in the same number as the circuit to which they are electrically connected.

**2.9 MODULAR TYPE SWITCHES / SOCKETS**

Modular type switches and modular type sockets shall be ISI marked and shall be as approved by the GE.

**2.10 LAMINATED SHEET COVER**

Laminated sheet cover shall conform to relevant IS and shall be of 3mm thick and of any of the following:

- a) Hylem
- b) Formica

**3.0 EXTERNAL ELECTRIFICATION**

The work under this contract shall be carried out in accordance with particular specifications, bill of materials and drawings forming part of this contract and the general specifications in the MES Schedule of Rates.

General rules, specifications, special conditions and all preambles in the MES Schedule of Rates shall be deemed to apply to the work under this contract unless otherwise mentioned in the tender document in which case the provisions in the tender document shall be taken precedence over the aforesaid provisions in the MES Schedule.

The Contractor shall visit site before quoting the rates and ascertain where main road/highways are to be crossed for laying HT (11 kV) cables and arrange permission from concerned civil authorities. The contractor shall deposit requisite money as demanded by civil authorities for permission etc. No extra cost is admissible to the contractor for obtaining permission from civil authorities and making good the road as per their specifications.

It shall be the responsibility of the contractor to obtain necessary approvals and clearances from authorities as directed by the Accepting Officer for the total electrical installation including cost of liaisoning, all accessories and all other items consumed required during testing and commissioning.

**3.1 Scope of Work**

The work under this section includes for full, final and entire completion of items of works described in Bill of Material, as specified in particular specifications and as shown on drawings.

**3.2 Layout**

The layout of equipment and cable routes shown on drawings is tentative and the final layouts shall be as approved by the GE in writing before the contractor takes the work in hand for execution. The length of cable may be increased / decreased to suit the site requirements. The contractors shall verify lengths of the cable, etc., actually required at site before purchasing the same.

**3.3 Samples of Material**

The contractor shall produce the samples of all the materials and obtain approval in writing from the GE before he places bulk orders for the materials for incorporation in the work. In respect of materials for which samples are not kept or detailed specifications are not given hereinafter the materials shall comply with relevant IS specifications. The contractor shall supply general Specifications, Test certificates from the manufacturers whose equipment are proposed to be incorporated in the work under this contract. However, prior approval from GE shall be taken before finalizing the make.

**3.4 Excavation and Earth Work**

Excavation for cable trenches shall be carried out as per the layout and the depth as directed by the GE. The minimum depth and width of the excavation shall be as specified in SSR 1991 (Part I) for LT/HT Cables. Excavation and earthwork shall be calculated, measured and paid for as specified in MES Standard Schedule of Rates. In case of any dispute with regard to the classification of various strata the decision of the GE shall be final and binding.

**3.5 Surplus Soil**

All surplus spoils of excavation shall be disposed off by the contractor at places as directed by the GE and spread and levelled.

**3.6 Making Good Damage**

Any damage during execution of the work to the MES property shall be made good by the contractor without any extra cost to the Government.

**3.7 Make / Manufacture of The Equipment Materials**

The equipment / materials shall be of various makes and manufacturers as stipulated in bill of material and particular specifications of this contract. In

case of equipment and material where make of manufacturer is not mentioned, the order of acceptance shall be as under:

- i) Materials bearing ISI markings.
- ii) In the absence of i) above, materials conforming to IS.
- iii) In the absence of i) & ii) above, the materials shall conform to QR superior in quality to the samples referred to in tender and /or shall comply with the specifications given hereinafter.

### **3.8 Standard of Quality and Workmanship**

The installation shall strictly comply with the provisions in the latest edition of Indian Electricity Act and Rules framed there under (as amended upto date) as applicable to the works in Bill of Material except where such regulations and rules are modified by these specifications, all works shall be carried out by properly skilled licensed electricians under the supervision of qualified supervisor. The entire work shall be of highest standard with approved materials and to the entire satisfaction of the GE.

### **3.9 Testing**

All electrical works shall be tested by the contractor in the presence of and to the entire satisfaction of the GE in accordance with SSR and Indian Electricity Rules. Any equipment, materials, etc., found unsatisfactory / not complying with the specifications shall be rectified / replaced by the contractor at his own cost. Notwithstanding the tests carried out at the time of commissioning the equipment / installations, the contractor shall be responsible for rectifying defects, replacing equipment during the defects liability period as laid down in General Conditions of Contracts. All expenses with regard to carrying out inspection and testing of all equipment at place of manufacture shall be borne by the contractor which shall include visits, lodging and boarding and other miscellaneous charges of GE or his authorized representative.

### **3.10 Production of Purchase Vouchers**

The contractor shall be required to purchase the articles required to be used in the work directly from the manufacturer to ensure their genuineness. He shall submit the original purchase vouchers, manufacturers guarantee certificates, excise duty, gate pass and test certificates to the GE for his verifications before claiming his payment. However, where the manufacturer do not have the system / policy of sales directly by them and deal their sales through dealers network only, the contractor may purchase the materials / articles from the authorized dealers of the company, who are required to show the cash memo/bills showing all the taxes, etc. Two copies of CTC of the same shall be made by the GE for reference and record. The original purchase vouchers shall be released to the contractor after defacing the same as having verified with respect to this contract.

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## **4.0 L.T. PANELS**

### **4.1 Scope**

The Scope of this section comprises Design, Fabrication, Supply, Installation, Testing and Commissioning of Low Tension electrical panels.

### **4.2 General**

Electrical Panels shall be provided and installed as specified. Switch gear, rating and quantities are as specified in BOQ.

The electrical panels shall be fully compartmentalized with separate cable alleys, totally enclosed, metal clad, flush front and back, cubicle pattern suitable for front access. The electrical panels shall generally conform to IS: 8623.

Drawing indicating the general arrangement of components & control wiring of LT panels shall be got approved from Engineer in charge before commencement of fabrication.

### **4.3 Construction**

Electrical Panels shall be of dust and vermin proof construction with a minimum classification of IP:52, suitable for indoor installation and air insulated.

All doors and covers shall have neoprene gaskets. Adequate protection shall be provided so that ingress of dust and moisture encountered in indoor installation shall not in any amount be sufficient to interfere with the satisfactory operation of enclosed equipment.

Electrical panels shall be free standing type or wall mounted type as specified. The basic structure being fabricated out of minimum 2.0 mm sheet steel reinforcing frame welded in place. All the doors shall be of 2.0 mm thick steel. The panel shall be fabricated over a 100 mm high MS channel or folded sheet frame.

All partitions shall be of 1.6 mm thick sheet steel. Door knob shall be provided with cir-clip. The panel shall be provided with drawing pocket and lifting hooks etc.

The switch gear shall comprise a continuous line up of single/multi tier cubicles. The installation of air circuit breaker shall be limited to the bottom two tiers only. The design shall be of fully compartmentalized execution with metal partitions. Each switch gear or breaker shall be housed in an individual front access door.

The enclosure of electrical panels shall be rigid and strong. Electrical panels shall have a bus bar chamber and required number of feeder compartments in vertical section. The operating handle of the panel board shall be at a

height not more than 1.7 mts from the finished floor level. All the cables entry of panel board shall be preferably from the top.

Suitable screw and rawl device shall be provided on each compartment door for locking the doors in position on the side of each vertical feeder / control compartment section. The compartment door shall be interlocked mechanically with the switch such that the door cannot be opened unless the switch is in OFF position. Means shall be provided to release the interlock at any time. All vertical cable alleys shall be provided with separate doors. Cable Alley doors shall be hinged type. Suitable cable clamping arrangement with slotted angle shall be provided in the cable allies.

Main incoming indication lamps, control switches and metering instruments shall be flush mounted on a separate cubicle/compartment.

Removable cable gland plates shall be provided with suitable gasket. The plate thickness shall be a minimum of 3mm.

#### **4.4 Bus Bar**

All bus bars shall be suitable for 415 volts, 3 phase, 4 wire, 50 Hz, AC supply. Main and vertical bus bars shall be made of high conductivity aluminium or copper as specified in BOQ. The bus bars shall be of sufficient cross section so that a current density of 100 amp/Sq. cm is not exceeded for aluminium. The cross sectional area of neutral bus bar shall be the same as that of phase conductor up to 200 amps capacity and for the capacity beyond 200 amps the neutral bus bars shall not be less than 50% of the phase bus bars. However, the cross section of the bus bars shall not be less than the sizes indicated in BOQ.

Bus bars shall be supported from top as well as bottom at regular interval. Bus bars shall be supported with suitable insulating materials such as SMC/DMC. The insulating supports shall be of single piece.

All the bus bars shall be adequately sleeved with heat shrinkable sleeves and shrouded and insulated from unit compartments and wire ways. Special care shall be taken in the design of bus bars with regard to safety aspects including provision of busbar guards to prevent accidental contact.

All buses and connections shall be supported and braced to withstand the stresses due to maximum short circuit current and also to take care of any internal expansion.

Bus bars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear when viewed from the front of switch gear assembly.

#### **4.5 LT Panel Components**



Unless otherwise specified, the specifications for LT Panel components shall be as follows. Bill of quantities/ Schedule of quantities may be referred.

#### **4.6 Moulded Case Circuit Breaker (MCCB)**

MCCBs shall be current limiting type with trip time of not exceeding 10 msec under short circuit conditions. The MCCBs shall be 4 pole fixed type with microprocessor based release as per BOQ.

The MCCBs shall comply with the requirements of IEC 60947-2/IS13947 -part 2.

MCCB shall have utilization category A.

The normal current rating and short circuit braking capacity of MCCBs shall be as specified in BOQ / SOQ. The MCCBs shall have  $I_{cs} = I_{cu}$  for Short circuit breaking capacity specified.

MCCB shall have spreader links as standard feature.

Fixing of internal accessories shall be site fittable and user friendly.

All MCCBs shall be fitted with the Rotary operating mechanism (ROM). The ROM shall be of robust design. MCCB mounted with a minimum number of linkages to ensure maximum reliability. All rotary mechanism shall be with door interlock (with defeat feature) & padlock facility.

All protection releases for MCCBs shall be shrouded to avoid unauthorized tampering.

All protection releases shall have.

- In built thermal memory.
- In built true RMS sensing.
- Sensitive to heating effects of harmonics and improper termination.

MCCB shall be suitable for both Copper and Aluminium termination.

The circuit breaker shall be provided with spring assisted quick-make, quick-break type manually operated trip free mechanism, mechanical ON/OFF/TRIP position indicators.

The thermal and short circuit tripping device shall be adjustable type.

#### **4.7 Terminal Blocks**

Terminal blocks used in prewired DBs/panels shall be of polyamide insulating material as per IEC/IS meeting V0/V2 inflammability class. All metal parts shall be of copper alloy and shall be suitable to mount on DIN/rail as per requirement

for item in schedule/BOQs. The terminal block shall withstand vibrations/arcng effect and shall be shock proof.

Terminals for circuits with voltage exceeding 125 V shall be shrouded. Terminal blocks shall be grouped depending on circuit voltage. Different voltage groups of terminal blocks shall be segregated.

Terminal blocks shall be adequately rated to carry the current of the associated circuit. Minimum rating of the terminal block is 10A.

Terminals shall be numbered for identification. Engraved white-on-black labels shall be provided on the terminal blocks, describing the function of the circuit.

Where duplication of a terminal block is necessary it shall be achieved by solid bonding links.

Terminal blocks for CT secondary lead wires shall be provided with shorting and disconnecting/earthing facilities.

Terminal blocks shall be arranged with at least 100mm clearance between two sets of terminal blocks.

Control terminals for external connections shall be suitable for terminating at least two conductors each of 2.5 sq mm size.

#### **4.8 Inter connections**

Inter connection between bus bars and outgoing MCCB/Switches shall be as below:

- a) For MCCB/Switches of capacity up to 63 Amps—PVC insulated cables/wires of suitable size with suitable socket/thimbles etc.
- b) For MCCB/Switches of capacity above 100 Amps—Solid aluminum/copper strips of suitable size insulated with PVC sleeve of heat shrinkable type.

All connections shall be made in such way that there is a clear metal-to-metal contact at the tapping so that current density of the bus bars at the point of contact does not exceed the permissible limit.

#### **4.9 Instruments and Meters**

Indicating and measuring instruments/meters shall be provided as specified in BOQ.

#### **4.10 Indicating Lamps and Push Button**

Indicating lamps and push buttons shall be provided as specified in BOQ.

**4.11 Space Heaters**

One number space heater controlled through a switch-fuse/MCB and thermostat in each vertical section shall be provided.

240V AC, 5A, 3-Pin, plug socket connected through a switch and a fuse in each shipping unit shall be provided.

**4.12 Unit Compartments**

Unit compartments shall be of adequate dimension to house the switchgear and other feeder equipment and for easy maintenance. Each feeder compartment shall have a hinged door. The door shall have neoprene gasket. The unit compartment size for ACB also MCCB shall be standardized.

**4.13 Feeder / Control Equipment**

Control gear feeder and other control equipment shall be provided as per the Single Line Diagrams and schedule of quantities. All the components shall meet the relevant IS specification with up to date amendments.

**4.14 Wiring**

All control and auxiliary wiring shall be provided with copper conductor, PVC insulated wires. Wiring shall be properly colour coded, tag numbered (ferruled) and laid out neatly in bunches and firmly fastened to the sides in the trolley. The terminations for conductors shall be done by crimping lugs on to the conductor ends.

The wiring shall be colour coded using red, yellow, blue and black for 3 phases and neutral respectively. The lugs shall be fastened to the equipment using suitable washers and screws.

All the wiring shall be neatly bunched and fastened to the sides of the trolley.

**4.15 Sheet Metal Surface Treatment**

Sheet metal frame work, components and accessories of Electrical Panels shall be given a rigorous sheet metal treatment with a seven tank chemical process. The sheet metal shall then be painted with grey enamel paint or powder coated as specified.

Electrical panels shall be fabricated by an agency having seven-tank sheet treatment facility.

**4.16 Type Test**

The fabricating agency shall have CPRI approval for similar panels for short circuit capacity not less than the highest KA fault level rating of switchgear connected.

The agency shall have CPRI test certificate for similar panel for the requirement of IP protection.

#### **4.17 Acceptance Test**

Acceptance tests on completed switchboards shall be as follows:

- a) A general visual check shall be carried out. This shall cover measurement of overall dimension, location, number and type of devices, terminal boxes, location and connection of terminals etc.
- b) Checking of bill of materials as per approved drawing.
- c) Checking of operation of various feeders as per approved schematic drawings.
- d) Operation check shall be carried out for every control function as per schematic drawings by manually simulating fault conditions and operation of control switches/relays etc.
- e) Checking of interchangeability of identical feeders.
- f) Insulation resistance test and value measurement on power and control circuits before and after high voltage withstand test.
- g) High voltage test on power and control circuit as per IS 8623.
- h) For equipment bought from other suppliers, certified test reports of tests carried out at the manufacturers works shall be submitted. Normally all routine tests as specified in the relevant standards shall be conducted by the sub supplier at its works and copies of routine test reports shall be furnished.

#### **4.18 Panel Accessories**

All accessories shall be provided as specified in BOQ

#### **4.19 Name Plate**

Electrical panels as well as their individual compartments shall be provided with plastic black anodized nameplates with white letter on black background. The nameplate shall be held with self-tapping screws. The size of the plate shall be minimum of 20x75 mm for cubicles and 40x150 mm for panels.

#### **4.20 Danger Plate**

Standard danger notice plate indicating the voltage grade shall be provided on each of the Electrical Panels

**4.21 Test/Certificate**

The panels shall be tested after fabrication, assembling and wiring at the Factory.

1. Wiring test shall be carried with 1000-volt megger to ensure adequate insulation resistance. (At manufacturer's works)
2. H.T. test shall be carried out as per IS at manufacturer's works.
3. Functional tests of all components.
4. Dimensional checks & Visual examination.
5. Primary/secondary current injection test for relays if protection relays are supplied as part of BOQ

**4.22 Installation, testing and commissioning**

Electrical panels shall be installed at the locations shown in the drawings. All electrical panels shall be provided with an integral base channel / wall frame for grouting the electrical panels to the floor/ wall as required. The electrical panels shall be grouted with required number of anchor bolts, supplied along with.

The required cables shall be brought and terminated at the electrical panels using cable glands, cable bracket, lugs and sockets as per BOQ. All the cables shall be properly arranged and dressed up in the cable alley. The various power and control cables shall be clamped firmly.

The tightness of all main and auxiliary bus bar connections shall be checked. All wiring terminations and bus bar joints shall be tightened wherever necessary before energizing the electrical panels. The commissioning checks shall include functional checks of all components installed in the panel including interlocks if provided, insulation check with 500 V Megger (not less than 100 mega ohms) etc shall be carried out before the panel board is energized.

**4.23 Quality of Cables**

Each cable length shall have relevant ISI certification mark as stipulated by Bureau of Indian Standards.

**4.24 Laying of Cables Supported from Building and Technological Structures, Walls, and Ceiling etc.**

For laying cables along building steel structures and technological structures the cable shall be taken by clamping with MS saddles screwed to the MS flats welded to the structure. MS saddles and flats are to be galvanised after fabrication.

For laying cables along concrete walls, ceilings etc. the cables shall be taken by clamping with MS saddles screwed to the MS flat welded on to the inserts.

Where inserts are not available the saddles shall be directly fixed in the walls using metallic anchor fasteners and MS flat spacers of minimum 6 mm thick.

The MS saddles shall be placed at an interval of not less than 500 mm both for horizontal and vertical runs. However, at the bends it shall be placed within 300 mm and where terminating to the equipment/junction box the cable shall be clamped immediately before such termination. In the area prevailing with corrosive atmosphere, PVC saddles instead of MS saddles shall be provided.

#### **4.24.1 Laying of Cables in Exposed/Embedded /GI Pipes/ HDPE Pipes /Conduit**

GI pipe/conduit for drawing cables in plant buildings shall be of medium class, hot dip galvanised, electric resistance welded, screwed type conforming to IS: 1239 (Part-I). GI pipes of the following sizes shall be used:

##### **GI Pipes**

- a) 20 mm nominal bore
- b) 25 mm nominal bore
- c) 40 mm nominal bore
- d) 50 mm nominal bore
- e) 65 mm nominal bore
- f) 80 mm nominal bore
- g) 100 mm nominal bore

##### **HDPE Pipes**

High density polyethylene pipe (HDPE) for drawing cables in plant, rooms, buildings and roads shall have ability to withstand heavy external loads, light weight, high ring stiffness, better impact strength, superior crush and electric resistance conforming to IS:14930 (Part II). HDPE pipes of the following sizes shall be used:

- a) 90 mm nominal outer dia
- b) 120 mm nominal outer dia
- c) 180 mm nominal outer dia
- d) 200 mm nominal outer dia

GI pipes/conduit less than 20 mm dia shall not be used both in exposed and embedded condition.

For installation of cables in GI pipe/HDPE pipe/conduit. Complete system shall be installed first without cables but having suitable pull wires laid in the pipes to facilitate cable pulling.

GI pipe/ HDPE pipe/conduit system shall be continuous, both mechanically and electrically and shall be connected to all boxes and fittings.

Where there is possibility of technical damage cable rack/trays shall be adequately protected by sheet steel covers.

For future installation of cables, provision shall be made to keep 20 per cent space as spare on each tray/rack/bracket.

Cable trays/racks shall be so arranged that they do not obstruct or impair clearances of passageway. Particular attention shall be given to this aspect while trays/racks cross in the cable tunnels and cable cellars where minimum clearance of 1800 mm shall be kept.

No joint shall normally be made at any intermediate point in through runs of cables unless the length of the run is more than the length of the standard drum supplied by the cable manufacturers. In such cases when jointing is unavoidable, the same shall be made by means of approved cable joint boxes/kits without any extra cost.

All cable entry opening in the equipment shall be sealed against entry of creeping reptiles.

#### **4.24.2 Trenching**

The minimum width of trench for laying cable shall be 350 mm.

Where more than one cable is to be laid in the same trench in horizontal formation, the width of trench shall be increased such that the inter-axial spacing between the cables, except where otherwise specified shall be at least 200mm.

There shall be a clearance of at least 15 cm between axis of the end cables and the sides of the trench.

Where gradients and changes in depth are unavoidable, these shall be gradual.

The bottom of the trench shall be level and free from stone, brickbats etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 80mm. The cable shall be laid at a depth of not less than 750 mm.

##### **a) Bending Radius**

The minimum safe bending radius for all types of PVC cables shall be taken as 12 times the overall diameter of the cable. Wherever practicable, larger radius shall be adopted. At joints and terminations, the bending radius of individual cores of a multi core cable shall not be less than 15 times its overall diameter.

##### **b) Separation**

Cables of different voltages and also power and control cables shall be kept in different trenches/on racks with adequate separation. Where

available space is restricted LV/MV cable shall be laid above HV cables.

Where cables cross one another, the cable of higher voltage shall be laid at a lower level than the cable of lower voltage.

Power and communication cables shall as far as possible cross at right angles, where power cables are laid in proximity to communication cables the horizontal and vertical clearances shall not normally be less than 60cm.

c) **Laying**

Cables shall be laid direct in ground in pipes/closed duct or on racks as per requirements.

For short runs and sizes upto 50 Sq. mm of cables upto 1.1 KV grade, any other suitable method of direct handling and laying can be adopted with the prior approval of the Engineer-in-Charge.

Cables laid in trenches in a single tier formation shall have a covering of clean, dry sand of not less than 170 mm above the base cushion of sand before the protective cover is laid.

d) **Sand Cushion**

In the case of vertical multi-tier formation after the first cable has been laid, a sand cushion of 300mm shall be provided over the initial bed before second tier is laid. If additional tiers are formed, each of the subsequent tiers also shall have a sand cushion of 300 mm as stated above. The top most cable shall have final sand covering not less 170 mm before the protective.

e) **Brick Protection**

Unless otherwise specified, the cables shall be protected by second class bricks of not less than 200 x 100 x 100 mm (nominal size) as per building specification or protection covers placed on top of the sand (bricks to be laid breadth wise) for the full length of the cable. Where more than one cable is to be laid in the same trench, this protective covering shall cover all the cables and project at least 50 mm over the sides of end cables.

The trenches shall be then backfilled with excavated earth free from stone or other debris and shall be rammed watered if necessary, in successive layers not exceeding 300mm, unless otherwise specified, a crown of earth shall be formed to allow for subsidence.

Where road turns, or lawns are cut or kerbstone displaced, these shall be made good, and all excess earth removed from site.



**f) Pipe Ducts**

For road crossings entry into buildings and paved areas cables shall be either drawn in ducts or in pipes of CI, GI, HDPE or reinforced cement concrete. Pipe shall be of a least 100 mm dia for a single cable and 150 mm diameter for more than one cable depending on the diameter. Top of pipe shall be not less than 750 mm from the top surface unless otherwise required. All pipes shall be provided with a fish wire.

Pipe ducts not used shall be plugged or both sides with lean cement mortar. Where cables have been drawn the ends shall be plugged with bituminised Hessian tape once the cables for water proofing.

**4.24.3 Laying of Cables Directly Buried in Ground**

Power and control cables laid directly buried in ground shall be laid generally conforming to the requirements of code of practice IS: 1255 in so far as it is applicable. Generally, cables shall be taken at a depth of 500mm from finished ground level and shall be provided at least 75 mm sand cushioning both at top and bottom and precast reinforced concrete protective covers.

For 1, 100 V grade power cables the horizontal axial spacing shall be 150 mm. Control cables shall be laid touching each other without any horizontal spacing. However, the distance of the control cable from the nearest power cables shall be 150 mm. Power and control cables may be laid in a common trench, but laid separately in groups. Generally, cables shall be laid in one layer. In general communication cables shall not be taken in a common trench. In case the same is required to be taken along with power cables, the minimum axial spacing between two cables shall be 350mm where a brick separator shall be provided between the two cables and without brick separation the spacing shall be 500 mm.

Precast concrete protective cover shall be placed centrally along the cables. The concrete slab shall be of RCC type as per appendix C of IS: 1255 of length having suitable provision for dovetailing with the adjacent slab. The length of the slab shall be 750 mm; the width however shall vary depending on the number of cables in the trench as well as axial spacing. The minimum width of slab shall not be less than 200mm.

After laying of cables the trench shall be back filled with good excavated soil and well rammed in successive layers not less than 300mm depth. The excavation of trenches shall be done with vertical sides and trenches shall be kept as straight as possible. The width of trench shall be in accordance with the number of cables to be laid out. In no case it shall be less than 400mm. The minimum clearance between trench edge and cable shall not be less than 100mm. along the route of the cable. Cable markers shall be installed at an interval of every 15 meters.

At the turning and tee-off point of the cable trench suitably chamfering shall be made keeping in view of the minimum radius of the bend.

Where cables are required to cross roads, railway tracks and surface drains they shall be taken through reinforced concrete spun pipes at a minimum depth of 750 mm.

For crossing water, oil, gas or sewage pipes etc. Cables shall be taken above the pipes where minimum 500 mm clearance is available from top of pipes. Where 500 mm clearance is not available the cables shall cross these pipes through RC pipes at a minimum depth of 750 mm from finished ground level keeping the distance between the utility pipes; and pipe carrying cables 250 minimum.

In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made in case the cable develops fault at a later date. Also when group of cables are laid together the cable length shall be adjusted to stagger the straight through joints.

#### **4.24.4 Cable Termination and Jointing**

Termination and jointing of aluminium conductor power cables shall be by means of compression method using compression type aluminium lugs. Copper conductor control cables shall be terminated directly into screwed type terminals provided in the equipment. Wherever control cables are to be terminated by means of terminal lugs, the same shall be of tinned copper compression type.

#### **4.24.5 Cable Tags**

Cable tags shall be out of 2 mm thick aluminium sheets, each tag 1½" in dia with one hole of 2.5mm dia, 6mm below the periphery. Cable designations are to be punched with letter/number punches and the tags are to be tied to cables with piano wires of approved quality and size. Tags shall be tied inside the panels beyond the glanding as well as below the glands at cable entries. Along trays tags are to be tied at all bends. On straight lengths, tags shall be provided at every 5 meters.

## **18.0 EARTHING**

### **18.1 Scope**

This chapter covers the essential requirements of earthing system components and their installation. For details not covered in these specifications, IS Code of Practice on Earthing (IS: 3043-1987) shall be referred to.

### **18.2 Application**

The electrical distribution system is with earthed neutral (i.e. neutral earthed at the Transformer / Generator). In addition to the neutral earthing, provision is made for earthing the metallic body of equipment and non-current carrying

metallic components in the sub-station, as well as in the internal/external electrical installations.

Earthing system is also required for lightning protection, computer installations etc. for functional reasons.

Earthing requirements are laid down in Indian Electricity Rules, 1956, as amended from time to time, and in the Regulations of the Electricity Supply Authority concerned. These shall be complied with.

### **18.3 Materials**

The material of Earth electrode and earth conductor shall be as specified in BOQ

### **18.4 Earth Electrodes**

The type of earth electrode shall be any of the following.

Plate/Pipe earth electrode as specified in BOQ.

Electrode materials and dimensions

The materials and minimum sizes of earth electrodes shall be as specified.

### **18.5 Earthing Conductor**

The earthing conductor (protective conductor from earth electrode up to the main earthing terminal/earth bus, as the case may be) shall be of the same material as the electrode, viz. GI or copper and in the form of wire or strip as specified. The size of earthing conductor shall be as specified.

### **18.6 Hardware Items**

All hardware items used for connecting the earthing conductor with the electrode shall be of GI in the case of GI pipe and GI plate earth electrodes, and forged tinned brass in case of copper plate electrodes.

### **18.7 Location of Earth Electrodes**

Normally an earth electrode shall not be located closer than 1.5 m from any building. Care shall be taken to see that the excavation for earth electrode does not affect the foundation of the building; in such cases electrodes may be located further away from the building, with the prior approval of the Engineer-in-Charge.

The location of the earth electrode will be such that the soil has a reasonable chance of remaining moist as far as possible. Entrances, pavements and roadways, should be avoided for locating earth electrodes.

**18.8 Installation****18.8.1 Electrodes****18.8.1.1 Various types of electrodes**

- a) Pipe electrode shall be buried in the ground vertically with its top at not less than 20 cm below the ground level. The installation shall be carried out as shown in drawing.
- b) In locations where the full length of pipe electrode is not possible to be installed due to meeting a water table, hard soil or rock, the electrode may be reduced length, provided the required earth resistance result is achieved with or without additional electrodes, or any alternative method of earthing may be adopted, with the prior approval of the Engineer-in-charge. Pipe electrodes may also be installed in horizontal formation in such exceptional cases.
- c) Plate electrode shall be buried in ground with its faces vertical, and its top not less than 3 m below the ground level. The installation shall be carried out as shown in drawing.
- d) When more than one electrode (plate/pipe) is to be installed, a separation of not less than 2 m shall be maintained between two adjacent electrodes.

**18.8.1.2 Advance Chemical Earthing for Aircraft Body Earth in Hangers**

Advance chemical earthing system for aircraft body earthing with ground receptacle in hangar consists of 10 feet length 17 mm dia 254 microns molecular bonded copper thickness along with the special ground receptacle of heavy duty bronze floor receptacle features a flush mount cover attached to the main body via a stainless steel ball chain. Brass ball stud located inside the receptacle provides the termination point for ground clamps. Brass ball stud shall be of removable type. Receptacle shall have the set screw type connection to fit into the 17 mm dia copper bonded steel rod.

**18.8.1.3 Artificial treatment of soil**

When artificial treatment of soil is to be resorted to, the electrode shall be surrounded by charcoal/coke/salt/chemical (Terrec powder or equivalent) as indicated in enclosed drawings. In such cases, excavation for earth electrode shall be increased as per the dimensions indicated in these figures.

**18.8.1.4 Watering arrangement**

In the case of plate earth electrodes, a watering pipe of 20mm dia. medium class G.I. pipe shall be provided and attached to the electrodes as shown in the drawing and a funnel with mesh shall be provided on the top of this pipe for watering the earth.

In the case of pipe electrodes, a 40 mm X 20 mm reducer shall be used for fixing the funnel with mesh.

The watering funnel attachment shall be housed in a masonry enclosure of size not less than 30 cm X 30 cm X 30 cm.

A cast iron/MS frame with MS cover of 6 mm thick, and having locking arrangement shall be suitably embedded in the masonry enclosure.

#### **18.8.1.5 Earthing conductor (Main earthing lead)**

In the case of plate earth electrode, the earthing conductor shall be securely terminated on to the plate with two bolts, nuts, check nuts and washers.

In the case of pipe earth electrode, wire type earthing conductor shall be secured as indicated in drawing using a through bolt, nuts and washers and terminating socket.

The earthing conductor from the electrode up to the building shall be protected from mechanical injury by a medium class, 15 mm dia. GI pipe in the case of wire, and by a minimum of 40 mm dia, medium class GI pipe in the case of strip. The protection pipe in ground shall be buried at least 30cm deep (to be increased to 60 cm in case of road crossing and pavements). The portion within the building shall be fixed on walls.

The earthing conductor shall be securely connected at the other end to the earth stud/earth bar provided on the switch board by:

Soldered or preferably crimped lug, bolt, nut and washer in the case of wire, and,

Bolt, nut and washer in case of strip conductor.

#### **18.8.1.6 Earth bus and main earthing terminal**

In all installations, main earthing terminal shall be provided at the main switchboard. This may be in the form of earth stud or single earth bar depending on the type of the switchboard.

A ring earth bus shall be provided in the substation building, switch room, and various panels shall be connected to that earth ring.

Following conductors shall be terminated on to the main earthing terminal.

- a) Earth connection from electric supply company (where provided)
- b) Earthing conductor from electrode.
- c) Protective conductors.
- d) Equi-potential bonding conductors.

**18.8.1.7 Protective (Loop earthing/ earth continuity) conductor**

Earth terminal of every switchboard in the distribution system shall be bonded to the earth bar/terminal of the upstream switch board by protective conductors.

Two protective conductors shall be provided for a switchboard carrying a 3-phase switchgear thereon.

**18.8.1.8 Earth Resistance**

The earth resistance at each electrode shall be measured. No earth electrode shall have a greater ohmic resistance than 1 ohm as measured by an approved earth testing apparatus.

Where the above stated earth resistance is not achieved, necessary improvement shall be made by additional provisions, such as additional electrode(s), different type of electrode, or artificial chemical treatment of soil etc., as may be directed by the Engineer-in-charge, at additional cost as per the provisions of the contract.

**18.8.1.9 Marking**

Earth bars/terminals at all switch boards shall be marked permanently, as "E". Main earthing terminal shall be marked "SAFETY EARTH - DO NOT DISCONNECT".

**18.8.2 MEASUREMENT OF EARTH ELECTRODE RESISTANCE**

Two auxiliary earth electrodes, besides the test electrode, are placed at suitable distance from the test electrode. A measured current is passed between the electrode 'A' to be tested and an auxiliary current electrode 'C' and the potential difference between the electrode 'A' and auxiliary potential 'B' is measured. The resistance of the test electrode 'a' is then given by

$$R = V/I$$

Where,

R- Resistance of the test electrode in ohms

V- Reading of the voltmeter in volts

I-Reading of the ammeter in amps

Stray currents flowing in the soil may produce serious errors in the measurement of earth resistance. To eliminate this, hand driven generator is used.

If the frequency of the supply of hand driven generator coincides with the frequency of stray current, there will be wandering of instrument pointer. An increase or decrease of generator speed will cause this to disappear.

At the time of test, the test electrode shall be separated from the earthing system.

The auxiliary electrodes shall be of 13mm diameter mild steel rod driven up to 1 m into the ground.

All the three electrodes shall be so placed that they are independent of the resistance area of each other. If the test electrode is in the form of a rod, pipe or plate, the auxiliary current electrode C shall be placed at least 30m away from it and the auxiliary potential electrode ' B' shall be placed mid-way between them.

Unless three consecutive readings of test electrode resistance agree, the test shall be repeated by increasing the distance between electrodes A and C up to 50m, and each time placing the electrode B mid-way between them.

On These principles, "Megger Earth Tester" containing a direct reading ohm-meter, a hand driven generator and auxiliary electrodes are manufactured for direct reading of earth resistance of electrodes.

### **24.3 Performance Guarantee**

The performance figures quoted in schedule of technical data shall be guaranteed within the tolerance permitted by relevant standard. In case of failure of the equipment to meet the guarantee, the GE reserves the right to reject the equipment. The contractor shall have to rectify the defect at no extra cost to the GE and without delaying the commissioning schedule

All expenses incurred on such tests including labour and provision of testing apparatus required to carryout the above mentioned tests shall be borne/ arranged by the contractor without any extra cost. However, electric energy for testing will be given free of charge. If the results of test are not found satisfactory, the contractor shall at his own expense rectify / replace the defective equipment/ material or any part thereof as directed by the GE. The decision of Accepting officer shall be final and binding in this respect.

Six copies of report of site tests carried out on all items and signed by representative of contractor shall be submitted to GE for approval

### **24.4 Test Certificates**

The contractor shall submit manufacture's test certificates for the following material/ equipment along with original purchase vouchers to Project Manager before incorporating the same in the work and before claiming the payments.

- (a) LT XLPE cables
- (b) MCBs
- (c) Panels/ Feeder Pillars

**24.5 Pre Commissioning Test of Installation**

Contractor will inform in writing to GE when electrical works is nearing completion on standard format to take up case with concerned Electrical Inspector (EI) of MES to plan visit to carry out inspection as per IE Rules. The test report shall be submitted to the Accepting Officer. The work will not be considered as completed till it is cleared by EI for commissioning. During testing if any defects / discrepancy is noted shall be attended by the contractor. If the installation require retest after repair / renewals it will be liability of contractor to arrange testing. All testing aid and documentations required for testing shall be arranged by the contractor. The complete provision of test shall be attended by GE contractor's representative and EI. If contractor's representative fails to attend testing inspite of pre decided schedule test shall proceed at the risk and cost of the contractor.



**LIST OF PROPOSED APPENDIX**

Appendix "A"	:	List of Material having ISI / BIS Certification Marking
Appendix "B"	:	Source of Materials
Appendix "C"	:	Recovery Charges for Testing of Material
Appendix "D"	:	Details of Lab Equipment
Appendix "E"	:	List of Approved Makes
Appendix "F"	:	Plant & Machinery Details
Appendix "G"	:	Waterproofing Bond
Appendix "H"	:	Anti Termite Treatment Bond
Appendix "I"	:	Cement Acceptance/ Rejection Form
Appendix "J/ J1"	:	Steel Supply / Rejection Form
Appendix "K"	:	Yardstick for Schedule "A" Section

**APPENDIX 'A'****LIST OF MATERIALS HAVING ISI/BIS CERTIFICATION MARKING**

SL. NO.	NAME OF MATERIALS		RELEVANT IS
1	2		3
<b>1.</b>	<b>CONCRETE</b>		
	a)	Integral cement water proofing compound	2645
	b)	Ply wood for concrete shuttering work	4990
<b>2.</b>	<b>JOINERY</b>		
	a)	Wooden flush door shutters, solid core type	2202 (Part-I)
	b)	Particle board and hard board face panel	2202 (Part-II)
	c)	Fibre glass reinforced plastic door shutters	
<b>3.</b>	<b>BUILDERS HARD WARE</b>		
	a)	Steel butt hinges	1341
	b)	Non-ferrous metal butt hinges	205
	c)	Ferrous tower bolts	204 (Part-I)
	d)	Non-ferrous tower bolts	208
	e)	Parliament hinges	362
	f)	Hydraulically operated door closers	3561
	g)	Continuous piano hinges	3818
	h)	Non-ferrous metal sliding door bolts	2681
	i)	Tee and strap hinges	206
	j)	Mild steel sliding door bolts	281
<b>4.</b>	<b>STEEL &amp; IRON WORK</b>		
	a)	Steel doors, windows and ventilators	1038
<b>5.</b>	<b>ROOF COVERING</b>		
	a)	Bitumen felts for water proofing and damp proofing	1322

## APPENDIX 'A'

SL. NO.	NAME OF MATERIALS		RELEVANT IS
1	2		3
<b>6.</b>	<b>CEILING AND LINING</b>		
	a)	Plywood for general purpose	303
	b)	Block boards	1659
	c)	Veneered particle board	3097
	d)	Marine plywood	710
	e)	Fiber hard board	1658
	f)	Wood particle board	3087
<b>7.</b>	<b>FLOORING</b>		
	a)	White Portland cement	8042
	b)	Cement concrete flooring tiles	1237
<b>8.</b>	<b>WATER SUPPLY, PLUMBING DRAINS AND SANITARY APPLIANCES</b>		
	a)	Concrete pipes with or without reinforcement	458
	b)	Salt glazed stone ware pipes and fittings	651
	c)	Flushing cistern for water closets and urinals valves symphonic type	774
	d)	Cast copper alloy screw down bib tap and stop valves	781
	e)	Galvanised mild steel tubes	1239 (Part-I)
	f)	Galvanised mild steel tube fittings	1239 (Part-II)
	g)	Sand cast iron, spigot and socket soil, waste and ventilating pipes & fittings	1729
	h)	Ball valves (horizontal plunger type) including floats for water supply purposes	1703
	i)	Cast iron manhole covers and frames	1726 (Part-I to VII)
	j)	AC pressure pipes	1592
	k)	Automatic flushing cisterns for urinals	2336
	l)	Vitreous china ware appliances	

**APPENDIX 'A'**

<b>SL. NO.</b>	<b>NAME OF MATERIALS</b>		<b>RELEVANT IS</b>
<b>1</b>	<b>2</b>		<b>3</b>
	i)	Wash down water closed	2556 (Part-II)
	ii)	Squatting pans	2556 (Part-III)
	iii)	Wash Basin	2556 (Part-IV)
	iv)	Laboratory sinks	2556 (Part-V)
	v)	Urinals bowl type	2556 (Part-VI)
	vi)	Half round channels	2556 (Part-VII)
	vii)	Symphonic wash down water closet	2556 (Part-VIII)
	viii)	Foot rests	2556 (Part-X)
	m)	Plastic WC seat covers	2546
	n)	Vertically cast iron pressure pipes for water gas and sewage	1537
	o)	Pillar taps for water supply purposes	1795
	p)	Centrifugally cast pipes for water, gas and sewage	1536
	q)	Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories	3989
	r)	Rubber sealing rings for jar mains, water mains and sewers	538
	s)	Cast iron fittings for pressure pipe for water, gas and sewage	1538 (Part-I to Part-XXIII)
<b>9.</b>	<b>ELECTRICAL WORKS</b>		
	a)	Ceiling roses	371
	b)	Tumbler switches	3854
	c)	Socket outlet 3-pin plug and socket	1293
	d)	Switch, fuses (Main and switch)	4064 (Part-I & II)
	e)	Rigid non-metallic conduit	9537 (Part-III)
	f)	Single core cable polythene insulated and PVC sheathed cable	1596
	g)	Rigid steel conduits	9537 (Part-II)

**APPENDIX 'A'**

<b>SL. NO.</b>	<b>NAME OF MATERIALS</b>		<b>RELEVANT IS</b>
<b>1</b>	<b>2</b>		<b>3</b>
	h)	Starter for tube light	2215
	i)	Fluorescent lamps	2418 (Part-I)
	j)	Aluminium conductor for overhead	398 (Part-I & II)
	k)	Switch gears	2208
	l)	HRC fuse links upto 650 volts	9224 (Part-I)
	m)	Porcelain insulators for overhead power lines	731
	n)	MCB	8228

**NOTE :** All fittings and fixtures for buildings including hardware and all other items enumerated in this appendix, sanitary fittings and electrical fittings etc. shall be ISI marked. In case any fittings / fixtures of ISI marked is not manufactured then the fittings and fixtures conforming to relevant IS may be incorporated as approved by the G.E. The contract provision shall be deemed to be amended accordingly and unit rate of buildings under Sch-'A' part-I(for all sections) and other parts of Sch-'A' shall be deemed to be inclusive for the same and no extra payment on this account shall be admissible.

Signature of Contractor

For Accepting Officer

**APPENDIX 'B'****SOURCE OF MATERIALS**

SL.NO	DESCRIPTION OF LOCAL MATERIALS	PURNEA
1	Stone	Pachami, Pakur- 230 KM
2	Sand/ Fine Aggregate	Bhagalpur(Bihar) – 90 KM BANKA—160 KM
3	Coarse aggregate	Pakur (Jharkhand)- 230 KM

**RECOVERY CHARGES FOR TESTING OF MATERIALS**

Legend : A-Site Lab, B-Zonal Lab/ Command Test Lab, C-National Test House/Semi/Govt. Approved Lab/Engg. College

SI. No.	Materials	Test	Method Testing	Frequency of Tests	Level of Test	Rate	Remarks
1	2	3	4	5	6	7	8
1.	Bricks			As per IS:5454 as given under  Lot size      Sample size 1001 to 10,000    5 10001 to 35,000    10 3500 to 50,000    15	Permissible %age of defective Bricks 0 0 1		Checks for visual and dimensional shall be also carried out as per IS-5454
		i) Compressive strength not less than 75 kg / sqcm			A	300.00	
		ii) Water absorption not more than 20% of weight			A	275.00	
		iii) Efflorescence-slight to moderate			A	300.00	
2.	Coarse Aggregate	i) Sieve Analysis		One test for every 15 cubic meter of aggregate or part thereof	A	250.00	
		ii) Flakiness index	-do-		A	150.00	
		iii) Estimation of deleterious materials	-do-	One test for every 100 cubic metre of aggregate or part thereof.	A	200.00	

Sl. No.	Materials	Test	Method Testing	Frequency of Tests	Level of Test	Rate	Remarks
1	2	3	4	5	6	7	8
		iv) Organic impurities	-do-	One test per source of supply	C	200.00	
		v) Moisture content	IS-2386 (Part-III)	Regularly as required	A	250.00	
		vi) Specific gravity	-do-	One test for each source of supply	A	250.00	
3.	Fine Aggregate	i) Sieve analysis	IS-2386 (Part-I)	One test for every ISCUM of FA or part when brought to site	A	200.00	
		ii) Test for clay silt and impurities	-do-	-do-	A	150.00	
		iii) Specific gravity	-do-	One for each source of supply	B	300.00	
		iv) Moisture content	-do- (Part-III)	Regularly as required subject to 2 tests / day when being used	A	300.00	
		v) Test for organic impurities	-do- (Part-II)	One test for each source of supply	C	300.00	
4.	Cement	i) Setting time	IS-4031 (Latest edition)	Once for each consignment or as and when required	B	300.00	
		ii) Soundness	-do-	-do-	C	250.00	
		iii) Compressive strength	-do-	-do-	B	500.00	
		iv) Fineness	-do-	-do-	C	250.00	
5.	Structural concrete M-15	i) Slump test or compacting factor test or VEE.BEE time	IS-1199	The minimum frequency of sampling of concrete of each grade shall be as under –			i) Random sampling shall be carried out



Sl. No.	Materials	Test	Method Testing	Frequency of Tests	Level of Test	Rate	Remarks	
1	2	3	4	5	6	7	8	
	grade and above			Qty. of concrete in the work (m3) 1-5 6-15 16-30 31-50 51 and above additional 50 cubic mere or part thereof	No. of Samples 1 2 3 4 4+1 for each	A	250.00	to cover all mixing units  ii) Refer IS-456-1978 clause 14.2 for frequency of samples
		ii) Compressive strength IS-516			A	250.00		
6.	a) PCC block for walling (hollow block)	i) Compressive strength	IS-2185	08 blocks out of total of	A	100.00	Samples : 14 blocks from consignment 5000 blocks or part thereof	
		ii) Water absorption	IS-2185	03 blocks out of total of	B	250.00	Of every	
		iii) Density	-do- (APPX-A)	03 -do-	B	150.00		
	b) PCC solid blocks for walling	i) Compressive strength	IS-2185	12 blocks out of total of 18	A	100.00	Sample : 18 blocks from consignment of every	
		ii) Water absorption	-do-	03 -do-	A	250.00	10,000 blocks	

Sl. No.	Materials	Test	Method Testing	Frequency of Tests	Level of Test	Rate	Remarks
1	2	3	4	5	6	7	8
							or part thereof
		iii) Density	-do-	03 -do-	A	250.00	These blocks to be checked for dimensions and weight also
7.	a) Cement flooring tiles / terrazzo tiles	i) Water absorption	IS-1237 – 1980 (APPX-D)	06 tiles out of total of 18	B	300.00	Samples : 18 tiles from each source of supply selected at random
		ii) Wet transverse strength	-do- (APPX-E)	-do-	B	350.00	
		iii) Resistance to water	-do- (APPX-F)	-do-	C	750.00	
8.	Burnt clay roofing tiles (hand made). As per IS-2690 (Part-II)	i) Water absorption	IS-3495 (Part-II)	06 tiles out of total of 12	B	500.00	Samples : 12 tiles from each source of supply
	<u>Length</u> : 150 mm to 250mm	ii) Compressive strength	-do- (Part-II)	-do-	B	300.00	Selected at random

Sl. No.	Materials	Test	Method Testing	Frequency of Tests	Level of Test	Rate	Remarks
1	2	3	4	5	6	7	8
	Width ____: 100mm to 200mm Mangalore Pattern Roofing tiles	i) Water absorption	IS:654 (APPX-A)	16 tiles out of total 32	B	300.00	Sample : 52 tiles from each consignment of 3000 tiles or part there of these tiles shall
	Thickness : 35 to 50 mm	ii) Breaking load	-do- (APPX-C)	-do-	B	250.00	Be checked for dimension and weight also
9.	Timber	i) Specific gravity and weight	IS-1708-1960	Minimum 3 samples from a lot of 4 cubic metre or 250 pieces of seasoned timber	B	250.00	
		ii) Moisture	IS-1708-1960		A	250.00	
10.	Water for construction purpose			Once at the stage of approval of source of water			Also refer clause-4.3 of IS-456 & its subsequent sub clause regarding suitability of water
		i) Test for acidity	IS:456 & 3825		B	500.00	

Sl. No.	Materials	Test	Method Testing	Frequency of Tests	Level of Test	Rate	Remarks
1	2	3	4	5	6	7	8
		ii) Test for alkalinity	-do-		B	500.00	
		iii) Test for	-do-		C	600.00	
11.	Welding of steel work	Visual inspection test	IS:818-1970 Clause-7.1	100% by visual inspection	A	700.00	Specified tests, their method and frequency to be decided on consideration of their importance by the Accepting Officer
12.	Timber paneled and glazed door (wooden shutters including factory made shutters)			Frequency of sampling from each lot shall be as under :- <b>Lot Size</b> <b>Sample size</b> 20 to 50                              05 51 to 100                              08 101 to 150                              13 151 to 300                              20 301 to 500                              32 501 to 1000                              50 1001 and above                              80			
	a)	Dimensions, sizes	IS-1003-1977		A	250.00	

Sl. No.	Materials	Test	Method Testing	Frequency of Tests	Level of Test	Rate	Remarks
1	2	3	4	5	6	7	8
	b)	Strength test					
		i) Slamming	IS-1303-1990	5% of the factory made shutters shall be tested for strength test	Manufacturer		
		ii) Impact indication	-do-		-do-		
		iii) Shock resistance	-do-		-do-		
		iv) Edge loading	-do-		-do-		
13.	Plywood (IS:303-1968)	a) Moisture content	IS-1734-1983 (Part-I)	6 test pieces from each of the board selected	B	250.00	Sampling shall be as per IS:7633-1975 table-I
		b) Water resistance test	-do- (Part-6)	As per Table-I shall be subjected to tests	C	500.00	
14.	Wood Particle board (Medium density)	a) Density	IS-2380-1977 (Part-3)	Three test specimen from each sample (size 150 mm x 75 mm)	A	100.00	Sampling shall be as per IS:308783 clause with moisture metre
		b) Moisture content	-do-	-do-	With moisture metre A&B	100.00	
		c) Water absorption	-do- (Part-16)	-do- (Size 300 x 300 mm)	A	100.00	

Sl. No.	Materials	Test	Method Testing	Frequency of Tests	Level of Test	Rate	Remarks
1	2	3	4	5	6	7	8
		d) Swelling due to surface absorption	-do- (Part-17)	-do- (size 125 mm x 100mm)	A	100.00	
		e) Swelling in water	-do-	-do- (size 200 mm x 100mm)	A	100.00	
		f) Modulus of rupture	-do- (Part-14)	Three test specimen as per IS:2380-77	B	150.00	
		g) Screw with drawel strength	-do- (Part-14)	-do- as per IS:2380	C	250.00	

Signature of Contractor

For Accepting Officer

## APPENDIX 'D'

**TESTING EQUIPMENTS REQUIRED FOR SETTING OF SITE LAB**

Sl. No	Particulars of equipment	Particulars of equipment
		Runway Resurfacing
A-1.	<b><u>Balances</u></b>	
	(i) 7 kg to 10 kg capacity – semi self-indicating type- Accuracy 1 gm	2
	(ii) 500 gm capacity –semi self-indicating type- Accuracy 0.0001gm	2
	(iii) Chemical balance – 100 gm capacity – Accuracy 0.001gm	01
	(iv) Pan Balance-5 kg capacity self-indicating type	1
	(v) Physical Balance - .001gm accuracy	1
	(vi) Platform scale – 300 Kg capacity	1
2.	Ovens- Electrically operated, thermo statically controlled	
	(i) Upto 100° C for Sensitivity 1° C	1
	(ii) Upto 200° C for determination on loss heating bitumen	1
3	Sieves : as per I.S 460-1962	
	(i) Set of IS sieves with lid and pan 450 mm diameter 80mm, 63mm, 40mm, 20mm, 16mm, 12.5mm, 10mm, 4.75mm, 2.36mm, 1.18mm, 0.75mm, 0.6mm, 0.3mm and 0.15mm size.	1 Set
	(ii) (a) Set of IS sieves with lid and pan 450mm diameter 63mm, 53mm, 45mm, 37.5mm, 26.5mm, 19mm, 13.2mm, 9.5mm, 6.7mm, and 4.75mm size.	1 Set

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Sl. No	Particulars of equipment	Particulars of equipment
		Runway Resurfacing
	(b) Set of IS sieves with lid and pan 200mm diameter 2.36mm, 2mm, 1.18mm, 0.75mm, 0.6mm, .0425mm, 0.3mm, & 0.075mm size.	1 Set
4.	Sieve shaker capable of taking 200mm and 300mm dia sieves electrically operated with time switch assembly.	1 No
5.	Proving rings- complete with dial gauge and calibration charts:	
	(i) 250Kg capacity	2
	(ii) 2000 Kg capacity	2
	(iii) 5 tonnes capacity	2
6	Dial Gauge	
	(i) 25 mm travel 1.1 mm/division	1
7.	Load frame 5 tonne capacity eclectically operated with speed control.	1
8	200 Tonne compression testing machine	1
9	Stop watches 1.0 sec, accuracy	4
10	Glassware comprising brakers, Pipettes, dishes, measuring cylinders (100 to 1000 cc capacity) rods and funnels	3 doz each
11	Hot plates 200 mm dia (1 No 1500 watt)	02
12	Enamel trays	
	(i) 600mm X450 mm X50 mm	6
	(ii) 450mm X 300 mm X 40 mm	6



## APPENDIX 'D'

Sl. No	Particulars of equipment	Particulars of equipment
		Runway Resurfacing
	(iii) 300 mm X 250 mm X 40 mm	6
	(iv) Circular plates of 250 mm dia	6
<b>B.</b>	<b>BITUMEN</b>	
1	Constant temperature bath for accommodating bitumen test specimen, electrically operated and thermostatically controlled	1
2	Petrol gas generator ( Laboratory model or any other alternative arrangement for heating of specimens in laboratory	1
3.	Penetrometer automatic type adjustable weight arrangements, and needles as per IS 1203 - 1958	1
4.	Laboratory mixer about 0.02 cubic meter capacity electrically operated fitted with heating jacket.	1
5.	Hubbard – field stability test apparatus complete	1
6	Marshall compaction apparatus as per ASTB 1559-62 T complete with electrically operated loading unit compaction pedestal hearing head assembly, dil micrometer land bracket, for flow measurement, load transfer bar, specimen mouth (4 inch dia ) with base plate, collars, specimen extractor, compaction hammer 4.53 Kg (10 lb) x 457 mm (18 in) fall	1
7.	Distant reading thermometers	1
8.	Centrifugal type bitumen extractor hand operated/motorised complete with petrol/commercial benzene	1Set
9.	Field density bottle along with cutting tray, chisel, hammer and standard sand.	02
10	3 meter straight edge	01
11	Camber board	01

## APPENDIX 'D'

Sl. No	Particulars of equipment	Particulars of equipment
		Runway Resurfacing
12	Core cutting machine with 10 cm dia diamond cutting edge	02 Set
13	Equipment for conducting	01 Set
14	Non-nuclear Density Gauge	01
15	Sieve set required as per specification	1 set
<b>C.</b>	<b>CONCRETE AND MATERIALS</b>	
1.	Vicat needle apparatus for setting time test with plungers, as per IS-269-1967	01 Set
1a	Water Still	02
2.	Moulds	
	(i) Beam - 150mm X 150mm x 700mm	36
	(ii) Cube - 150mm x 150mm x 150mm	36
	(iii) Cube - 75mm x 75mm x 75mm	36
3.	High frequency mortar cube vibrator	1
4.	Concrete power driven, I cubic feet capacity	1
5.	Rapid moisture meter	1
6	Variable frequency and amplitude vibrating table size 1 meter X 1 meter, as per IS 2514-1963	1
7	Flakiness index test apparatus	1
8.	Aggregate impact test apparatus as per IS 2386- Part IV – 1963	1
9	Los Angles abrasion apparatus as per IS – 2386- Part IV 1963	1
10	Flow table as per IS 712-19731	1

**APPENDIX 'D'**

Sl. No	Particulars of equipment	Particulars of equipment
		Runway Resurfacing
11	Equipment for slump test and compaction factor test	1
12	Equipment for the determination of specific gravity of fine and coarse aggregate as per IS-2386 Part III – 1963	1
13	Digital compression and flexural strength testing machine of 200 tonne capacity with additional dial for flexural testing.	1
14	Core cutting machine with 15 cm dia diamond cutting edge	1No.
15.	Sieve set required as per specification	
<b>D.</b>	<b>CONTROL OF PROFILE AND SURFACE EVENESS</b>	
1.	Survey level and staff	1 set
2	3 meter straight edge and measuring edge	1 set
3	Unevenness indicator (optional)	1
4.	Camber templates single lane/ Double lane	2 Each
5	Field CBR testing equipment	2 sets
6	Water testing kit(PH meter, TDS meter, Chloride & Hardness testing Kit).	1 Set
7	Riffle Box	1
8	Atterberg Limits (liquid and plastic limits) determination apparatus	01 Set
9	Compaction test Equipment both 2.5 kg and 4.5 kg rammers (Lights and heavy compactive efforts)	01 set
10	Dry Bulk density test apparatus (sand pouring cylinder, tray, can etc) complete	01 set
11	Speedy Moisture Meter complete with chemicals	01 set
12	Post hole Auger with extensions	01 set
13	Unconfined compression test apparatus	01 set
14	Riffle Box small size	01 set
15	Miscellaneous sand scoop, spatula, straight Edge Gauged Trowel, Steel foot rules, Scales, Mortar Pans, Spade, shovels, Filter paper and Wax	As Reqd

**APPENDIX 'D'**

Sl. No	Particulars of equipment	Particulars of equipment
		Runway Resurfacing
16	Other equipment for site test as outlined in BIS	
17	Dynamic Cone Penetrometer	01
18	Elongation & Flakiness guage	
19	Solubility test equipment for cracking test of Bitumen	
20	Marshall mould casting apparatus	
21	Le-Chatelier's mould to check soundness of cement	
22	Infrared Thermometer	
23	Pensky martin cup to check flash & fire point of bitumen.	
24	Ring & ball apparatus- softening point of bitumen.	
25	Brookfield Viscometer.	
26	Ductility test equipment	
27	RO Plant	
28	Sand Screener	
29	Total Station	01
30	Cement godown of sufficient capacity for cement storage.	

- Note: -**
- (i) In addition to above the contractor shall install sufficient number of machines and equipment at site so that all control tests can be performed at site.
  - (ii) List of laboratory equipment at site lab given under this Appendix is General. Contractor shall be deploy equipment at site lab as applicable to this contract only.
  - (iii) Site Lab may be common for Base Security & Runway work, where both works are to be executed in the same stations by the same contractor.

Signature of Contractor

For Accepting Officer

**LIST OF APPROVED MAKES / AGENCIES**1. **GENERAL & CIVIL ITEMS**

SL. NO.	ITEM / WORK	APPROVED MAKES / AGENCIES
1.	CEMENT	ULTRATECH / ACC / AMBUJA / BIRLA / DALMIA / JK / SHREE / JAYPEE
2.	WALL PUTTY	BIRLA / BERGER / SHALIMAR / ASIAN
3.	WHITE CEMENT	JK CEMENT / BIRLA
4.	REINFORCEMENT STEEL (TMT) (PRIMARY PRODUCERS)	SAIL / RINL / TISCO / JSW TMT/ JAI BALAJI / SHYAM TMT / ELEGANT TMT / SIMHADRI TMT / ELECTROSTEEL STEELS LTD/ KAMACHI / CONCAST MAXX / ADHUNIK / GOEL TMT / SRMB SRIJAN PVT LTD/ RASHMI METALIKS LTD
5.	STRUCTURAL STEEL	SAIL / RINL / TISCO / JINDAL (For Angle, Beam, Column, Channel & Plates.)
6.	CONCRETE ADDITIVE / ADMIXTURE	SIKA / FOSROC/ BASF INDIA LTD/ CHOKSEY
7.	RMC	J K LAXMI, LAFARGE AGGREGATE AND CONCRETE INDIA / ULTRATECH CEMENT LTD / RMC READYMIX (INDIA)
8.	MECHANICAL EXPANSION JOINTS	HERCULES STRUCTURAL PVT. LTD. SYSTEMS / C-S GROUP /SAND FIELD INDIA LTD
9.	EXPANSION JOINT FILLER BOARD	ELECON PRODUCTS / FOSROC /SUPREME
10.	FIRE CHECK / STEEL DOORS	GODREJ / SHAKTI HARMON / PACIFIC FIRE CONTROL/ RADIANT
11.	METAL ROLLING SHUTTER	B A ENTERPRISES / MULTIWYN INDUSTRIES / MODERN FABRICATOR / DOORWYN INDUSTRIES
12.	HARDWARE	DORSET / GODREJ / DORMA / OZONE/ ASSA ABLOY
13.	ALUMINIUM EXTRUDED FRAMES & SHUTTERS	HINDALCO / MODERN FABRICATOR / JINDAL / BALCO

SL. NO.	ITEM / WORK	APPROVED MAKES / AGENCIES
14	PLAIN FLOAT GLASS / FROST GLASS / TOUGHENED GLASS	SAINT-GOBAIN/ ASAHI/ MODIGUARD /TRIVENI FLOAT GLASS
15	SOLAR CONTROL AND THERMAL INSULATED GLASS	SGG EVO/ EVOLITE/ ENVISION
16	CERAMIC & VITRIFIED TILES	KAJARIA / NITCO/ ASIAN GRANITO INDIA/ HR JOHNSON LIMITED./ SOMANY
17	POLYURETHENE SEALANT AND PRIMER	PIDILITE INDUSTRIES LTD. / CICO / SIKA / STP / FOSROC / BOSTIK / CHOKSEY
18	EPOXY RESIN / POLYURETHENE BASED FLOOR COATING.	CHOKSEY / SIKA / FOSROC / BASF /STP / APURVA
19	ACOUSTIC FALSE CEILING / PANELLING	INDIA GYPSUM / GYPTONE / SAINT GOBAIN/ARMSTRONG / BORAL
20	POLYCARBONATE SHEET	PRESTAR INFRASTRUCTURE PVT LTD / FIBREWAYS TECHNOLOGY / GE PLASTIC
21	ACRYLIC DISTEMPER, OIL BOUND DISTEMPER ( FOR HANGAR & BASE SECURITY )	BERGER PAINT / NEROLAC PAINTS / BRITISH PAINTS / JOTUN INDIA PVT. LTD.
22	SYNTHETIC ENAMEL / ACRYLIC PAINT	SUPERLAC (SHALIMAR) /APCOLITE (ASIAN) / LUXOL (BERJER) / BOROLAC (JENSON & NICHOLSON)
23	CEMENT BASE PAINT	SNOWCEM / BERGER PAINT / ASIAN PAINT / JOTUN INDIA PVT. LTD.
24	APP MEMBRANE & WATER PROOFING AGENCIES	SIKA / STP / FOSROC
25	ACRYLIC / CEMENTITIOUS WATER PROOFING COMPOUND	APURVA / SIKA / FOSROC / CHOKSEY/ STP
26	CHLOROPYRIPHOS ATT CHEMICAL	DURBAN/ TRISHUL/ DE-NOCIL / NATIONAL PEST CONTROL / PEST CONTROL OF INDIA
27	METAL DOOR	ICLEAN HOLLOW METAL/SHAKTI MET-DOR LTD. / NEWER METALS (P) LTD. / SEHGAL & SEHGAL INDUSTRIES.
28	SANDWICH PANEL / GALVALUME SHEET	TATA BLUE SCOPE / SAXENA MARINE TECH (P) LTD / KIRBY / LLOYD

SL. NO.	ITEM / WORK	APPROVED MAKES / AGENCIES
29	PRE ENGINEERED BUILDING (PEB )	LLOYD INSULATION (INDIA) LIMITED`/ JINDAL BUILDSYS LTD / RCC ECO-BUILD SYSTEM LTD./ KIRBY BLDG SYSTEM/ JINDAL STEEL AND POWER LTD
30	CONCERTINA COIL / BARBED WIRE / CHAIN LINK	GLOBAL TECHNOCRATS PVT. LTV. / SHIVA ENGINEERING CO. / JAIDURGA FENCING WIRE / KRISHNA INDUSTRIES
31	ULTRASONIC BIRD REPELLER	SONIC / CONWAY EXPORT PVT LTD.
32	TURBO VENTILATOR	CITADEL ARCHITECTURAL SOLUTIONS PVT. LTD./ SUDHA VENTILATING SYSTEM PVT LTD. / STAR ROOFING SOLUTIONS
33	PLY BOARD/ PARTICLE BOARD / MDF & HDF BOARD	ARCHID PLY / GREENPLY/ NATIONAL / CENTURY/ KITPLY
34	ROCK WOOL /GLASS WOOL/ MINERAL WOOL	UP TWIGA/ LLOYD/ OWENS CORNING / ROCKWOOL INSULATION, BHILAI
35	SILICON SEALANT	ALSTONE/ McCOY / GE /DOWCORNING
36	ANCHOR BOLT	HILTI INDIA PVT. LTD. / FISCHER

**2. PAVEMENT WORKS**

SL. NO.	ITEM / WORK	APPROVED MAKES / AGENCIES
1.	BITUMEN VG GRADE	IOCL / BPCL / HPCL
2.	JOINT SEALANT FOR PAVEMENT	CHOKSEY CHECMICALS PVT. LTD./ SIKA / FOSROC / STP / MARUTI BITUMEN /CIPY /BASF
3.	CURING COMPOUNDS	CHOKSEY CHEMICAL LTD. / SIKA / PIDILITE/ FOSROC / MARUTI BITUMEN / STP
4.	GEOTEXTILES	MACCAFERRI / HMBS TEXTILES PVT. LTD /GIRIDHAR TECHFAB PVT. LTD
5.	BACKUP ROD	ELCON PRODUCTS / SUPREME INDUSTRIES
6.	ANTI STRIPPING AGENT	OPAL PRODUCTS PVT. LTD. / PETROCHEM SPECIALITIES & BITUMEN PRIVATE LTD. / TIKI TAR
7.	COMPRESSIVE FILLER BOARD FOR EXPANSION JOINT	ELECON PRODUCTS / FOSROC / SUPREME / TIKITAR / STP

8.	BITUMEN EMULSION	SHELL BITUMEN INDIA PVT. LTD./ M/S HINDUSTAN COALS LTD / MARUTI BITUMEN / G R INFRA PROJECTS / TIKI TAR
9.	'RECRON 3S' TRIANGULAR FIBRE (6MM & 12MM)	M/S RELIANCE INDUSTRIES LTD, NEW DELHI

**3. PLUMBING WORK - EXTERNAL**

Sl. No.	Materials	APPROVED MAKES / AGENCIES
1.	WTP/ETP	ION EXCHANGE / THERMAX / MADHWAK / FONTUS WATER /SINTEX
2.	HDPE/ UPVC PIPE AND FITTING	SUPREME / FINOLEX /JAIN PIPES / KISAN / PRINCE / ORI PLAST
3.	G.I. FITTINGS (MALLEABLE CAST IRON)	KENT / KS / UNIK / ZOLOTO
4.	R.C.C PIPES	ANY MAKE ISI MARKED
5.	GUNMETAL VALVE (FULLWAY VALVE) CLASS-1	AUDCO / LEADER / ZOLOTO / UPADHYAY
6.	NON RETURN VALVE	AUDCO / LEADER / ZOLOTO / UPADHYAY
7.	STONEWARE PIPES & GULLY TRAPS	ANY MAKE ISI MARKED
8.	SFRC MANHOLES FRAME & COVER & GRATING	K K MANHOLE / OM CONCRETE
9.	BUTTERFLY VALVE	AUDCO / LEADER / ZOLOTO / UPADHYAY
10.	ELECTRIC MOTORS	KIRLOSKAR / SIEMENS / CROMPTON / ABB
11.	M.S./G.I PIPES	TATA / JINDAL / PRAKASH / SURYA
12.	G.M. /C.I. DOUBLE FLANGED/SCREWED/WAFER TYPE NON RETURN VALVES.	KIRLOSKAR /LEADER / KARTAR / ZOLOTO



Sl. No.	Materials	APPROVED MAKES / AGENCIES
13.	WATER LEVEL INDICATOR	ADVANCE /HTEC /RMG
14.	WATER LEVEL CONTROLLER	ADVANCE /HTEC /RMG/ PUNE TECTROL
15.	SUMP PUMP	KSB / KIRLOSKAR / CROMPTON GREAVES
16.	SUBMERSIBLE PUMP	KSB / KIRLOSKAR / CROMPTON GREAVES / CALAMA
17.	C.I. VALVES FULL WAY	KIRLOSKAR / UPADHYAY / KARTAR
18.	SEPTIC TANKS	SINTEX / TIRUPATI
19.	MONORAIL HOIST/EOT CRANE	SAFEX ENERGY PVT LTD / PIONEER CRANES & ELEVATORS PVT LTD / DINESH ENTERPRISES

**4. PLUMBING WORK - INTERNAL**

Sl. No.	Materials	APPROVED MAKES / AGENCIES
1.	VITREOUS CHINA SANITARYWARE	HINDWARE (ITALLIAN COLLECTION) /PARRYWARE (SUPER FINE)/CERA (1 <sup>ST</sup> QUALITY) / KOHLER / ROCA
2.	W.C. SEATS & COVER	HINDWARE / PARRYWARE / CERA
3.	STAINLESS STEEL SINKS	CERA / KOHLER / PRAYAG / BLUE STAR
4.	C.P. FITTINGS , ACCESSORIES & FLUSH VALVES	JAQUAR & COMPANY PVT. LTD/ MARC / KOHLER / CERA / PARRYWARE
5.	LIQUID SOAP DISPENSER	CHILLY/ PRAYAG / POLYTUFF / KOPAL
6.	HAND DRIER	KOPAL // PRAYAG / POLYTUFF / CERA
7.	SOIL, WASTE , VENT PIPES & FITTINGS - CAST IRON PIPES (IS:3989)	NECO/ HEPCO/ BIC /ELECTRO STEEL / AIC / PIC / BINAY UDYOG PVT LTD.
8.	PVC RAIN WATER PIPES	ORI-PLAST / SUPREME / PRINCE / KISAN
9.	OIL SEPERATOR	ACO / LYRA
10.	GREASE SEPERATOR	ACO / LYRA

Sl. No.	Materials	APPROVED MAKES / AGENCIES
11.	RCC PIPES	ANY MAKE ISI MARKED
12.	G.I. PIPES	TATA / JINDAL / PRAKASH / SURYA
13.	G.I. FITTINGS (MALLEABLE CAST IRON)	KS / UNIK / ZOLOTO
14.	CPVC PIPES & FITTINGS	KISAN / ASTRAL / ASHIRWAD / SUPREME / PRINCE / RELIANCE
15.	GUN METAL VALVES (FULLWAY, CHECK AND GLOBE VALVES)	ZOLOTO / LEADER / SANT/ KARTAR/ATAM
16.	BALL COCKS	LEADER / KIRLOSKAR / ZOLOTO
17.	CLAMPS / HANGERS	INTELLOTECH / CLEVIS
18.	BALL VALVE WITH PLASTIC FLOAT	LEADER / KAPSTAN / KRANT
19.	GULLY TRAPS	PERFECT/BURN/HIND/R.K.
20.	C.I. MANHOLES COVERS AND FRAMES	NECO / PIC / BIC. / AIC CASTING / HEPKO
21.	STAINLESS STEEL/C P GRATING	CHILLY/CAMRY/JAYNA
22.	COCKROACH TRAPS	CHILLY/PRAYAG / POLYTUFF
23.	BATHROOM/BASIN CABINET	CERA / PARRYWARE / POLYTUFF / COMMANDER
24.	RCC/SFRC MANHOLE COVERS/ PRECAST RCC GRATING	KK / S K PRECAST CONCRETE / ADVENT CONCRETOVISION
25.	UPVC PIPES/ FITTINGS	SUPREME / ASTRAL/KISAN / PRINCE
26.	MIRROR	MODIGUARD / SAINT GOBAIN / CERA / PRAYAG / ZIRCON
27.	MULTI FUNCTIONAL WALL MOUNTED RECESS PANEL	EURONICS/UTEC
28.	EMERGENCY EYE WASH	SUPER SAFETY / UNICARE
29.	WATER COOLERS	BLUE STAR/VOLTAS/USHA
30.	WATER HEATER	JAQUAR / CROMPTON GREAVES / USHA / BAJAJ

Sl. No.	Materials	APPROVED MAKES / AGENCIES
31.	WATER FILTER/PURIFIER	EUREKA FORBES /BLUE STAR / KENT
32.	OVERHEAD HDPE WATER TANK	SINTEX / POLYCON / ORIPLAST / JINDAL

5. ELECTRICAL

Sl. No.	Item	APPROVED MAKES / AGENCIES
1.	VOLTMETER AND AMMETER	AE / HAVELLS / L&T / SCHNEIDER / BCH / CONZERV
2.	SELECTOR SWITCH, PUSH BUTTONS, EMERGENCY SWITCHES	SIEMENS / L & T / GE / BCH / SCHNEIDER
3.	CURRENT TRANSFORMER	AE / CROMPTON GREAVES / AREVA / SCHNEIDER
4.	HRC FUSES	L & T / GE / SIEMENS / ABB
5.	MAIN / SUB DISTRIBUTION BOARD / VTPN / SPN DB	GE / SCHNEIDER / SIEMENS / ABB / LEGRAND / C&S ELECTRIC LTD.
6.	FRLS PVC INSULATED COPPER CONDUCTOR SINGLE / MULTI CORE STRANDED WIRES OF 650 / 1100 VOLT GRADE	FINOLEX / NICCO / KEI / HAVELLS / POLYCAB
7.	TELEPHONE WIRES	SKYTONE / FINOLEX / BELDEN / HAVELLS / BATRA HENLEY / POLYCAB
8.	TELEPHONE TAG BLOCK	TVS R & M / KRONE / ITI
9.	MS CONDUIT / PVC CONDUIT	BEC / RMG / INTER CRAFT NEC / ATUL PIPE / PRESTO PLAST / FINOLEX / RICHIA CABLE
10.	SWITCHES, TV & TELEPHONE SOCKET OUTLETS, BOXES (MODULAR TYPE) (RJ - 11, RJ - 45)	LEGRAND (ARTEOR) / SCHNEIDER (OPLTE) / C & S (DIVINO) / ANCHOR
11.	NETWORKING SYSTEM	AKSH / SIGNAMAX / HONEYWELL / SCHNEIDER / L&T / SIEMENS
12.	CEILING FAN / WALL BRACKET FANS	HAVELLS / BAJAJ / CROMPTON GREAVES

Sl. No.	Item	APPROVED MAKES / AGENCIES
13.	EXHAUST FAN	HAVELLS / BAJAJ / CROMPTON GREAVES
14.	TERMINAL BLOCKS / CAGE CLAMP / CONNECTORS	HANSON / SPIELBERG
15.	LIGHTNING PROTECTION	DUVAL MESSIEN / SOUTH ASIAN ENTERPRISE LTD. / DEHN INDIA PVT. LTD.
16.	TRANSIENT VOLTAGE SURGE SUPPRESSOR	PHOENIX / SIEMENS / ABB / LEGRAND
17.	DWC HDPE PIPE	DURA LINE / CARLON / EMTELLE / KISAN
18.	LIGHT FIXTURES	PHILIPS / BAJAJ /CROMPTON/ SUDHIR
19.	LAMPS & TUBES	PHILIPS / CROMPTON GREAVES /SURYA / BAJAJ
20.	TRANSFORMERS	ABB / AREVA / SIEMENS / SCHNEIDER / ANDREW YULE
21.	AUTO VOLTAGE REGULATOR	ABB / ANDREW YULE / AREVA / ICON
22.	CONTACTORS	L & T / SCHNEIDER - TESYS / SIEMENS / ABB (A RANGE )
23.	RCCB	GE / SCHNEIDER / SIEMENS / ABB / LEGRAND / C&S ELECTRIC LTD.
24.	MOULDED CASE CIRCUIT BREAKER (MCCB)	L&T (DSHINE) / SIEMENS (3VA) / SCHNEIDER - NSX / ABB (TMAX) / LEGRAND / C&S ELECTRIC LTD.
25.	MCB	SCHNEIDER (ACTI-9) / L&T (AU) / SIEMENS (5SL) / LEGRAND – LEXIC / C&S ELECTRIC LTD.
26.	VCB / SF6	ABB / ANDREW YULE / AREVA / SIEMENS
27.	ACB	L&T- UPOWER / SCHNEIDER - MASTERPACT NW / SIEMENS- 3WL / ABB- EMAX / LEGRAND (DMX3) / C&S ELECTRIC LTD.
28.	PUSH BUTTONS	ABB / SIEMENS / L&T / TELEMECHANIQUE / SCHNEIDER

Sl. No.	Item	APPROVED MAKES / AGENCIES
29.	PROTECTION RELAYS	ABB / AREVA / L&T / SCHNEIDER / SIEMENS
30.	TIMERS	BAJAJ / LEGRAND / L&T / SCHNEIDER
31.	INDICATING LIGHTS	ABB / SIEMENS / L&T / AE / SCHNEIDER
32.	INDICATING INSTRUMENTS	RISHABH / CONSERVE / L&T / ENERCON
33.	KWH METERS	HPL INDIA (SOCOMAC) / L&T / CONSERVE / SECURE
34.	HT XLPE CABLE	CABLE CORPORATION OF INDIA / HAVELLS / GLOSTER / FINOLEX / POLYCAB
35.	LT CABLE	GLOSTER / FINOLEX / POLYCAB / KEI
36.	LED LIGHT	PHILIPS / GE / BAJAJ / WIPRO
37.	CABLE GLANDS	DOWELS / CROMPTION / BICO / SIEMENS / COMET / RAYCHEM
38.	D.G. SET - ENGINE	GREAVES COTTON / CUMMINS / KIRLOSKAR / ASHOK LEYLAND
39.	D.G. SET - ALTERNATER	KIRLOSKAR / SIEMENS / CROMPTON GREAVES / ALSTOM / BHARAT BIJLEE STAMFORD
40.	LT PANEL / CAPACITOR PANEL / DG PANEL / DISTRIBUTION BOARD PANEL / FEEDER PILLAR	L&T / SCHNEIDER / ABB / C& S ELECTRICS
41.	HT PANELS	SIEMENS / ABB / SCHNEIDER

Sl. No.	Item	APPROVED MAKES / AGENCIES
42.	PSS (Package Substation)	SIEMENS / ABB / SCHNEIDER / CROMPTON GREAVES / ANDREW YULE
43.	OCTAGONAL POLE	BAJAJ / JINDEL / PHILIPS / SURYA / CALCUTTA POLES & TUBES
44.	GRP POLE	BAJAJ / CROMPTOM / PHILIPS / SURYA / SUMIP
45.	STEEL TUBULAR POLE	JINDAL STEEL / CALCUTTA POLES & TUBES / NATIONAL TUBEING CO. / BOMBAY TUBE & STORE
46.	LIGHTING ARRESTORS	AREVA T&D / OBLUM / ELPRO / BHEL
47.	GI PIPE	TATA / JINDAL / SURYA / PRAKASH
48.	HIGH MAST POLE	BAJAJ / PHILIPS / SURYA / CROMPTON GREAVES
49.	HDPE PIPE	KISAN MOULDING LTD / JAIN IRRIGATION SYSTEM / DURALINE / PRINCE / SUPREME
50.	HT & LT CABLE JOINTS	M-SEAL / DENSON / RAYCHEM / 3-M
51.	ALL OTHER ITEMS NOT COVERED ABOVE	AS PER SAMPLE APPROVED
52.	WATER DISPENSER (HOT/COLD)	AQUAGUARD / VOLTAS / KENT

**Notes:-**

1. If any item/work in the list is manufactured by a manufacturer with both ISI & Non-ISI marking, only ISI marked item will be accepted.
2. In case of any variations in the make given in the Schedule 'A'/BOQ with this list, the makes given in Schedule 'A'/BOQ will take precedence.
3. In case of specific catalogue number of any make mentioned in schedule 'A' with equivalent of other approved make, the contractor may supply the item with specific catalogue number as mentioned or may submit proposal justifying the equivalency of proposed make with the specified catalogue number.
4. Any difficulty/ non-availability of items as per approved make mentioned in this list may be brought out prior to Pre-Bid conference by the Tenderer.
5. Any proprietary item left out in this list shall only be procured from the reputed manufacturer similar to those, mentioned in this list for similar item or existing in approved list of E-in-C Branch/CEEC Kolkata.

**APPENDIX 'F'****LIST OF MAJOR PLANT AND EQUIPMENT**

Sl. No	Tools & Plant	Minimum Quantity	
		Runway Resurfacing	Vintage (in year)
1.	Paver with electronic sensor (minimum width of paver finisher 09 meter) for laying bituminous layer with printing facility.	01 No	05
1.a	Paver for laying bituminous layer		
2.	Computerized hot mix plant (Batch mix) of 1x30 TPH with Printing Facilities.	01No	05
2a	Computerized hot mix plant (Drum type) of 1x30 TPH with Printing Facilities.		
3.	Pneumatic tyre roller (07 to 25 ton capacity)	02No	05
4.	Dual mode tandem vibratory roller (08 to 10 ton capacity)	02 Nos	08
5.	Bitumen sprayer 10 to 12 ton motorized	01 No	08
6.	Insulated bitumen containers of suitable capacity near hot mix plants.	02 Nos	08
7.	Computerized ready mix concrete plant with printing facility.	2x90Cum/hr - 02 Nos & 1x60Cum/hr - 01 Nos	05
8.	Slip form paver with electronic sensor (minimum 08 to 13 meter width) for laying concrete pavement.	01 No	05
9.	Hand held heavy duty needle vibratos (electrically operated / diesel driven) for PQC	06 Nos	08

**APPENDIX 'F'**

10.	Fix form paver (width of paving upto 14.5m)	01 No	05
11.	Machine for joint filling	01 No	08
12.	Diamond cutter for joints (Diesel / electric driven ) (Two full depth concrete cutting machine)	04 Nos	08
13.	WMM plant of 90 to 120 TPH capacity	01 No	08
14.	Vibratory type sand screeners	01 No	08
15.	Mechanized runway marking and painting equipment	01 No	08
16.	Air compressors 350 cfm	02 No	08
17	Profilometer /Roughometer	01 No	08
18.	Core cutting machine (150mm diameter & 100mm diameter bit)	01 No	08
19.	Field testing equipment to test 'K' value & CBR value complete set.	01 No	08
20.	Dharam Kanta/ Weigh Bridge (100 Ton)	01 No	05
21.	Total station survey equipment	02 No	08
22.	Dumpers	10 Nos	05



**APPENDIX 'F'**

23.	Transit mixers	06 Nos	05
24.	JCB	02 Nos	05
25.	Wheel loaders	01 No	05
26.	Motor graders	01 No	05
27.	Diamond bit cutters	01 No	05
28.	Texturing machine	01 No	05
28a	Lab testing equipment for site lab		08
29.	Steel/Reinforcement cutting & Bending Machine	As per site requirement and as directed by GE	
30.	Cranes of different capacity		
31.	Man-lift		
32.	Steel scaffolding(movable)		
33.	Drill machine		
34.	Plate Vibrator		

## Note:-

1. Plants required only for bituminous road work may be mobilized as per time schedule agreed by GE.
2. Plants may be demobilized with written approval of GE when there is no requirement in the balance work.

**GUARANTEE TO BE EXECUTED BY CONTRACTORS FOR REMOVAL OF DEFECTS AFTER COMPLETION IN RESPECT OF WATER PROOFING WORKS.**

The Agreement made this ..... date of ..... Two Thousand & ..... between ..... (hereinafter called the Guarantor of the one part) and the Chief Construction Engineer, North east project (hereinafter called the Government of the other part).

WHEREAS THIS AGREEMENT is supplementary to the Contract (hereinafter called the `said Contract") dated ..... and made between the GUARANTOR of the one part and the Government of the other part, whereby the Contractor inter-alia undertook to render the building and structures, in the said contract, completely water and leak proof.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the effect that the said structures will remain water and leakproof for ten years from the date of installation of the water proofing treatment.

NOW THE GUARANTOR hereby guarantees that water proofing treatment installed by him will render the structures completely water and leak proof and the minimum life of such water proofing treatment shall be ten years to be reckoned from the date after the maintenance period prescribed in the contract.

Provided that the guarantor will not be responsible for leakage caused by earthquake or structural defects or misuse or alteration :

The decision of the Government with regard to cause of leakage shall be final.

During this period of guarantee the guarantor shall make good all defects and in case of any defect is found, and render the building water proof to the satisfaction of the Government at his own cost and shall commence the work for such rectification within seven days from the date of issue of the notice from Government calling upon him to rectify the defects failing which the work shall be got done by the Department by some other contractor at the GUARANTOR'S cost and risk. The decision of the Government as to the cost, payable by the Guarantor shall be final and binding.

That if guarantor fails to make good the defects or comments breach thereunder then the guarantor will indemnify the Government and his successors against all loss, damage, cost, expense or otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and/or cost incurred by the Government the decision of the Government will be final and binding on the parties.

IN WITNESS WHEREOF these presents have been executed by the obligator ..... for and on behalf of Director General, Married Accommodation Projects on the day, month year first above written.

SIGNED, SEALED AND DELIVERED by OBLIGATOR in the presence of :

Signature of Guarantor  
Witness 1  
Witness 2

Signature of Contractor  
Witness 1  
Witness 2

Signature of Accepting Officer  
Witness 1  
Witness 2

.....  
**PERFORMANCE GUARANTEE (ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE) TO BE EXECUTED BY CONTRACTORS FOR REMOVAL OF DEFECTS AFTER COMPLETION IN RESPECT OF RECONSTRUCTIONAL ANTI-TERMITE TREATMENT**

ARTICLES OF AGREEMENT made at Chabua, this ..... day of ..... two thousand & ..... between Chief Construction Engineer, North East Project, having its office at Chabua Air Force Station, Dibrugarh, Assam hereinafter referred to as the "Accepting Officer" of the part and Messrs ..... a firm registered under the Companies Act of 1956 and having their registered office at ..... hereinafter referred to as the "Guarantor" (which expression shall mean and include the partners or partner for the time being of the firm and their or his respective heirs, executors and administrations/its successors and assigns in law) in the other part.

WHEREAS THIS AGREEMENT is supplementary to the Contract (hereinafter called the `said contract') between the Accepting Officer and Messrs ..... hereinafter called the `Contractor'), whereby the contractor inter-alia, undertook to render the building and structures, in the said contract, safe from termite proof and completely termite proof.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the effect that the said structures will remain termite proof for ten years from the date of providing of termite proofing treatment.

NOW THE GUARANTOR hereby guarantees that termite proofing treatment given by him will render the structures completely termite proof and the minimum life of such termite proofing treatment shall be ten years to be reckoned from the date of giving of termite proofing treatment.

Provided that the guarantor will not be responsible for termite infestation caused by earthquake or structural defects or misuse or alteration:

The decision of the Accepting Officer with regard to cause of termite infestation shall be final.

During this period of guarantee the guarantor shall make good all defects and in case of any defect being found, render the building termite proof to the satisfaction of the PM at his own cost and shall commence the work for such rectification within seven days from the date of issue of the notice from the PM calling upon him to rectify the defects falling which the work shall be got down by the PM by some other contractor at the Guarantor's cost and risk. The decision of the Accepting Officer as to the cost, payable by the Guarantor shall be final and binding.

That if the guarantor fails to make good defects or commits breach thereunder then the guarantor will indemnify the Accepting Officer and his successors against all loss, damage, cost, expense or otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and/or cost incurred by the Accepting Officer the decision of the Accepting Officer will be final and binding on the parties.

Signature of Guarantor  
Witness 1  
Witness 2

Signature of Contractor  
Witness 1  
Witness 2

Signature of Accepting Officer  
Witness 1  
Witness 2

CEMENT SUPPLY AND ACCEPTANCE REGISTER

1. CA No. & Name of work:
2. Control No.:
3. Name of Manufacturer/Brand Name/Gde of Cement (A) Manufacture \_\_\_\_\_ (B) Brand \_\_\_\_\_ (C) Grade \_\_\_\_\_
4. Qty of cement & Lot No/Week No. (in Bags): (Qty \_\_\_\_\_ (b) Lot No/Week No \_\_\_\_\_
5. Manufacturer's test Certificates No. \_\_\_\_\_
6. Random Test Details: (a) Physical test report from vide their letter No. \_\_\_\_\_ (Name of approval Lab/Engineer-in-Charge College)  
(b) Chemical rest report from \_\_\_\_\_ vide their letter No. \_\_\_\_\_ (Name of approval Lab/Engineer-in-Charge College)
7. Details of Physical & Chemical properties:

Physical requirement (as per IS-4031)										Chemical requirement (as per IS-4031)							
	Specific Surface dce (M2/Kg)	Soundness by Le Chatellar expansion (%)	Soundness by Auto clave Expansion	Initial Setting time (Minutes)	Final Setting time (Minutes)	Compressive strength			Temp during testing C	Standard consistency (%)	Lime saturation factor (Ratio)	Almina Lon Ratio (%)	Insoluble residues (%)	Magnesium (%)	Sulphuric Anhydride (%)	Loss on Ignition (%)	Alkalis (%)
						03 days (Mpa)	07 Days (Mpa)	28 days (Mpa)									
As per relevant IS																	
As per manufa-cturer's test Certificate																	
As per random test certificate																	

Remarks with Signature

Accepted/Rejected

Contractor

Junior Engineer

Engineer-in-Charge

GE/PM

Remarks of BOO/Inspecting Officer/CWE/ Chief Engineer

PARTICULAR SPECIFICATIONS (CONTD..)

STEEL SUPPLY & ACCEPTANCE REGISTER

1. CA No & Name of Work :
2. Contract No :
3. Name of Manufacturer's TC No :
4. Manufacturer :
5. (a) Random Test Details (a) Physical test report from \_\_\_\_\_ (Name of NABL approval lab/ Govt Engg College) vide their letter No \_\_\_\_\_  
(b) Chemical test report from \_\_\_\_\_ (Name of NABL approval lab/Govt Engg College) vide their letter No \_\_\_\_\_
6. Type of Steel, Dia & Qty(a)type : TMT/CRS (b) Dia\_\_\_ mm (c) Actual Wt \_\_\_ MT (d) Conversion Wt \_\_\_ MT

	Chemical Test						Mechanical Test						
As per IS 1786-2008	Carbon %	Sulphur %	Phosphorous %	Manganese %	Silicon %	Corrosion Resistant element	Wt per meter	Stress (N/mm <sup>2</sup> ) 0.2% proof	Tensile Strength (N/mm <sup>2</sup> )	Elongation %	Bend test	Rebend test	Remarks
As per manufacture's test certificate													
As per independent test													

Remarks with Signature

Contractor

Junior Engineer

Engineer-in-Charge

Accepted/Rejected

GE/PM

Remarks of BOO/Inspecting Officer/CWE/ Chief Engineer

.....

## FREQUENCY FOR NORMAL MASS, TENSILE, BEND AND REBEND TESTS OF STEEL

NORMAL SIZE	QUANTITY
<b>STEEL FOR CONCRETE</b>	
1. Bars size less than 10 mm	1 sample (3 specimens) for each test for every 25 tonnes or part thereof
2. Bars size 10 mm to 16 mm	1 sample (3 specimens) for each test for every 35 tonnes or part thereof
3. Bars size over 16 mm	1 sample (3 specimens) for each test for every 45 tonnes or part thereof
<b>STRUCTURAL STEEL</b>	
4. Tensile Test	1 Test for every 25 tonnes of steel or part thereof
5. Bend Test	1 Test for every 25 tonnes of steel or part thereof

- NOTE:-**
1. For various tests, acceptance criteria, tolerance etc. refer to Appendix 'J' and relevant BIS Codes.
  2. Testing as per above frequency is mandatory before payment is released to the contractor or steel is incorporated in the work. However, tests will not be insisted upon for the steel required for guard bars, holdfasts, grills and such other allied items. Any items of steel not meeting the requirements, shall be rejected and the particular consignment removed from the site by the contractor at his own cost. The contractor will have no claim on this account. Cost of tests and test samples as per above frequency shall be borne by the contractor irrespective of test results.
  3. The GE may also increase frequency and number of samples/tests for his satisfaction. However, cost of samples, transportation and other overheads shall be borne by the contractor irrespective of test results.

## APPENDIX ' K '

**PURNEA -GROUND RUN POINT**  
YARDSTICK FOR STAGE PAYMENT

STAGE NO.	BRIEF DESCRIPTION OF THE STAGE	% OF TOTAL COST
Stage - I	All work Upto Pedestal / Plinth beam Top - Excavation in trenches and over areas, PCC in foundation, RCC including Reinforcement & Formwork. in Pedestal, Column, footings, Plinth Beam	15.00 %
Stage - II	RCC work from pedestal / plinth beam top to 1st floor slab - RCC work including reinforcement and formwork in beams, columns, slab.	15.00 %
Stage - III	Brickwork and Plaster internal & External - DPC,Brick work, Half brickwork & all plastering work	6.00 %
Stage - IV	Plumbing works, CP fittings, sanitary wares up to 1st Manhole - Plumbing & sanitary pipe lines laying	5.00 %
Stage - V	Flooring in all floors , Dado/ Skirting - All types of flooring in floors, waterproofing work and completion of Blast Deflector Panel	8.00 %
Stage - VI	External painting, Internal Painting	5.00 %
Stage -VII	Door/ Window frame with shutters, fittings and fixtures in all floors.	6.00 %
Stage - VIII	Hangar Pavement flooring including PQC	15.00 %
Stage - IX	Roofing work - Roof Sheeting	11.00 %
Stage - X	Wall Cladding (Prefab.)	9.00 %
Stage - XI	All balance work, site clearance, submission of all test report, Guarantee & Handing Over	5.00 %
	<b>Total</b>	<b>100.00 %</b>

Note:- Further splitting of any stage shall be at the descriation of the GE with mutual acceptance and approval of CWE.

## LIST OF DRAWING – OF PHASE-II

SL. NO.	DRAWINGS NO.	REVISION	DATE	DESCRIPTION
<b>PURNEA RUNWAY</b>				
<b>PAVEMENT DRAWINGS</b>				
1	2011012/PU/AR/H/T/PV-01	R0	08-Aug-18	Part Site Plan (West) showing proposed resurfacing/Extension of Pavements – Sheet 1 of 2
2	2011012/PU/AR/H/T/PV-02	R0	08-Aug-18	Part Site Plan (East) showing proposed resurfacing/Extension of Pavements – Sheet 2 of 2
3	2011012/PU/AR/H/T/PV-03	R0	08-Aug-18	Part Site Plan (West) showing clearance Lines for Pavements – Sheet 1 of 2
4	2011012/PU/AR/H/T/PV-04	R0	08-Aug-18	Part Site Plan (East) showing clearance Lines for Pavements – Sheet 2 of 2
5	2011012/PU/AR/H/T/PV-05	R0	08-Aug-18	Pavement Cross Section (Sheet 1 of 3)
6	2011012/PU/AR/H/T/PV-06	R0	08-Aug-18	Pavement Cross Section (Sheet 2 of 3)
7	2011012/PU/AR/H/T/PV-07	R0	08-Aug-18	Pavement Cross Section (Sheet 3 of 3)
8	2011012/PU/AR/H/T/PV-8	R0	08-Aug-18	Pavement Details
9	2011012/PU/AR/H/T/PV-9	R0	08-Aug-18	Pavement Details (RCC Ducts & FOD Trap)
10	2011012/PU/AR/H/T/PV-10	R0	08-Aug-18	Pavement Details (Concrete Top with Broom Finish)
11	2011012/PU/AR/H/T/PV-11	R0	08-Aug-18	Part Site Plan (West) showing Airfield Drainage – Sheet 1 of 2
12	2011012/PU/AR/H/T/PV-12	R0	08-Aug-18	Part Site Plan (East) showing Airfield Drainage – Sheet 2 of 2
13	2011012/PU/AR/H/T/PV-13	R0	08-Aug-18	HRS Duct Plan for New Dispersal
14	2011012/PU/AR/H/T/PV-14	R0	08-Aug-18	RCC Details of Culvert under Taxiway
<b>ARCHITECTURAL DRAWINGS</b>				
15	2011012/PU/AR/H/T/A-5.1	T0	27-Sep-16	Ground Floor Plan, Roof Plan & Details. GROUND RUN POINT
16	2011012/PU/AR/H/T/A-5.2	T0	27-Sep-16	Elevation, Sections, Schedule of Doors/ Windows & Finishes, Toilet Details
<b>STRUCTURAL DRAWINGS</b>				
17	2011012/PU/AR/H/T/S-1.1	R0	27-Dec-16	Column Layout
18	2011012/PU/AR/H/T/S-1.2	R0	27-Dec-16	Foundation Plan and Details
19	2011012/PU/AR/H/T/S-1.3	R0	27-Dec-16	G.A. and R.C. Detail of Beam at Plinth Level
20	2011012/PU/AR/H/T/S-1.4	R0	27-Dec-16	G.A. at Roof Level
21	2011012/PU/AR/H/T/S-1.5	R0	27-Dec-16	Typical Cross Section and Connection Details
22	2011012/PU/AR/H/T/S-1.6	R0	27-Dec-16	Steel Roof Plan
23	2011012/G/AR/H/T/S-001	T0	21-Jul-17	Miscellaneous Details
24	2011012/PU/AR/H/T/S-G.1	T0	27-Dec-16	Standard Curtailment Drawing
<b>ELECTRICAL DRAWINGS :</b>				
25	2011012/PU/AR/H/T/E-01	T0	27-Sep-16	Static Ground Receptacle Layout
26	2011012/PU/AR/H/T/E-02	T1	27-Dec-16	Electrical layout SU-30 Ground Run Point
<b>PLUMBING DRAWINGS</b>				
27	2011012/PU/AR/H/T/P-MP-01	To	27-Sep-16	External Water Supply and Sewerage Layout
28	2011012/PU/AR/H/T/P-5.1	T0	27-Sep-16	SU-30 Ground Run Point
29	2011012/PU/AR/H/T/P-G.1	T0	27-Sep-16	Detail of Septic Tank
30	2011012/HS/AR/H/T/GN-01	T0	25-Jan-18	Typical Detail of Cover Slab of Soak Pit
<b>MISCELLANEOUS DRAWINGS</b>				
31	2011012/GEN/AR/T/SK-01	T0	17-Oct-17	Anchor Block Detail
32	2011012/GE/AR/BS/H/T/SK-02	T0	22-09-2017	Typical Detail of Site Barricading
33	2011012/GE/AR/H/T/A-G.1	T0	27-09-2016	General Notes ( All Deciplines)
34	2011012/GE/AR/H/T/A-G.2	T0	27-09-2016	Iron Mongary
35	2011012/GE/AR/H/T/A-G.3	T0	27-09-2016	Typical Detail of Doors & Windows
36	2011012/GE/AR/H/T/A-G.4	T0	27-09-2016	Typical Detail of Steel Doors
37	2011012/GE/AR/H/T/A-G.5	T0	27-09-2016	Typical Detail of Steel Door & PVC Door
38	2011012/GE/AR/H/T/A-G.6	T0	27-09-2016	Miscellaneous Details (Sheet 1 of 3)
39	2011012/GE/AR/H/T/A-G.7	T0	27-09-2016	Miscellaneous Details (Sheet 2 of 3)
40	2011012/GE/AR/H/T/A-G.8	T0	27-09-2016	Miscellaneous Details (Sheet 3 of 3)
41	-	-	-	Site plan showing location for labour camp & T&P etc