



ERNAKULAM REGIONAL CO-OPERATIVE MILK PRODUCERS' UNION LTD.
P.B.NO.2212, EDAPPALLY, KOCHI – 682 024
PHONE: 0484 – 2541193

Tender No: EU/PC/712/PD/2021-22/5

**TENDER FOR CIVIL WORKS – CONSTRUCTION OF FOUNDATION
STRUCTURE FOR CONTAINERISED STORE MODULE WITH RCC SLAB
AND RR MASONRY AT PRODCUTS DAIRY EDAPPALLY.**

2022

BID FORM

1	Registered name of bidder:	
2	Address:	Office Address:
3	Telephone:	Land Phone : Mobile : E mail : Fax :
4	Details of the Contact Person	Name: Mobile No: Email :

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SECTION I

ERNAKULAM REGIONAL COOPERATIVE MILK PRODUCERS' UNION LTD.

P.B. NO. 2212, EDAPPALLY, KOCHI – 24

Phone-0484-2541193, 2556863

TENDER NOTICE

The Ernakulam Regional Co-Operative Milk producers' Union Ltd, invites e-tender from eligible bidders for the work:. **TENDER FOR CIVIL WORKS – CONSTRUCTION OF FOUNDATION STRUCTURE FOR CONTAINERISED STORE MODULE WITH RCC SLAB AND RR MASONRY AT PRODUCTS DAIRY EDAPPALLY** Interested eligible Bidders may obtain further information from the office of the ERCMPU Ltd.

1. The bid shall be submitted in Single cover system consisting price bid.
2. Detailed terms and conditions, scope of work etc. are contained in the bidding document of the above work which is uploaded in the Kerala Government e-portal www.etenders.kerala.gov.in.

Bid reference No	:	EU/PC/712/PD/2021-22/5
Estimated value	:	Rs. 2.30 Lakhs
Tender download	:	Can be downloaded from the website www.etenders.kerala.gov.in
EMD	:	Rs. 2000/- as online remittance
Price of bidding document	:	Rs. 500/+ GST @18%
Bid publish date	:	14.02.2022 14.00 hrs
Document download start date	:	14.02.2022 14.30 hrs
Date of Pre-Bid Meeting	:	15.02.2022 11.00 hrs
Bid submission start date	:	16.02.2022 10.00 hrs.
Bid submission closing date	:	23.02.2022 13.30 hrs.
Date of opening (technical bid)	:	23.02.2022 14.30 hrs
Time of completion	:	45 days
Address for communication and place of bid opening	:	Thrissur Dairy , Ramavarmapuram P O, Thrissur District , Kerala
Bid Validity	:	90 days

All bids must be accompanied by Bid security (EMD) and tender fee as specified in the e-tender notice.

Edappally

Date: 11.02.2022.

DIRECTOR

Copy to :All Dairies, Notice Board, Website,O/c, M/f

MANAGING

GENERAL TERMS & CONDITIONS

TENDER FOR CIVIL WORKS – CONSTRUCTION OF FOUNDATION STRUCTURE FOR CONTAINERISED STORE MODULE WITH RCC SLAB AND RR MASONRY AT PRODUCTS DAIRY EDAPPALLY.

Ernakulam Regional Cooperative Milk Producers Union Ltd, invite your item wise competitive rates for the work mentioned above, subject to the following terms and conditions.

1.How to offer the Tender

- a) Tender document exhibited in our website www.milma.com. Interested parties can download the same from our website.
- b) Sealed tender shall be submitted by indicating the rates in the “Form of Submitting Tender
- c) Tender form submitted should be mentioned the details of Earnest Money Deposit (EMD) and tender fee remitted online in the following account
- d) Tenders filled in the prescribed form should be submitted at the above office on or before **23.02.2022 at 13.30 hrs.** The envelope should carry superscription “**TENDER FOR CIVIL WORKS – CONSTRUCTION OF FOUNDATION STRUCTURE FOR CONTAINERISED STORE MODULE WITH RCC SLAB AND RR MASONRY AT PRODUCTS DAIRY EDAPPALLY.**”
- e) Tenders will be opened on **23.02.2022 at 14.30 hrs.** at the above office.
- f) Negotiation, if any, will be done with the lowest quoted party only.
- g) All pages of the tender document shall be signed by the contractor while submitting the tender.

2. Scope of work.

- i. Earth work excavation
- ii. Providing PCC first layer
- iii. RR Masonry Wall
- iv. RCC Slab with proper shuttering work.
- v. Finishing works

3. Schedule of Quantities and rates

- a. The specification for each item of work and schedule of quantities are given in the enclosed Annexure – schedule of quantities.
- b. The rate quoted shall be inclusive of all applicable taxes and duties, ESI Contribution, material cost including steel and cement, labour cost, transportation of materials to site, loading and unloading charges and nothing extra will be paid on any account.
- c. The unit rates should be quoted both in figures as well and in words. In case of discrepancy in the rate quoted in figures and in words, the amount quoted in words shall be taken as final and binding on the party. Based on the unit rates quoted, the total amount for each item of work should be worked out and indicated in the offer.
- d. The unit rate quoted should be legible without any erasion/overwriting. In case of any correction and alteration in the unit rates at the time of quoting the same should be signed in full by the quotationer.
- e. Quantities indicated in the schedule are only tentative and may vary to the +/- side. However, payment will be made for the actual quantity executed at site as per the directions of Engineer in charge, on unit rate basis. No extra claim shall be entertained on this account.
- f. The award of work shall be on item rate contract basis and no part of the work shall be considered on percentage or lumpsum basis unless specifically agreed by the undersigned.
- g. The unit rate quoted should remain firm for the entire duration of contract and nothing extra will be paid on any account

4. Earnest Money Deposit

- a. The offer should be accompanied by an EMD of Rs.2,000/- (Rupees Two thousand only).

<u>Name of account holder</u>	<u>Ernakulum Regional Co-operative Milk Producers' Union Ltd. (ERCMPU Ltd-Milma)</u>
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<u>Address</u>	<u>Koonanthal, Edappally, Kochi-682024</u>
<u>Account with Bank</u>	<u>Indian Overseas Bank</u>
<u>Branch address</u>	<u>Periyamkumath Building, Koonamthal, Edappally-682024</u>
<u>IFSC</u>	<u>IOBA0001496 (fifth character is zero)</u>
<u>Account number</u>	<u>149602000000045</u>
<u>Account Type</u>	<u>Current account</u>

- b. The EMD shall be paid through RTGS/NEFT into the above account along with Tender Fee(Rs. 500) and GST (Rs.90/-). Total amount to be paid is Rs. 2590/-
- c. Offers without EMD are liable to be rejected.
- d. The EMD of the unsuccessful quotationers will be released on finalisation of the contract.
- e. The EMD of the successful quotationer will be released only after submission of agreement and performance security.
- f. No interest will be paid for the EMD for the period for which it lies with the KCMMF.

5. Period of Validity

The offers submitted by the quotationer shall remain valid for acceptance for a period of 90 days from the date of opening.

6. Period of Completion

The entire works should be completed in all respects within 20 days from the date of receipt of work order/ date of clearance.

However, the quotationer after examining the scope of work and site conditions can specify in the offer the shortest period by which he can complete the above works in all respects.

7. Agreement

The successful bidder has to execute an agreement within 15 days of receipt of the order.

8. Performance Security

Within 7 days of receipt of the order the successful bidder has furnished a performance security for an amount of 5% of the contract value. The performance security shall be in the form of Demand Draft or a Bank Guarantee in favour of Kerala Co-operative Milk Marketing Federation Ltd. The Bank Guarantee shall be valid for the entire period of contract including guarantee period plus 75 days. The amount can be remitted to the above mentioned account also.

9. Submission of bills

- a) Bills shall be prepared in duplicate in the name of Dairy Manager products Dairy , Edappaly .
- b) Payment shall be released against RA Bills . However, the value of each bill shall not be less than Rs1,00,000/- (Rs. One lakh only).
- c) After completion of the above work in all respects, the Contractor should submit the final bill along with the measurement sheets for all the works.
- d) While settling the bills, statutory deductions such as income Tax, sales tax on works contract, contribution to KCWWF, ESI etc. will be deducted from the payment due to the contractor.

10. Guarantee

The entire work executed should be guaranteed for a period of one year from the date of completion of the work for quality and workmanship. In case any work or part thereof, is found defective due to substandard material, bad workmanship, the same shall be repaired/replaced by the contractor without any extra cost during the guarantee period and the entire expenditure towards such repair/replacement shall be borne by the contractor.

11. Liquidated Damages

Incase the work is not completed within the stipulated period of completion, liquidated damage will be levied @ 1% per week for the value of the portion of work so delayed subject to a maximum of 10% of the work order value. However, if the works are delayed due to genuine reasons beyond the control of the

contractor due consideration will be given while operating the liquidated damages clause provided the contractor furnishes the documentary evidence for the same and the same is found to be acceptable.

12. Submission of tender and opening

- a. The offer must be submitted in original in a sealed cover superscribing the name of the work, due date and time of opening.
- b. The offers complete in all respects along with EMD Details should reach Head Office, ERCMPU, Edappally P O, Kochi-24 on or before 23.02.2022 at 13.30 hrs and the same shall be opened at 14.30 hrs. in the presence of interested quotationers or their authorized representatives.

13. General

- a) The work should be carried out in consultation with the Head of Dept (Engineering& Projects), ERCMPU or the authorized representative of Managing Director of ERCMPU and should be strictly as per the specification and directions.
- b) The undersigned reserves the right to accept any quotation in part or full.
- c) The undersigned reserves the right to accept or reject any or all quotations without assigning any reason whatsoever and no explanation can be sought on this account.
- d) The cement and steel required for the above work shall have to be arranged by the contractor at site.
- e) All the materials to be used are approved make and quality. Before supply of materials obtain necessary approval from the Project Engineers.

**FORM OF AGREEMENT FOR CIVIL CONSTRUCTION WORK
(On Non-judicial stamp paper of Rs.200/-)**

THIS AGREEMENT made this ----- day of ----- 20---- (Two thousand and -----
-) between Kerala Co-operative Milk Marketing Federation Ltd. A society
registered under the Kerala Co-operative Societies Act 1969 (Act 21 of 1969) and
having its registered office at Milma Bhavan, Pattom, Trivandrum 695 004 (herein
after referred to as KCMMF which expression shall, unless repugnant to the context
meaning thereof include the successors and assignees of the KCMMF) of the ONE
PART, and -----

(hereinafter referred to as the Contractor, which expression shall, unless repugnant
to the context or meaning thereof. Include the heirs successors, assignees, executors
and administrators f the contractor) of the OTHER PART.

WHEREAS the KCMMF is desirous that certain works should be executed viz., ----

----- and has by letter of acceptance dtd. -----, accepted a bid
by the Contractor for the execution. Completion and maintenance of such work.
NOW THIS AGREEMENT WITNESSTH AS FOLLOWS:

- 1.0 In this agreement words and expressions shall have the same meanings as
are respectively assigned to them in the Conditions of Contractor hereinafter
referred to

- 2.0 The following documents shall be deemed to form and be read and
constructed as a part of this agreement, viz., read and construed as a part of
this agreement viz.,
 - i. this Form of Agreement
 - ii. the Letter of Acceptance
 - iii. the said bid and Appendix
 - iv. the Technical Specifications
 - v. the Schedule of Quantities
 - vi. the Schedule of Supplementary information
 - vii. Special Conditions of Contract
 - viii. General conditions of contract
 - ix. Schedule of Materials to be issued by Owner/KCMMF
 - x. Form of Bank Guarantees

3.0 The aforesaid documents shall be taken as complementary and mutually explanatory of one another, but in the case of ambiguities and discrepancies shall take precedence of ambiguities and discrepancies shall take precedences in the order set out above

4.0 In consideration of the payment to be made by the KCMMF to the Contractor as hereafter mentioned, the Contractor hereby covenants with the KCMMF to execute, complete and maintain the works in conformity with the provisions of the contract.

5.0 The KCMMF Ltd. hereby covenants to pay the Contractor in consideration of the execution, completion and maintenance of the works the Contract Price at the times and in the manner prescribed in the Contract.

IN WITNESS WHEREOF the parties hereto have caused their respective common seals to be hereunto affixed the day, month and year first and written.

Signed, sealed and delivered for and on behalf of the within named KCMMF by the hands of its Authorized Signatory.

Authorized
Signatory
Kerala Co-operative
Milk Marketing Federation
Limited, Trivandrum.

In the presence of:

Witness:

1. Signature
Name
Address

2. Signature
Name
Address

Signed, sealed and delivered for an behalf of the within named Contractor the other part. In the presence of:

Witness

1. Signature
 Name
 Address

2. Signature
 Name
 Address

1.0 Proforma of Bank guarantee for Performance Security on Non-judicial stamp paper of Rs.200/-

Bank guarantee No.

Date:

This deed of guarantee made thisday of 2020 (Two thousand and) by (Name and address of the bank), hereinafter referred to as the bank, which shall unless repugnant to the context or the meaning thereof includes includes its legal representatives, successors and assigns and the Kerala Co-operative milk Marketing Federation (herein after referred to as the KCMMF) which expression shall unless repugnant to the context or meaning thereof include its legal representative, successors or assigns.

Where as the Kerala Co-operative milk Marketing Federation/ its clients has awarded a contract bearing numberon M/s..... (Name and address of the party), hereinafter referred to as the Contractor, for the execution, completion and the maintenance of

.....And whereas, the Contractor has agreed to submit a performance security in the form of a bank guarantee to the KCMMF as per the terms and conditions of the bidding documents and the contract which will be kept valid up to calendar months from the date of bank guarantee (the period should be till end of Period of Maintenance). And where as, the bank and its duly constituted agent and officer has already read and understood the Contact made between the KCMMF and the Contractor.

In consideration of the KCMMF having agreed to award the contract on the Contractor, we (the bank), do hereby guarantee, undertake, promise and agree with the KCMMF, its legal representatives, successors and assigns that the within named (the name of the Contractor) their legal representatives and assignees will faithfully perform and fulfill everything within the bidding document and the Contract order on their part to be performed or fulfilled, at the time (time being the essence of the contract) and in the manner therein provided, do all obligations thereunder and we further undertake and guarantee to make payment to the KCMMF a sum of Rs.....(Rupees..... only) being 5% of the Contract value, in case the Contractor, their legal representatives and assignees do not faithfully, perform and fulfill everything within the bidding document and the Contract order on their part to be performed or fulfilled, at the time and in the manner therein provided

and do not willfully and promptly do all obligations thereunder.

In case, the Contractor fails to perform or fulfill the Contract as per the terms and conditions agreed upon, the KCMMF is entitled to demand an amount equivalent to 5% of the Contract value from the Contractor and the demand made by the KCMMF itself will be conclusive evidence and proof that the Contractor has failed to perform or fulfill his obligations under the Contract and neither the Contractor nor the Bank shall be entitled to raise any dispute regarding the reasons for the failure of performance or fulfillment on any ground whatsoever.

We, (the name of the Bank), do hereby undertake to pay an amount equivalent to 5% of the Contract value, being the amount due and payable under this guarantee, without any demur, merely on a demand from the KCMMF stating that the amount claimed is due by way of non-performance of the Contractual obligations as aforesaid by the Contractor or by the reason of the Contractor's failure to perform the said contractual commitments, any such demand made on the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs..... (Rupees only) being the amount equal to 5% of the Contract value.

We, the bank, further agree that the performance security herein contained shall remain in full force and effect for a period of calendar months from the date of the bank guarantee (the period shall be till the end of Period of Maintenance) whichever is later or till the KCMMF certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said Contractor and accordingly discharge the guarantee, unless a demand or a claim under this guarantee is made on us in writing by the KCMMF on or before we shall be discharged from all liabilities under this performance security hereafter.

We, the bank further agree with the KCMMF that the KCMMF shall have the fullest liberty without or consent and without affecting in any manner our obligations hereunder to vary any of the terms and the conditions of the bidding document and the Contract or to extend the time of performance by the said Contractor from time to time or postpone for any time or from time to time and any of the power exercisable by the KCMMF against the Contractor and to forbear or enforce any of the terms and conditions relating to the said bidding document and the Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor, or for any forbearance, act or omission on the part of the KCMMF to the said Contractor by any such mater or

thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

This guarantee shall be in addition to and without prejudice to any other securities or remedies which the KCMMF may have or hereafter possess in respect of the works executed or intended to be executed and the KCMMF shall be under no obligation to marshal in favor of the bank any such securities or funds or asset that the KCMMF at its absolute discretion may vary, exchange, renew, modify or refuse to complete to enforce or assign any security or instrument.

The bank agrees that the amount hereby guaranteed shall be due and payable to the KCMMF on serving us with a notice, requiring the payment of the amount and such notice shall be deemed to have been served on the bank either by actual delivery thereof to the bank or by dispatch thereof to the bank by registered post at the address of the bank.

Any notice sent to the bank at its address by registered post shall be deemed to have been duly served on the bank notwithstanding that the notice may not in fact have been delivered to the bank.

In order to give full effects to the provisions of this guarantee the bank hereby waives all rights inconsistent with the above provisions and which the bank might otherwise as a guarantor be entitled to claim and enforce.

We,, lastly undertake not to- this guarantee during its currency except with the previous consent of the KCMMF in writing and the guarantee shall be a continuous and irrevocable guarantee up to a sum of Rs.....(Rupees) The guarantee shall remain force until and unless the guarantee is renewed or a claim is preferred against the bank within three months from the said date (the date of expiry) all rights of the KCMMF under the guarantee shall cease and the bank shall be released and discharged from all liabilities hereunder.

SIGNATURE

SEAL

PLACE

DATE

Note: The Contractor should ensure that the seal and the code no. of the signatory is put by the bankers, before submission of the bank guarantees.

ERCMPU

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CONTRACTOR

SECTION -II
TECHNICAL SPECIFICATIONS.

SECTION II

1.00 EARTHWORK

Scope

This section covers the works specification of earthwork in excavation in all kinds of soils including murrum, hard murrum, soft rock (without blasting), hard rock (without blasting), rock (with blasting), filling excavated earth in plinths, sand filling in plinth, rubble soling, and brick on edge soling.

Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

- | | | | |
|-------|---|-------------|---|
| a) IS | - | 4081 | Safety code for blasting and related drilling operations |
| b) IS | - | 1200 | Method of measurement of building works. |
| c) IS | - | 3764 | Safety code for excavation work. |
| d) IS | - | 3385 | Code of practice for measurement of Civil Engineering Works. |
| e) IS | - | 2720 | Part II Determination of moisture content. |
| | | | Part VIII Determination of moisture content dry density relation using light compaction |
| | | Part XXVIII | Determination of dry density of soils, in-place by the sand replacement method |
| | | Part XXIX | Determination of dry density of soils, in place by the core cutter method. |

Drawings

Engineer will furnish all necessary drawings showing the areas to be excavated, filled, sequence of priorities etc. Contractor shall follow strictly such drawings.

General

Contractor shall provide all tools, plants, instrument, qualified supervisory personnel, labour materials, and temporary works, consumables, any and

everything necessary, whether or not such items are specifically stated herein, for completion of the Work.

Contractor shall carry out the survey of the site before excavation and set properly all lines and establish levels for various works such as earthwork in excavation for leveling, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to establish reference/grid lines at 5m intervals or nearer as determined by Engineer based on ground profile. These shall be checked by Engineer and thereafter properly recorded.

The area to be excavated / filled shall be cleared of fences, trees, plants, logs, slumps, bush, vegetations, rubbish slush etc. and other objectionable matter. If any roots or stumps of trees are found during excavation, they shall also be removed. The material so removed shall be burnt or disposed off as directed by Engineer. Where earth fill is intended, the area shall be stripped of all loose/soft patches, top soil containing deleterious matter/ materials before fill commences.

Relics, Objects of Antiquity, etc

All gold, silver, oil minerals archeological and other findings of importance, all precious stones, coins, treasures, relics, antiquities and other similar things which may be found in or upon the site shall be the property of owner and Contractor shall duly preserve the same to the satisfaction of Owner/ERCMPU and from time to time deliver the same to such person or persons as Owner/ERCMPU may from time to time authorise or appoint to receive the same.

1.01 Earth work in excavation up to 1.50M from existing GL

A) Classification

Any earthwork will be classified under any of the following categories:-

i) All kinds of soils

These shall include all kinds containing kankar, sand, silt, moorum and/or shingle, gravel, clay, loam peat, ash, shale etc. which can generally be excavated by spade, pick-axe and shovel and which is not classified under soft and discomposed rock, and hard rock defined below. This shall also include embedded rock boulders not bigger than 1 metre in any dimension and not more than 200 mm in any one of the other two dimensions.

ii) Soft Rock

This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite etc. which are to be excavated with without blasting or could be excavated with picks, hammer, crow bars, wedges. This shall also include excavation in macadam and tarred roads and pavements. This shall also include rock

boulders not bigger than 1metre in any dimension and not more than 500mm in any one of the other two dimensions Rubble masonry to be dismantling will also be measured under this item.

iii) Hard Rock:

This shall include rock which cannot be easily excavated with pick-axes, hammer, crow bars and wedges but has to be either heated where blasting is prohibited or has to be blasted. They shall be stacked separately for measurement.

This shall comprise any rock or cement concrete or RCC, the excavation of which cannot be carried out by using mechanical/hydraulic excavators and where blasting is resorted. Architects opinion as to the particular rock requires blasting or not shall be final and binding. Any secondary blasting/breaking of blasted boulders is required will have to be carried out at site before stacking. After blasting, blasted rock capable of being lifted by hand together with spalls should be stacked at site for recording measurements. These stacks shall then be transported to various locations at site for reuse in masonry as directed by Engineer-in charge.

- (B) The earth work in excavation shall be done as per the Architect and structural consultant's drawings up to required depths and levels and alignments in all sorts of soils. The depth of the foundation will be as per the Engineer's instructions. The lining work should be done by the Contractor. Roots or trees met with during the excavation shall be cut and smeared with coal tar. Excavated earth shall be stacked at least 3m away from the trenches or as per the Engineer's instructions, so that it may not damage the sides of the excavated trenches. The sides of the excavated trenches shall be vertical and in straight line and bottom uniformly leveled watered, consolidated and ready for termite treatment. The maximum lead for stacking the earth shall be 100 m, unless otherwise categorically specified in the item description.
- (C) In firm soil if the excavation is deeper than 2m the sides of the trenches shall be made bigger by allowing steps of 50cm on either side so as to keep the slope 0.25 to 1. In loose soft or slushy soil the width of the step shall be suitably increased or the sides sloped or shoring and strutting may be done as per the Engineer's instructions.
- (D) For excavation for drain work, the sides and the bottoms should be to the required slope, shape and gradient. The cutting shall be done from top to bottom. Under no circumstances shall underdetermining or under cutting be allowed. The final surface shall be neatly leveled and well compacted. The earth from the cutting shall be directly used for filling either in plinth or on grounds.

- (E) For excavation in trenches for pipes nothing extra shall be payable for the lift irrespective of the depth unless specifically mentioned otherwise in the Schedule of Quantities.
- (F) If the trenches are made deeper than specified level due to oversight or negligence of the Contractor the extra depth shall be filled up by lean concrete of mix 1:5:10 (1 cement); 5 coarse sand and 10 coarse aggregate of nominal size 40mm) and if the trench is made wider than shown in the drawings the Contractor has to make good at his own cost. The foundation trenches shall be free from water and muck, while the foundation work is in progress.
- (G) The trenches which are ready for concreting shall be got approved by the Engineer.
- (H) The excavated stacked earth shall be refilled in the trenches and sides of foundation in 150 mm layers and the balance surplus shall be first filled in layers, in plinth and the remaining surplus shall be disposed off by uniform spreading within the site/outside the site as directed by the Engineer.
- (I) Adequate protective measures shall be taken by the Contractor to see that the excavation for the building foundation does not affect the adjoining structure's stability and safety. Contractor will be responsible if he has not taken precaution for the safety of the people, property or neighbour's property caused by his negligence during the constructional operations.
- (J) To the extent available selected surplus spoils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, sulphates, organic & other foreign material. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150mm size, mixed with properly graded fine material consisting of murum or earth to fill up the voids and the mixture used for filling.
- (K) As soon as the work in foundations has been accessed and measured, the spaces around the foundations, structures pits, trenches ,etc. shall be cleared of all debris and filled with earth in layers 15 cm to 20 cm, each layer being watered, rammed and properly consolidated before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer.
- (L) Mode of measurement for Earth work in excavation including back filling.
 - i) Lead
Lead for deposition/disposal of excavated material, shall be as specified in the respective item of work. If the lead is not specified in the respective item, a basic lead of 100 m shall be considered for quoting rates. Only leads beyond 100m shall be considered as extra lead and the contractor shall be compensated for the same. For the purpose of measurement of lead the area to be excavated or filled or area on which excavated materials is to be

deposited/disposed off shall be divided into suitable blocks and for each of the blocks, the distance between centre lines shall be taken as the lead which shall be measured, as far as practically possible, by the shortest straight line route on the plan and not the actual route taken by Contractor. No extra compensation is admissible on the grounds that the lead including that for borrowed materials had to be transported over marshy or katcha land/route.

- ii) All excavation shall be measured net. Dimensions for purposes of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, tanks, rafts or other foundations structure to be built, multiplied by the mean depth from the surface of the ground in accordance with the drawings. Excavation inside slopes shall not be paid for. Contractor may make such allowances in his rates to provide for excavation inside slopes keeping in mind the nature of the soil and safety of excavation. In soft/slushy soil or in firm soil if the excavation is deeper than 2m the slides of the trenches shall be made bigger by allowing steps of 50cm on either side so as to keep slope 0.25:1. This shall be paid as per original tender rate. However, if concreting is proposed against the additional/extra excavation made by the Contractor shall be made good by the Contractor with concrete of the same class in the foundations at his own cost.
- iii) Backfilling as per specification the side of foundations of columns, footings, structures, walls, tanks rafts, trenches etc. which excavated materials will not be paid for separately. It shall be clearly understood that the rate quoted for excavation including backfilling shall include stacking of excavated material as directed, excavation/stacking of selected stacked material, conveying it to the place of final backfill, compaction etc. as specified. As a rule material to be back filled shall be stacked temporarily the basic lead of 100 metres unless otherwise specified in the item.
- iv) The rates quoted shall also include for dumping of excavated materials in regular heaps, bunds, riprap with regular slopes as directed by Engineer within the lead specified and leveling the same so as to provide natural drainage. Rock/soil shall be laid along the centre of the heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Excavated soft rock or hard rock shall be stacked separately.
- v) The bailing out of water shall also be executed by the contractor at his own cost.

1.02 Earth work in excavation for depth exceeding 1.50 M but not exceeding 3.0 M

The general specification shall be same as for the item 1.01 given above.

1.03 Earth work in excavation for depth exceeding 3.0M but not exceeding 4.5 M

The general specification shall be same as for the item 1.01 given above.

1.04 Earth work in excavation in rocks up to 1.50 M from GL

- (A) Unless otherwise stated herein, IS 4081, safety code for blasting and related drilling operations shall be followed. After removal of over burden, if any, excavation shall be continued in rock to such widths, lengths, depths and profiles as are shown on the drawings or such other lines and grades as may be specified by Engineer. As far as possible all blasting shall be completed prior to commencement of construction. At all stages of excavation, precautions, shall be taken to preserve the rock below and beyond the lines specified for the excavating, in the soundest possible condition. The quantity and strength of explosive used shall be such as will neither damage nor rack the rock outside the limits of excavation. All precautions, as directed by Engineer shall be taken during the blasting operations and care shall be taken that no damage is caused to adjoining buildings or structure as a result of blasting operations. In case of damage to permanent or temporary structures, Contractor shall repair the same to the satisfaction of Engineer at his cost. As excavation approaches its final lines and levels, the depth of the charge holes and amount of explosives used shall be progressively and suitably reduced.
- (B) Specific permission of Engineer will have to be taken by Contractor for blasting rock and he shall also obtain a valid blasting license from the authorities concerned. If permission for blasting is refused by Engineer, the rock shall be removed by wedging, pick barring, heating and quenching or other approved means. All loose /loosened rock in the sides shall be removed by barring wedging, etc. The unit rates for excavation in hard rock shall include the cost of all these operations.
- (C) Contractor shall obtain necessary license for storage of explosives fuses and detonators issued to him from Owner's stores or from a supplier arranged by the Contractor, from the authorities dealing with explosives. The fees, if any, required for obtaining such license, shall be borne by Contractor. Contractor shall have to make necessary storage facilities, for the explosives etc. as per rules and regulations of local, State and Central Govt. authorities and Statutory bodies. Explosives shall be kept dry and shall not be exposed to direct rays of sun or be stored in the vicinity of fire, stoves, steam pipes or heated metal, etc. No explosive shall be brought near the work in excess of quantity required for a particular amount of firing to be done and surplus left after filling the holes shall be removed to the magazine. The magazine shall be built as far as possible from the area to be

blasted. Engineer's prior approval shall be taken for the location proposed for the magazine.

(D) In no case shall blasting be allowed closer than 30 meters to any structure or to locations where concrete has just been placed. In the latter case the concrete must be at least 7 days old.

(E) For blasting operations, the following points shall be observed:-

- i) Contractor shall employ a competent and experienced supervisor and licensed blaster in charge for each set of operation, who shall be held personally responsible to ensure that all safety regulations are carried out.
- ii) Before any blasting is carried out, Contractor shall intimate Engineer and obtain his approval in writing for resorting to such operations. He shall intimate the hours of firing charges, the nature of explosive to be used and the precautions taken for ensuring safety.
- iii) Contractor shall ensure that all workmen and the personnel at site are excluded from an area within 200M radius from the firing point, at least 15 minutes before firing time by sounding warning siren. The areas shall be encircled by red flags. Clearance signal shall also be given sounding a distinguishing siren.
- iv) The blasting of rock near any existing buildings, equipment or any other property shall be done under cover and Contractor has to make all such necessary muffling arrangements. Covering may preferably be done by MS plates with adequate dead weight over them. Blasting shall be done with small charges only and where directed by Engineer, a trench shall have to be cut by chiseling prior to the blasting operation separating the area under blasting from the existing structures.
- v) The firing shall be supervised by a Supervisor and not more than six (6) holes at a time shall be set off successively. If the blasts do not tally with the number fired, the misfired holes shall be carefully located after half an hour and when located, shall be exploded by drilling a fresh hole along with misfired hole (but not nearer than 600mm from it) and by exploding a new charge.
- vi) A wooden tamping rod with a flat end shall be used to push cartridges home and metal rod or hammer shall not be permitted. The charges shall be placed firmly into place and not rammed or pounded. After a hole is filled to the required depth the balance of the hole shall be filled with stemming which may consist of sand or stone dust or similar inert material.
- vii) Contractor shall preferably detonate the explosives electrically.
- viii) The explosive shall be exploded by means of a primer which shall be fired by detonating a fuse instantaneous detonator (FID) or other approved cables. The detonators with FID shall be connected by special nippers.

- ix) In dry weather and normal dry excavation, ordinary low explosive gunpowder may be used. In damp rock, high explosive like gelatin with detonator and fuse wire may be used. Under water or for excavation in rock with substantial accumulated seepage electric detonation shall be used.
- x) Holes for charging explosive shall be drilled with pneumatic drills, the drilling pattern being so planned that rock pieces after blasting will be suitable for handling without secondary blasting.
- xi) When excavation has almost reached the desired level, hand trimming shall have to be done for dressing the surface to the desired level. Any rock excavation beyond an over break limit of 75mm shall be filled up as instructed by Engineer, with concrete of strength not less than M10. The cost of filling such excess depth shall be borne by Contractor and the excavation carried out beyond the limit specified above will not be paid for. Stepping in rock excavation shall be done by hand trimming.
- xii) Contractor shall be responsible for any accident to workmen, public or owner's property due to blasting operations. Contractor shall also be responsible for strict observance of rules, laid by Inspector of explosives, or any other Authority duly constituted under the State and/or Union Government.
- xiii) Mode of Measurement:

Volume of rock excavated shall be calculated on the basis of length, breadth and depth of excavation indicated on the drawings. No payment will be made for excavations/over break beyond payment line specified, wherever such measurement is not possible, as in case of stratas intermixed with soil, excavated rock shall be properly stacked as directed by Engineer and the volume of rock shall be calculated on the basis of stack measurements after making 40% allowance for voids. The measurement of the earth work shall be paid as per the drawing or the requirements of the site as approved by the Engineer.
- xiv) The rate quoted for excavation shall include the following jobs:
 - a) Refilling of the trenches and consolidating and spreading as per the Engineer's directions.
 - b) Shoring and strutting as demanded by the site conditions and as instructed by the Engineer.

1.05 Earth work in excavation in rocks depth exceeding 1.50M but not exceeding 3.0M.

The general specification is same as item No.1.04.

1.06 Filling in plinth with selected excavated earth

- (A) Plinth above in layers 15-30 cm, watered and compacted with mechanical compaction machines. The base surface shall be cleared of vegetation by up-rooting or any organic matter, prior to commencement of filling operation. When filling reaches the finished level, the surface shall be flooded with water, if directed by the Engineer, for at least 24 hours, allowed to dry and then the surface again compacted as specified above to avoid settlements at a later stage. The finished level of the filling shall be trimmed to the level/slope specified.
- (B) Where specified in the item description given in the Schedule of Quantities that the compaction of the plinth fill shall be carried out by means of 10/12 tonnes rollers smooth wheeled, sheep-foot or wobble wheeled rollers. As rolling proceeds water sprinkling shall be done to assist consolidation. Water shall not be sprinkled in case of sandy fill.
- (C) Mode of Measurement
Payment for filling in plinth with selected excavated material will be made as specified/directed. Payment for this work will be made based on measurement of plinth/dimensions filled. The plinth/ground levels shall be surveyed before hand for this purpose. The lead shall be 100M or as specified in the schedule of quantities. It shall be measured in cum.

1.07 Filling in plinth with selected earth for lead exceeding 100m but not exceeding 300m.

The general specification is same as item No.1.06.

1.08 Filling excavated earth in ground for land development

- (A) No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by Engineer.
- (B) Filling shall be carried out as indicated in the drawings and as directed by Engineer. If no compaction is called for, the fill may be deposited to the full height in one operation and leveled. If the fill has to be compacted, it shall be placed in layers not exceeding 600mm and leveled uniformly and compacted before the next layer is deposited.
- (C) Field compaction is called for, test shall be carried out at different stages of filling and also after the fill to the entire height has been completed. This shall hold good for embankment as well.
- (D) Contractor shall protect the earth fill from being washed away by rain or damaged in any other way. Should any slip occur, Contractor shall remove the affected material and make good the slip at his own cost.
- (E) The fill shall be carried out to such dimension and levels as indicated on the drawings after the stipulated compaction. The fill shall be considered as

incomplete if the desired compaction has not been obtained.

(F) Mode of Measurement

It shall be measured in cum. The rate shall include all operations such as lead and transport, filling and consolidating as directed.

1.09 Filling in plinth and ground with earth brought from outside

(A) Filling shall be carried out with approved material as described in 1.01 (J). The material and source shall be subject to prior approval of Engineer. The approved area, from where the fill material is to be dug, shall be cleared of all bushes, roots plants, rubbish etc. top soil containing salts, sulphate and other foreign material shall be removed. The materials so removed shall be burnt or disposed off as directed by Engineer. The Contractor shall make necessary access roads to those areas and maintain the same, if such access road does not exist, at his cost.

(B) If any material is rejected by Engineer, Contractor shall remove the same forthwith from the site at no extra cost to the owner. Surplus fill material shall be disposed off by uniform spreading within the site as instructed by the Engineer.

(C) The compaction shall be carried out as specified in the item no.1.06 for filling in plinth and as per item No.1.08 for filling in ground for land development.

(D) Mode of Measurement

Backfilling, plinth filling etc. with borrowed earth will be paid for under specified items. The quoted rate shall include all operations such as clearing, excavation, lead and transport, fill, compaction etc. as specified. Actual quantity of consolidated filling or actual quantity of excavation in the borrow pits (less such top soil which has been excavated and not used for filling) whichever is less shall be measured and paid for in cubic metres. The lead, lift etc. shall be as indicated in the schedule of quantities.

1.10 Providing and filling local sand in trenches, plinth and surrounding areas

(A) At places backfilling shall be carried out with local sand if directed by Engineer. The sand used shall be kept flooded with water for 24 hours to ensure maximum consolidation. Any temporary work required to contain sand under flooded condition shall be to Contractor's account. The surface of the consolidated sand shall be dressed to require level or slope. Construction of floors or other structures on sand fill shall not be started until Engineer has inspected and approved the fill.

(B) Mode of measurement

Actual quantity of consolidated sand filling shall be measured and paid in cubic metres.

1.11 Providing and laying rubble Rubble soling

(A) Rubble used for packing under floors, foundations etc. shall be hard, durable, rock, free from veins, flaws and other defects. The size of the rubble shall be 100 mm – 150mm unless otherwise specified in the item description in the Schedule of Quantities and the quantity shall be got approved by the Engineer.

(B) Rubble shall be laid closely in position on the sub-grade. All interstices between the stones shall be wedged in with smaller stones of suitable size well driven to ensure tight packing and complete filling of interstices. Such filling shall be carried out simultaneously with the placing in position of rubble stone and shall not lag behind.

(C) Small interstices shall be filled with murrum, well watered and rammed.

(D) Mode of Measurement

The unit of measurement shall be sq. m/cum of the work done as per the drawings

and /or as specified in the Schedule of Quantities.

1.12 Brick Soling

A) Bricks shall be laid on edge or flat as per the item specification. The bricks shall be placed as close as possible. Broken bricks shall not be used except for closing the line. Bricks should not show any efflorescence on drying.

The under layer be dressed/leveled in required slope/grade and compacted with mechanical compactor roller with a layer of sand as per detail. Sand fill of specified thickness as per the details shall be measured and paid under relevant item separately.

B) The soling pattern shall be as specified in the item specification, it can be plain, diagonal or herring-bone. Suitable slope shall be maintained as specified by the Engineer.

C) The joints shall be filled with earth or sand as specified if it is to be filled with cement mortar, the proportion of the mortar shall be as specified in the item specification.

D) Mode of measurement

This item shall be measured in sqm of work done as per the drawings/directed by the Engineer. No deduction shall be made for any opening up to 0.1 sqm.

1.13 Providing and laying dry stone pitching.

A) Stone subject to marked deterioration by water or weather will not be accepted. The stone shall be hard, durable and fairly regular in shape and its thickness in any one direction shall not less than the thickness of the pitching as specified in the Schedule of Quantities.

B) Before laying the pitching the sides of the sloped surface shall be trimmed to the required slope and profiles. The depressions shall be thoroughly filled and compacted. It shall commence from the bottom. The stones shall be placed normal to the slope and the largest dimension is perpendicular to the face of the slope unless such dimension is more than the thickness of the pitching. The largest stones shall be placed at the bottom. The joints between the stones shall be filled with good earth. The earth shall be got approved by the Engineer before filling.

C) Mode of measurement It shall be measured in sq.m. The rate shall include preparation of base, providing and laying of stones and filling up of joints with approved good earth.

1.14 Providing and laying dry stone pitching with cement pointing

The general specification shall be same as the item No. 1.13 but for the joints between the stones shall be filled with cement mortar of proportion as specified in the item description in the Schedule of Quantities.

A) Mode of Measurement

Same item 1.13 but in this the rate includes the pointing also.

1.15 Providing and Filling dry brickbats at all levels

The brickbats shall be of 40-65mm (average) thickness in size. The brickbats shall be clean and mortar free. They should be washed off dust before it is filled. They shall be filled in places as directed by the Engineer. The brick bats for filling in soak pits or trenches shall be uniform in size without dust.

Mode of Measurement

The bulk volume of the filling shall be measured in cum, No deduction shall be made for voids.

Providing & laying single layer flat brick soling

Providing and laying single layer flat brick soling with approved quality well burnt

(having crushing strength of 50Kg per Sqcm) or over burnt bricks including laying bricks in plain/diagonal/herring bone pattern filling the joints with local sand as per general specifications of item no. 1.12 etc complete.

Mode of Measurement

This item shall be measured in sq.m. of work done as per the drawings/directed by the Engineer. No deduction shall be made for any opening up to 0.1.

Carting away earth outside the site

Carting away the excavated surplus earth/debris generated out of dismantling of brick work/concrete as specified in the schedule of the quantities outside of the site including loading at site, transportation, unloading, spreading etc complete as directed.

Mode of measurement

Quantity carted away shall be measured in Cum.

Length, breadth and depth of the pit shall be measured where full quantity of excavated earth is carted away.

OR

80% fill measurement of earth/debris in truck shall measured and paid for.

Contractor shall maintain fill record of measurement and the quantities in respect of total quantity of earth work in excavation, quantity back filled in trenches/pits after laying concrete/masonry foundations etc and quantity of surplus earth carted away and the same to reconciled intermittently during execution.

Supplying the chemicals and carrying out pre-construction Anti - termite treatment.

Supplying the chemicals and carrying out pre-construction Anti – termite treatment at the various stages of construction as per IS/and as recommended by the chemical manufacturer to safeguard the building against termite including execution and submission of guarantee for a period of Ten years. This work is to be got, executed through Pest Control (India) Ltd as per their specifications or an approved equivalent specialized agency.

For anti termite treatment chemicals used – CHLOROPYRIPHOS 20 EC @1% concentration in aqueous emulsion. At DPC level (if DPC is done) or over masonry course, 5 litre per SqM emulsion to be applied. The junction of wall and plinth (after completion of each filling) to be done @ 1 litre per Rmt including

rodding for better spreading. 5 litre per sqm emulsion to be applied over filling after compaction. Finally the earth around the external perimeter of building up to depth of 30cm shall be treated @ 5 litres per Rmt including making holes and forcing liquid. Critical areas such as openings around pipes, cable trench etc to be soaked with chemical emulsion.

Note: Contractor shall submit detailed specification of the chemical and application procedure along with their offer.

Mode of measurement

Building area in plan shall be measured in Sqm. Based on the treatment provided (No co-efficient shall be applied).

1.16 Earth work excavation in soft rocks up to 1.5 m depth.

General specifications shall be same as for item 1.01 and 1.01 (ii)

1.17 Earth work excavation in soft rocks depth exceeding 1.5 m but not exceeding 3M.

General specification shall be same as for item No.1.01 and 1.01 (ii)

1.18 Earth work in excavation for depth exceeding 4.5 M but not exceeding 6 M

General specification shall be same as for item No.1.01 including charges for shoring strutting bailing/pumping etc. as directed.

SECTION II

2.00 CONCRETE WORK

I **Applicable Codes**

The following codes and standards are made a part of the Specifications. All standards, codes or practices referred to herein shall be the latest edition

including all applicable official amendments and revisions.

In case the discrepancy between this specification and those referred to herein, this specification shall prevail

(a) **Materials:**

S. No.	Code	Specifications
1	IS 269	Specification for ordinary, rapid hardening and low heat Portland Cement
2	IS 455	Specification for Portland blast furnace slag
3	IS 1489	Specification for Portland pozollana cement
4	IS 4031	Methods of physical tests for hydraulic cement
5	IS 650	Specification for standard sand for testing of cement
6	IS 383	Specification for coarse and fine aggregates from natural sources for concrete
7	IS 2386 (Part I to VIII)	Methods of test for aggregates for concrete
8	IS 516	Methods of test for strength of concrete
9	IS 1199	Methods of sampling and analysis of concrete
10	IS 2396 (I) IS 5640	Flakiness Index of aggregates
11	IS 3025	Methods of sampling and test (Physical and chemical water used in industry)
12	IS 432 (Part I & II)	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
13	IS 1139	Specification for hot rolled mild steel and medium tensile steel deformed bars for concrete reinforcement
14	IS 1566	Specification for plain hard drawn steel wire fabric for concrete reinforcement

S. No.	Code	Specifications
15	IS 1785	Specification for plain hard drawn (Part I) steel wire for pre-stressed concrete
16	IS 1786	Specification for cold twisted steel bars for concrete reinforcement
17	IS 2090	Specification for high tensile steel bars used in prestressed concrete
18	IS 4990	Specification for plywood for concrete shuttering work
19	IS 2645	Specification for integral cement water-proofing compounds

(b) Equipment:

S. No.	Code	Specifications
1	IS 1791	Specification for batch type concrete mixer
2	IS 2438	Specification for roller pan mixer
3	IS 2505	Specification for concrete vibrators immersion type
4	IS 2506	Specification for screed board concrete vibrators
5	IS 2514	Specification for concrete vibrating tables
6	IS 3366	Specification for pan vibrators
7	IS 4656	Specification for form vibrators for concrete
8	IS 2722	Specification for portable swing weigh-batchers for concrete (single and double bucket type)
9	IS 2750	Specification for steel scaffoldings

(c) Code of Practice:

S. No.	Code	Specifications
1	IS 456	Code of practice for plain and reinforced concrete
2	IS 1343	Code of practice for prestressed concrete
3	IS 457	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures

4	IS 3370 (Part I to IV)	Code of practice for concrete structures for storage of liquids
5	IS 3935	Code of practice for composite construction
6	IS 3201	Criteria for design and construction of precast concrete trusses
7	IS 2204	Code of practice for construction of reinforced concrete shell roof
8	IS 2210	Criteria for the design of RC shell structures and folded plates
9	IS 2751	Code of practice for welding of mild steel bars used for reinforced concrete construction
10	IS 2502	Code of practice for bending and fixing of bars for concrete reinforcement
11	IS 3558	Code of practice for use for immersion vibrators for consolidating concrete
12	IS 3414	Code of practice for design and installation of joints in buildings
13	IS 4014 (Part I&II)	Code of practice for steel tubular, scaffolding
14	IS 2571	Code of practice for laying insitu-cement concrete flooring

(d) Construction Safety

S. No.	Code	Specifications
1	IS 3696	Safety code for scaffolds and ladders

(e) Measurement

S. No.	Code	Specifications
1	IS 1200	Method of measurement of building works
2	IS 3385	Code of practice for measurement of civil engineering works

The above mode of measurements shall be applicable only it is not given specifically in the tender document.

II **General**

The quality of materials, methods and control of manufacture and transportation of all concrete work irrespective of mix, whether reinforced or otherwise shall conform to the applicable portions of this specifications.

Engineer shall have the right to inspect the source/s of material/s, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and Engineer's approval obtained, prior to starting of concrete work.

III **Materials**

The ingredients to be used in the manufacture of standard concrete shall consist solely of standard type Portland cement, clean sand, natural coarse aggregate, clean water and admixtures.

(A) Cement

a) If the Contractor is instructed to supply cement, then the following points shall be applicable:

i. Unless otherwise specified the cement shall be ordinary portland cement in 50Kg bags. The use of bulk cement will be permitted only with the approval of Engineer.

ii. A certified report attesting to the conformance of the cement, to IS specifications by the cement manufacturer's chemist shall be furnished to Engineer if demanded.

iii. Cement held in storage for a period of ninety (90) days or longer shall be tested. Should at any time Engineer have reasons to consider that any cement is defective, then irrespective of its origin, and/or manufacturers test certificate, such cement shall be tested immediately at contractor's cost at a National Test Laboratory/approved laboratory and until the results of such tests are found satisfactory, it shall not be used in any work. Contractor shall not be entitled to any claim of any nature on this account.

A cement stores shall be constructed and maintained as detailed under (b) (i) here under for storing specified quantity of cement for the project.

(B) If the cement is supplied by the ERCMPU

i) Contractor will have to make his own arrangements for the storage of minimum 250 MT of cement. If supplies are arranged by owner, cement

will be issued in quantities to cover work requirements of one month or more, as deemed fit by Engineer and it will be the responsibility of contractor to ensure adequate and proper storage. Cement in bulk may be stored in bins or silos which will provide complete protection from dampness contamination and minimise caking and false set. Cement bags shall be stored in a dry enclosed shed (storage under tarpaulins will not be permitted), well away from the outer walls and insulated from the floor to avoid contact with moisture from ground and so arranged as to provide ready access damaged or reclaimed or partly set cement will not be permitted to be used and shall be removed from the site. The storage bins and storage arrangements shall be such that there is no dead storage. Not more than 12 bags shall be stacked in any tier. The storage arrangement shall be approved by Engineer. Consignments of cement shall be stored as received and shall be consumed in the order of their delivery.

(C) Aggregates

- a) Aggregate in general designates both fine and coarse inert materials used in the manufacture of concrete. Fine aggregate is aggregate all of which passes through 4.75mm IS sieve. Coarse Aggregate is aggregate most of which is retained on 4.75mm sieve.
- b) All fine and coarse aggregates proposed for use in the work shall be subject to Engineer's approval and after specified materials have been accepted the source of supply of such materials should not be changed without prior approval of Engineer.
- c) Aggregates shall, except as noted above, consist of natural sands, crushed stone and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, durable against weathering, may cause corrosion of the reinforcement or may impair the strength and/or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the mix design and preliminary tests on concrete specified later.
- d) Sampling and Testing
Samples of the aggregates for mix design and determination of suitability shall be taken under the supervision of Engineer and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests which have been made on proposed aggregates and on concrete made from this source of aggregates shall be furnished to Engineer in advance of the work for use in determining aggregate suitability. The costs of all such tests, sampling etc. shall be borne by contractor.

e) Storage of Aggregates

All coarse and fine aggregates shall be stacked in stock separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign materials and with earth during storage and while heaping the materials shall be avoided. The aggregate must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Rackers shall be used for lifting the coarse aggregates from bins or stock piles. Coarse aggregate shall be piled in layers not exceeding 1.20 meters in height to prevent coning of segregation. Each layer shall cover the entire area of the stock pile before succeeding layers are started. Aggregates that have become segregated shall be rejected.

f) Specific Gravity

Aggregate except as noted above, and for other than light weight concrete shall consist of natural or crushed sand shall be conform to IS 383. The sand shall be clean sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, alkali, organic matter, mica, salt or other deleterious substances, which can be injurious to the setting qualities/strength/durability of concrete.

C) Machine made sand

Machine made sand will be acceptable, provided the constituent rock/gravel composition shall be sound, hard dense, non-organic uncoated and durable against weathering.

i) Screening and Washing

Sand shall be prepared for use for such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fractions.

ii) Foreign material Limitations

The percentages of deteriorious substances in sand delivered to the mixer shall not be exceed the following:

i.	Material finer than 75 micron IS sieve	3.00	15.00
ii.	Shale	1.00	-
iii.	Coal and lignite	1.00	1.00
iv.	Clay lumps	1.00	1.00
v.	Total of all above substances including items (i) to (iv) for uncrushed sand and items (iii) and (iv) for crushed sand	5.00	2.00

iii) Gradation

Unless otherwise directed or approved, the grading of sand shall be within the limits indicated here under:

IS Sieve Designation	Percentage passing for			
	Grading Zone I	Grading Zone II	Grading Zone III	Grading Zone IV
10 mm		100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 micron	15-34	35-59	60-79	80-100
300 micron	5-20	8-30	12-40	15-50
150 micron	0-10	0-10	0-10	0-15

Where the grading falls outside the limits of any particular grading zone of sieves other than 600 micron IS sieve, by total amount not exceeding 5 percent, it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600 micron IS sieve or to percentage passing any other sieve on the coarser limit of grading zone I or the final limit of grading zone IV.

iv) Fineness Modulus

The sand shall have a fineness modulus of not less than 2.2 or more than 3.2. The fineness modulus is determined by adding the cumulative percentages retained on the following IS sieves sizes 4.75mm, 2.36 mm, 1.18mm 600 micron, 300 micron and 150 micron and dividing the sum by 100.

D) Coarse Aggregate

- a) Coarse aggregate for concrete, except as noted above and for other than lightweight concrete shall conform to IS 383. This shall consist of natural or crushed stone and gravel and shall be clean and free from elongated, flaky or laminated pieces adhering coatings, clay lumps, coal residue, clinkers slag, alkali, mica, organic matter or other deleterious matter.

b) Screening and washing

Natural gravel and crushed rock shall be screened and/or washed for the removal of dirt or dust coating, if so demanded by Engineer.

c) Grading

Coarse aggregate shall be graded in both cases the grading shall be within the following limits.

Sieve Designation	% Passing for single sized aggregate of nominal size mm					% Passing for graded aggregate of nominal size mm			
	40	20	16	12.5	10	40	20	16	12.5
63mm	100	..	..	..	..	100	..	..	..
40mm	85-100	100	..	..	..	95-100	100	..	..
20mm	0-20	85-100	100	..	..	30-70	95-100	100	..
16mm	..	..	85-100	100	..	..	..	90-100	..
12.5mm	..	..	..	85-100	100	..	..	..	90-100
10mm	0.5	0-20	0-30	0-45	85-100	10-35	25-55	30-70	40-85
4.75mm	..	0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36 mm	..	..	..	..	0-5	..	..	..	.

The pieces shall be angular in shape and shall have granular or crystalline surfaces, friable, flacky and laminated pieces, mica and shale, if present, shall be only in such quantities that will not, in the opinion of engineer affect adversely the strength and/or durability of concrete. The maximum size of coarse aggregate shall be 75 mm for class A concrete 40 mm for class B concrete and 20 mm for class C concrete. The maximum size of coarse aggregate shall be the maximum size specified above, but in no case greater than $\frac{1}{4}$ of the minimum thickness of the member, provided

that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. Plums above 150 mm and up to any reasonable size can be used in plain mass concrete work of large dimensions up to a maximum limit of 20% of volume of concrete when specifically approved by Engineer. For heavily reinforced concrete members the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5 mm less than the minimum cover to the reinforcement whichever is smaller. The amount of fine particles occurring in the free state or as loose adherent shall not exceed 1% when determined by laboratory sedimentation tests as per IS 2386 after 24 hours immersion in water, a previously dried sample shall not have gained more than 10% of its oven dry weight in air, as determined by IS 2386.

d) Foreign Materials Limitations

The percentages of deleterious substance in the coarse aggregate delivered to the mixer shall not exceed the following

		<u>Percent by weight</u>	
		<u>Uncrushed</u>	<u>Crushed</u>
i)	Material finer than 75 micron IS siever	3.00	3.00
ii)	Coal and lignite	1.00	
	1.00		
iii)	Clay lumps		1.00
	1.00		
iv)	Soft fragments	3.00	
	-		
v)	Total of all the above substances	5.00	5.00

(E) Water

a) Water used for both mixing and curing shall be free from injurious amounts of deleterious materials. Portable waters are generally satisfactory for mixing and curing concrete.

Water used for both mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel.

b) In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS-456 the

sample of water taken for testing shall be typical for the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

c) Average 28 days compressive strength for at least three 15 cm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water.

d) The initial setting time of test block made with the appropriate set cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than plus minus 30 seconds from the initial setting time of control test block prepared with the appropriate test cement and distilled water. The test blocks shall be prepared and tested in accordance with the requirements of IS 4031.

e) Where water can be shown to contain an excess of acid, alkali sugar or salt, engineer may refuse to permit its use. As a guide, the following concentrations, represent the maximum permissible values:

- i) To neutralize 200 ml sample of water, using phenolphthalein as indicator, it should not require more than 2 ml of 0.1 normal NaOH. The details of test shall be as given in IS 3025.
- ii) To neutralize 900 ml sample of water using methyl orange as an indicator, it should not require more than 10 ml of 0.1 normal HCl. The details of test shall be given in IS 3025.
- iii) Percentage of solids when tested in accordance with the method indicated below shall not exceed the following:

	<u>Percent</u>	<u>Method of test (Ref. to clause no in IS 3025-1964)</u>	
Organic solids = total	0.02	10 and 11 (organic)	
Solids minus ignited residue)			
Inorganic sulphate (as SO ₄)	0.30	11 (ignited residue)	
Alkali Chlorides (as Cl)	0.05	20	
		0.10	24
ERCMPU	40	CONTRACTOR	

Permissible limit for solids shall be as given in Table I given below:

Sl. (max)		Tested as per	Permissible limit
No.			
i)	Organic	IS 3025 (Part 18)	200mg/1
ii)	Inorganic	IS 3025 (Part 18)	3000mg/1
iii)	Sulphates (as SO ₃)	IS 3025 (Part 24)	400mg/1
iv)	Chlorides (as Cl)	IS 3025 (Part 32)	2000mg/1 for concrete not containing embedded steel and 500mg/1 for reinforced concrete work.
v)	Suspended matter	IS 3025 (Part 17)	2000mg/1

- In case of doubt regarding development of strength, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time tests specified in c) and d) given above.
- The sample of water taken for testing shall represent the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.
- The pH value of water shall be not less than 6.
- Water found satisfactory for mixing is also suitable for curing concrete. However, water used for curing should not produce any objectionable stain or unsightly deposit on the concrete surface. The presence of tannic acid or iron compounds is objectionable.

(F) Brick aggregates

The brickbats shall be of new bricks well burnt, hard durable and broken to sizes, well graded. It shall be free from dust. The size shall be of 37 mm and down. It shall be free from earth and other impurities.

(G) Reinforcement steel

a) Reinforcement bars, if supplies are arranged by contractor, shall be either plain round mild steel bars grade I as per IS 432 (Part I) or medium tensile steel bar as per IS 432 (Part I) or hot rolled mild steel and medium tensile steel deformed bars as per IS 1139 or cold twisted steel bars as per IS 1786, as shown and specified on the drawings. Wire mesh or fabric shall be in accordance with IS 1566 substitution of

reinforcement will not be permitted except upon written approval from Engineer.

b) Plain round mild steel bars grade II as per IS 432 (Part I) may be used with prior approval of Engineer in writing and with 10% increase in the reinforcement area but its use shall not be permitted in structures located in earthquake zones subjected to severe damage (as per IS:1895) and for structures subject to dynamic loading (other than wind loading), such as frames supporting rotary or reciprocating machinery etc.

c) All reinforcement shall be clean, free from grease, oil, paint, loose mill scale, loose rust, dust, bituminous material or any other substances that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated. Pitted and defective rods shall not be used.

2.01 Providing and laying Brickbat cement concrete 1:4:8 (1 cement, 4 coarse sand, 8 brickbats of size 37 mm and down)

The brick bats, sand and cement shall be of quality as described in the materials section above. The materials shall be mixed in volumetric proportions in concrete mixer only. The concrete shall be laid in layers of 150mm thick and well consolidated with rammer of weight 4.5 to 5.5 kg steel rammers of base area 300 sqcm till slurry comes on top before the next layer is laid. Curing shall be done for 7 days. For joints the edge of the concrete shall be finished off with a slope not steeper than 2:1 and well roughened.

Mode of Measurement

This shall be measured in cum and part thereof. The bed concrete provided for flooring shall be paid for under this item. The rate shall include cost the shuttering to be provided.

2.02 Providing and laying brickbat cement concrete 1:5:10 (1 cement, 5 coarse sand, 10 brickbats of size 37 mm and down).

The General specification is same as for item no.2.01 but for the volumetric proportion of the sand and brickbats is 5 and 10 instead of 4 and 8 respectively

2.03 Providing and laying plain cement concrete 1:4:8 (1 cement: 4 coarse sand, 8 graded stone aggregate of nominal size 37 mm and down)

The coarse aggregate, cement and coarse sand shall be of quality as specified in the materials section. The other procedures are same as that specified in item No.2.01

2.04. Providing and laying plain cement concrete 1:3:6 (1 cement:3 coarse sand, 6

graded stone aggregate of nominal size 37 mm and down

-Do- Same as per item No.2.03 but for the volumetric proportions of the coarse sand and the stone aggregate which shall be 3:6 instead of 4:8.

2.05 Providing and laying RCC of mix M 15 for structures up to plinth

level Mix

Design

a) All concrete in the works shall be of design mix as defined in IS 456, unless it is a nominal mix concrete such as 1:3:6, 1:4:8 or 1:5:10. Whether reinforced or otherwise, all design mix concrete works to be carried out under this specification shall be divided into the following classifications:

Minimum Compressive Strength of 15cm Cubes at 7 and 28 days after mixing, Conducted in Accordance with IS 516

Class	Preliminary test N/Sqmm		Work test N/Sqmm		Max.size of aggregate mm	Minimum cement content per cum
	At 7 days	At 28 days	At 7 days	At 28 days		
M40	35.0	54.0	27.0	46.0	20	550 Kg
M35	31.0	45.0	23.5	39.0	20	470 Kg
M30	28.0	42.0	20.0	33.0	40 or 20	420 Kg
M25	23.5	35.0	17.0	28.0	40 or 20	370 Kg
M20	19.4	29.0	13.5	22.0	40 or 20	320 Kg
M15	14.0	17.0	10.0	16.0	40 or 20	300 Kg

- b) It shall be very clearly understood that whenever the class of concrete such as M20 is specified it shall be the contractor's responsibility to ensure that minimum crushing strength stipulated for the respective class of concrete is obtained at works. The maximum total quantity of aggregate by weight per 50 kg of cement shall not exceed 450 kg except when otherwise specifically permitted by Engineer.
- c) To fix the grading of aggregates, water cement ratio, workability and the quantity of cement required to give preliminary and works cubes of the minimum strength specified, the proportions of the mix shall be determined by weight/volume. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Mix proportioning shall be carried out according to Indian Standard specifications.
- d) Whenever there is a change either in required strength of concrete or water cement ratio or workability or the source of aggregates and/or

cement, preliminary tests shall be repeated to determine the revised proportions, of the mix to suit the altered conditions.

- e) While fixing the value for water cement ratio for preliminary mixes, assistance may be derived from the graph (appendix IS 456 showing the relationship between the 28 day compressive strengths of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with IS 269.
- f) If the contractor is intending to use Ready Mixed Concrete (RMC), shall get approval of the Engineer/Owner/Architect before placing RMC into the structure/permanent work. Stages of approval start from the particular grade of concrete, source of concrete and its constituents with necessary mentioned tests, No of trial mixes, Cube test results (the test results of concrete for 7 days and 28 days strength should be reported by the supplying firm independently apart from field tests at site) etc, as per the relevant IS Codes and as per the Engineer's requirements at any stage, without any extra cost implication to the Contract in any manner either for supply, testing, placing concrete in to place with all necessary material, labour, plant and equipments, safety measures and any statutory duties, taxes, other liabilities in this regard. Contractor must ensure that the RMC should be placed in position within 2 1/2 hours from loading of concrete into transit mixer. Relevant documents like trip sheet should sent along with each mix. Contractor must ensure that the minimum cement content for particular grade shall follow as specified in technical specification. Testing of RMC (fresh/hardened) shall comply relevant IS Codes (IS 4926:1976 reaffirm 1990).

Preliminary test

- a) Test specimens shall be prepared with at least two different water/cement ratios for each class of concrete, consistent with work ability required for the nature of the work. The materials and proportions used in making preliminary tests shall be similar in all respects to those to be actually employed in the works as the object of these tests is to determine the proportions of cement, aggregates and water necessary to produce concrete of required consistency and to give the specified strength. It will be the contractor's sole responsibility to carry out these test and he shall therefore furnish to Engineer a statement of proportions proposed to be used for the various concrete mixes.
- b) Materials shall be brought to the room temperature and all materials shall be in a dry condition. The quantities of water, cement and aggregates for each mix shall be determined by weight/volume to an accuracy of 1 part in 1000 parts.
- c) Mixing shall be done by a mixer machine as per IS 516 in such a manner as to avoid loss of water. The cement and fine aggregate shall first be mixed dry until the mixture is uniform in colour. The coarse aggregate shall then be added, mixed and

water added and mixed thoroughly for a period of not less than 3 minutes until the resulting concrete is uniform in appearance. Each mix of concrete shall be of such quantity as to leave about 10% excess concrete after moulding the desired number of test specimens.

d) The consistency of each mix of concrete shall be measured immediately after mixing, by the slump test in accordance with IS 1199. If in the slump test, care is taken to ensure that no water or other materials is lost, the materials used for the slump test may be remixed with the remainder of the concrete for making the specimen test cubes. The period of remixing shall be as short as possible yet sufficient to produce a homogenous mass.

e) Compression tests of concrete cubes shall be made as per IS 516 on 15 cm cubes. Each mould shall be provided with a metal base having a plane surface so as to support the mould during filling without leakage. The base plate shall be preferably attached to the mould by springs or screws. The parts of the mould when assembled shall be positively and rigidly held together. Before placing concrete the mould and base plate shall be cleaned and oiled. The dimensions and internal faces of the mould shall be accurate within the following limits:

Height and distance between the opposite faces of the mould shall be of specified size plus minus 0.2 mm. The angle between the adjacent internal faces and between internal faces and top and bottom planes of mould shall be 90 Deg. plus/minus 5 Deg. The interior faces of the mould shall be plane surfaces with a permissible variation 0.03mm.

f) Concrete test cubes shall be moulded by placing fresh concrete in the mould and compacted as specified in IS 516.

g) Curing shall be as specified in IS 516. The cubes shall be kept in moist air of at least 90% relative humidity at a temp. of 27 Deg. Cent. Plus/minus 2 deg. Cent. For 24 hours plus/minus half hour from the time of adding water to the dry ingredients. Thereafter they shall be removed from the moulds and kept immersed in clean, fresh water and kept at 27 Deg. Cent. Plus/minus 2 Deg. cent. temp. until required for test. Curing water shall be renewed every seven days. A record of maximum and minimum temperatures at the place of storage of the cubes shall be maintained during the period they remain in storage.

h) Testing of specimens

The strength shall be determined based on not less than five cubes test specimens for each age and each water cement ratio. All these laboratory test results shall be tabulated and furnished to Engineer. The test result shall be accepted by Engineer if the average compressive strengths of the specimens are tested subject to the condition that only one out of the five consecutive test may give a value less than the specified strength for that

age. The Engineer may direct the Contractor to repeat the tests if the results are not satisfactory and also to make such changes as he considers necessary to meet the requirements specified. All these preliminary tests shall be conducted by the Contractor at his own cost in an approved laboratory.

Proportioning consistency, batching and mixing of concrete Proportioning

a) Aggregate

The proportions which shall be decided by conducting preliminary test shall be by volume. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete mixing. The supply of properly graded aggregate of uniform quality shall be maintained over the period of work, the grading of aggregates shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stocked in separate stock piles. The grading of coarse and fine aggregate shall be checked as frequently possible as determined by Engineer, to ensure maintaining of grading in accordance with the samples used in preliminary mix design. The material shall be stock piled well in advance of use.

b) Cement

The cement shall be measured by volume/Weight

c) Water

Only such quantity of water shall be added to the cement and aggregates in the concrete mix as to ensure dense concrete, specified surface finish, satisfactory workability, consistent with the strength stipulated for each class of concrete. The water added to the mix shall be such as not to cause segregation of material for the collection of excessive free water on the surface of the concrete.

The water cement (W/C) ratio is defined as the volume of water in the mix (including the surface moisture of the aggregates) divided by the volume of cement in the mix. The actual water cement ratio to be adopted shall be determined in each instance by the Contractor and approved by the Engineer.

d) Proportioning by water/cement ratio

The W/C ratio specified for use by Engineer shall be maintained. The contractor shall determine the water content of the aggregates as frequently as directed by Engineer as the work progress and as specified in IS 2386 (Part III) and the amount of water added at the mixer shall be adjusted as directed by Engineer so as to maintain the specified W/C ratio. To allow for the variation I volume of aggregates due to variation in their moisture content

suitable adjustments in the volume of aggregates shall also be made.

e) Consistency and slump

Concrete shall be of a consistency and workability suitable for the conditions of the job. After the amount of water required is determined, the consistency of the mix shall be maintained throughout the progress of the corresponding parts of the work and approved tests eg. Slump tests, compacting factor tests, in accordance with IS - 1199 shall be conducted from time to time to ensure the maintenance of such consistency.

f) The following tabulation gives a range of slumps which shall generally be used for various types of construction unless otherwise instructed by the Engineer.

SLUMPS FOR VARIOUS TYPES OF CONSTRUCTION

Only sufficient quantity of water shall be added to concrete during mixing to produce a mix of sufficient workability to enable it to be well consolidated, to be worked into the corners of the shuttering and around the reinforcement, to give the specified surface finish, and to have the specified surface strength. The following slumps shall be adopted for different kinds of works:

Name of Work	When vibrator used	When vibrator not used
Mass concrete in foundations, footings retaining walls and pavements.	10 mm to 25 mm	50 mm to 75 mm
Thin sections of floors of less than 75mm thick	25mm to 40 mm	75 mm to 100 mm

For Reinforced cement concrete work:

Mass concrete in foundations, footings retaining walls and pavements.	10 mm to 25 mm	80 mm
Beams, slabs, columns	25mm to 40 mm	100 mm to 125 mm
Thin shells, folded plates etc	40 mm to 50 mm	125 mm to 150 mm

The concrete mix shall be in the proportion as arrived at as per the mix design and all the ingredients to be measured by weight (i.e. by weigh batching). All concrete work shall be carried by weigh batching only. In case if it is approved by the Engineer, the equivalent volume of coarse and fine aggregates based on the bulk density can be adopted. Contractor shall make available weigh scale of appropriate capacity at site for intermittent checking the weight of the ingredients so measured

by volume during the concreting operation.

Sampling and testing concrete in the field

- a. Facilities required for sampling materials and concrete in the field shall be provided by the Contractor at no extra cost. The following equipment with operator shall be extra cost. The following equipment with operator shall be made available at Engineer's request (all must be in serviceable condition).
 - i. One concrete cube testing machine suitable for 15 cm machine suitable for 15 cm cubes of 100 tonnes capacity with proving calibration ring.
 - ii. Twelve cast iron cube moulds of 15 cm size
 - iii. One Lab. Balance to weigh up to 5 kg with sensitivity of 10 gm
 - iv. One set of sieves for coarse and fine aggregates
 - v. One set of slump cone complete with tamping rod
 - vi. A set of measures from 5 litre to 0.1 litre
 - vii. One electric oven with thermostat upto 120 Deg.Cent.
 - viii. One flakiness gauge
 - ix. One elongation index gauge
 - x. One sedimentation pipette
 - xi. One pycnometer
 - xii. Two calibrated glass jar of 1 litre capacity

The above list of the facility is an indicative and is not limiting. The contractor shall arrange necessary laboratory equipment/glassware etc as may be required as per relevant IS specification code of practice or as advised by the Structural Consultants.

Arrangement can be made by the contractor to have the cubes tested in an approved laboratory in lieu of a testing machine at site at his expense, with the prior consent of the Engineer

- b. At least 6 test cubes of each class of concrete shall be made for every 15.0 cum of concrete or part thereof. Such samples shall be drawn on each day for each type of concrete. Of each set of 6 cubes, three shall be tested at 7 days age and three at 28 days age. The laboratory test results shall be tabulated and furnished to Engineer. Engineer will pass the concrete if average strength of the specimens tested is not less than the strength specified, subject to the condition that only one out of three consecutive tests may give a value less than the specified strength but this shall not be less than 90% of the specified strength. The cubes shall be tested on 7th and 28th day from the day of casting of the cubes.

The requirement of number of samples shall be determined by the Engineer and as such 1 sample for quantity of concrete up to 5 Cum 2 samples for quantity from 6 to 14 Cum to be taken.

An additional set of test cube if asked by the Engineer shall be cast and taken by the contractor which may be kept for record/verification at later date.

a. **Admixtures**

Admixtures may be used in concrete only with the approval of Engineer based upon evidence that, with the passage of time, neither the compressive strength nor its durability reduced. Calcium chloride shall not be used for accelerating setting of the cement for any concrete containing reinforcement, or embedded steel parts. When calcium chloride is permitted to be used, such as in mass concrete works, it shall be dissolved in water and added to the mixing water in an amount not to exceed 1.5% of the volume of the cement in concrete. When admixtures are used, the designed concrete mix shall be corrected accordingly. Admixtures shall be used as per manufacturer's instructions and in the manner and with the control specified by Engineer.

b. **Air entraining agents**

Where specified and approved by Engineer, neutralized vinyl resin or any other approved air entraining agent may be used to produce the specified amount of air in the concrete mix and these agents shall conform to the requirements of ASTM standard 6260, air entraining admixtures for concrete. The recommended total air content of the concrete is 4% plus minus 1%. The method of measuring air content shall be as per IS 1199.

c. **Water reducing admixtures**

Where specified and approved by Engineer water reducing lignosulfonate mixture shall be added in quantities specified by Engineer. The admixtures shall be added in the form of a solution.

d. **Retarding admixtures**

Where specified and approved by Engineer, retarding agents shall be added to the concrete mix in quantities specified by Engineer.

e. **Water proofing agent**

Where specified and approved by Engineer, water proofing agent conforming to IS : 2645 shall be added in quantities specified by Engineer.

Optional tests

- a. Engineer may order tests to be carried out on cement, sand, coarse aggregate and water in accordance with the relevant Indian Standards. Test on cement shall include
 - i. fineness test
 - ii. test for normal consistency
 - iii. test for setting time
 - iv. test for soundness
 - v. test for tensile strength
 - vi. test for compressive strength
 - vii. test for heat of hydration by experiment and by calculations in accordance with IS:269.

Tests on sand shall include

- i. sieve test
- ii. test for organic impurities
- iii. decantation test for determining clay and silt content
- iv. specific gravity test
- v. test for unit weight and bulkage factor.

Tests on coarsed aggregate shall include

- e) test for sieve analysis
- f) specific gravity and unit weight of dry loose and rodded aggregate
- g) soundness and alkali aggregate reactivity
- h) petrographic examination
- i) deleterious materials and organic impurities
- j) test for aggregate crushing value.

Any or all these tests would normally be ordered to be carried out only if Engineer' feels the materials are not in accordance with the specifications or if the specified concrete strengths are not obtained and shall be performed by contractor at site or at an approved test laboratory. If the tests are successful, ERNAKULAM REGIONAL CO-OPERATIVE MILK PRODUCERS' UNION LTD shall pay for all such optional test otherwise the contractor shall have to pay for them.

- b. If the works cubes do not give the stipulated strengths Engineer reserves the right to ask contractor to dismantle such portions of the work, which in his opinion are unacceptable and re-do the work to the standard stipulated at contractor's cost.
- c. Load test on members or any other tests

- i. In the event of any work being suspected of faulty material or workmanship or both, Engineer requiring its removal and reconstruction may order the contractor that it should be load tested in accordance with the following provisions.
- ii. The test load shall be 125% of the maximum superimposed load for which the structure was designed. Such test load shall not be applied before 56 days after the effective hardening of the concrete. During the test, struts strong enough to take the load shall be placed in position leaving a gap under the members. The test load shall be maintained for 24 hours before removal.
- iii. If within 21 hours of the removal of the load, the structure does not show a recovery of at least 75 percent of the maximum deflection shown during the 24 hours under load the test loading shall be repeated after a lapse of at least 72 hours. The structure shall be considered to have failed to pass the test if the recovery after the second test is not at least 75 per cent of the maximum deflection shown during the second test. If the structure is certified as failed by engineer, the cost of the load test shall be borne by the contractor. If the maximum deflection in mm, shown during 24 hours under load is less than $40(L \times L)/D$, where L is the effective span in M; and D, the overall depth of the section in mm, it is not necessary for recovery to be measure and recovery provisions of (iii) shall not apply. *This will be governed by relevant IS.*
- iv. Any other tests eg. taking out in approved manner concrete cores, examination and tests on such cores removed from such parts of the structure as directed by Engineer, sonic testing etc. shall be carried out by contractor if so directed.
- v. Should the results of any test prove unsatisfactory, or the structure shows signs of weakness, undue deflection or faulty construction the contractor shall remove the rebuild the member or members involved or carryout such other remedial measures as may be required by owner/ Ernakulam Regional Co-operative Milk Producers' Union Ltd, the contractor shall bear the cost of so doing, unless the failure of the member or members to fulfill the test conditions is proved to be solely due to faulty design.

Concrete in alkali soils and alkaline water

Where concrete is liable to attack from alkali salts or alkaline water, special cements containing low amount of tricalcium aluminate shall be used, if so specified in the drawings. Such concrete shall have a minimum 28 days compressive strength of 250 kg per sqcm and shall contain not less than 370 kg of cement per cubic metre of concrete in place. If specified, additional protection shall be obtained by the use of a chemically resistant stone facing or a layer of plaster of paris covered with suitable fabric, such as jute thoroughly impregnated with tar.

Preparation prior to concrete placement

a) Before the concrete is actually placed in position, the insides of the form work shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection, especially at bottom of columns and walls forms to permit removal of saw dust, wood shavings, bindings wire, rubbish dirt etc. Openings shall be placed or holes drilled, so that these materials and water can be removed easily. Such openings/holes shall be later suitably plugged.

b) The various agencies shall be permitted ample time to install drainage and plumbing lines in floor and trech drains, conduits,hangers, anchors, inserts, sleeves, bolts, frames and other miscellaneous embedments to be cast in the concrete as indicated on the drawings or as is necessary for the proper execution of the work Contractor shall cooperate fully with all such agencies and shall permit the use of scaffolding form work etc. by other agencies at no extra cost.

c) All embedded parts, inserts etc. supplied by Owner or Contractor shall be correctly positioned and securely held in the forms to prevent displacement during deposition and vibrating of concrete.

d) Anchor bolts shall be positioned and kept in place with the help of proper manufactured templates. The use of all such templates, fixture etc. shall be deemed to be included in the rates.

e) Slots, openings, holes, pockets etc. shall be provided in the concrete work in the positions indicated in the drawings or as directed by Engineer.

f) Prior to concrete placement all work shall be inspected and approved by Engineer and if found unsatisfactory, concrete shall not be poured until after all defects have been corrected at Contractor's cost. Cat ladders shall be provided on their reinforcement to facilitate labour movement.

g) Approval by Engineer for all materials and work as required herein shall not relieve contractor from his obligation to produce finished concrete in accordance with the drawings and specifications.

h) No concrete shall be placed in wet weather or on water covered surface. Any concrete that has been washed by heavy rains, the work shall be entirely removed, if there is any sign of cement and a sand having been washed from the concrete mixture. To guard against damage which may be caused by rains, the works shall be covered with tarpaulins immediately after the concrete has been placed and

compacted. Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over/around freshly placed concrete, suitable drains and sumps shall be provided.

i) Immediately before concrete placement begins, proposed surfaces except framework which will come in contact with the concrete to be placed, shall be covered with a bonding mortar.

Transportation

a) All buckets, containers or conveyors used for transporting concrete shall be mortartight. Irrespective of the method of transportation adopted, concrete shall be delivered with the required consistency and plasticity without segregation or loss of slump. However, chutes shall not be used for transport of concrete without the written permission of Engineer and concrete shall not be rehandled before placing.

b) Concrete must be placed in its final position before it becomes too stiff to work. On no account, water shall be added after the initial mixing concrete which has become stiff or has been contaminated with foreign materials shall be rejected and disposed off as directed by Engineer.

c) All equipment used for mixing, transporting and placing of concrete shall be maintained in clean condition. All pans, buckets, hoppers, chutes, pipelines and other equipment shall be thoroughly cleaned after each period of placement.

Procedure for placing of concrete

a) Before any concrete is placed, the entire placing programme, consisting of equipment, layout proposed procedures and methods shall be submitted to engineer for approval if so demanded by Engineer and no concrete shall be placed until Engineer's approval has been received. Conveyor for conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete during depositing without segregation of materials, considering the size of the job and placement location.

b) Concrete shall be placed in its final position before the cement shall normally be compacted in its final position within thirty minutes of leaving the mixer and once compacted it shall not be disturbed.

c) Concrete in all cases, be deposited as nearly as practicable directly in its final position and shall not be rehandled or caused to flow in a manner which will cause

segregation, loss of materials, displacement of reinforcement, shuttering or embedded inserts or impair its strength. For locations where direct placement is not possible and in narrow forms, contractor shall provide suitable drop and elephant trunks to confine the movement of concrete. Special care shall be taken when concrete is dropped from a height especially if reinforcement is in the way, particularly in columns and thin walls.

d) Except when otherwise approved by Engineer, concrete shall be placed in shovels or other approved implements and shall not be dropped from a height more than 1 M or handled in a manner which will cause segregation.

e) The following specification shall apply when placing of concrete by use of mechanical equipment is specifically called for while inviting bids or is warranted considering the nature of work involved. The control of placing shall begin at the mixer discharger, concrete shall be discharged by a vertical drop into the middle of the bucket or hopper and this principle of a vertical discharge of concrete shall be adhered to throughout all stages of delivery until the concrete comes to rest in its final position.

f) Central bottom dump buckets of a type that provides for positive regulation of the amount and rate of deposition of concrete in all dumping position, shall be employed

g) In placing concrete in large open areas, the buckets shall be spotted directly over the position designated and then lowered for dumping. The open bucket shall clear the concrete already in place and the height of drop shall not exceed 1 M. the bucket shall be opened slowly to avoid high vertical bounce. Dumping of buckets on the swing or in any manner which results in separation of ingredients or disturbance of previously placed concrete will not be permitted

h) Concrete placed in restricted forms by wheel barrows, buggies, cars, short chutes or hand shoveling shall be subject to the requirement for vertical delivery of limited height to avoid segregation and shall be deposited as nearly as practicable in its final position.

i) Where it is necessary to use transfer chutes, specific approval of Engineer must be obtained to the type, length, slopes, baffles, vertical terminals and timing of operations, the discharge and without segregation. To allow for the loss of mortar against the sides of the chutes, the first mix shall have less coarse aggregate. During cleaning of chutes the waste water shall be kept clear of the forms. Concrete shall not be permitted to fall from the end of the chutes by more than 1 M. Chutes when

approved for use shall have slopes not flatter than 1:3 and steeper than 1:2 chutes shall be of metal or metal lined and of rounded cross section. The slopes of all chute sections shall be approximately the same. The discharge end of the chutes shall be maintained above the surface of the concrete in the forms.

j) Concrete may be conveyed and placed by mechanically operated equipment eg. Pumps or pneumatic placers only with the written permission of Engineer. The slump shall be held to the minimum, necessary for conveying concrete by this method.

k) When pumping is adopted before pumping of concrete is started, the pipeline shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. The concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

l) When pneumatic placer is used, the manufacturer's advice on layout of pipeline shall be followed to avoid blockages and excessive wear. Restraint shall be provided at the discharge box to cater for the reaction at this end. Manufacturer's advice shall be followed regarding concrete quality and all other related matters when pumping or pneumatic placing equipment is used.

m) Concreting, once started, shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 15 to 90 mm as directed by Engineer. These shall be placed as rapidly practicable to prevent the formation of cold joints or planes of weakness between each succeeding layer within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit shall be spotted progressively along the face of the layer with such overlap as will facilitate spreading the layer to uniform depth and texture with a minimum of shoveling. Any tendency to segregation shall be corrected by shoveling stones into mortar rather than mortar onto stones. Such a condition shall be corrected by redesign of mix or other means, as directed by Engineer.

n) The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed.

o) Compaction

i. Concrete shall be compacted during placing the approved vibrating equipment until the concrete has been consolidated to the maximum practicable density, is free of pocket of coarse aggregate and fits tightly against all form surfaces,

reinforcement and embedded fixtures. Particular Care shall be taken to ensure that all concrete placed against the forms faces and into corners of forms or against hardened concrete at joints is free from voids or cavities. The use of vibrators shall be consistent with the concrete mix and caution exercised not to over vibrate the concrete to the point that segregation results.

ii. Vibrators shall conform to IS specifications. Type of vibrator to be used shall depend on the structure where concrete is to be placed. Shutter vibrators to be effective, shall be firmly secured to the formwork which must be sufficiently rigid to transmit the vibration and strong enough not to be damaged by it. Immersion vibrators shall have no load frequency, amplitude and acceleration as per IS 2505 depending on the size of vibrator. Immersion vibrators in sufficient numbers and each of adequate size shall be used to properly consolidate all concrete. Tapping or external vibrating of forms by hand tools or immersion vibrators will not be permitted

iii. The exact manner of application and the most suitable machines for the purpose must be carefully considered and operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn when air bubbles cease to come to the surface. Immersion vibrators shall be withdrawn very slowly. In no case shall immersion vibrators be used to transport concrete inside the forms. Particular attention shall be paid to vibration at the top of a lift e.g. in a column or wall.

iv. When placing concrete in layers, which are advancing horizontally as the work progresses, great care shall be exercised to ensure adequate vibration, blending and mixing of the concrete between the succeeding layers.

v. The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below with the underlayer is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints

vi. Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. They shall also not be allowed to come in contact with forms or finished surfaces.

vii. Form attached vibrators shall be used only with specific authorization of Engineer.

viii. The surface vibrators will not be permitted under normal conditions. However for this slabs vibration by specially designed vibrators may be permitted upon approval of Engineer. Whereas for cement concrete pavements appropriate surface vibrator shall be used in addition to immersion vibrator approved by the Engineer.

ix. The formation of stone pockets or mortar bondages in corner and against faces of forms shall not be permitted. Should these occur they shall be dug out, reformed and refilled to sufficient depth and shape for through bonding, as directed by Engineer.

p) Placement interval

Except when placing with slip forms each placement of concrete in multiple lift work, shall be allowed to set for at least 24 hours after the final set of concrete and before the start of a subsequently placement.

q) Special provision in placing

When placing concrete in walls with openings and in floors of integral slab and beam construction and other similar conditions, the placing shall stop when the concrete reaches the top of the opening in walls and bottom horizontal surface of the slab, as the case may be placing shall be resumed before the concrete in place takes initial set, but not until it has time to settle as determined by Engineer.

r) Placing concrete through reinforcement steel

When placing concrete through reinforced steel, care shall be taken to prevent segregation of the coarse aggregate. When the congestion of steel makes placing difficult it may be necessary to temporarily move the top steel aside to get proper placement and restore reinforcing steel to design position.

s) Bleeding

Bleeding of free water, on top of concrete being deposited into the forms shall be caused to stop the concrete pour. The conditions causing this defect corrected before any further concreting is resumed.

Curing, protecting, repairing and finishing

a) Curing

i. All concrete shall be cured by keeping it continuously damp for the period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays or ponded water continuously saturated covering of sacks, canvas, hessian or other absorbent materials, or approved effective curing compounds applied with spraying equipment capable of producing a smooth, even textured coat. Extra precautions shall be exercised in curing concrete during cold and hot water as outlined hereinafter. The quality of curing water shall be the same as that used for mixing concrete.

ii. Certain types of finish or preparation for overlaying concrete must be done at

certain stage of the curing process and special treatment may be required for specific concrete surface finish.

iii. Curing of concrete made of high alumina cement and supersulphated cement shall be carried out as directed by Engineer.

iv. Fresh concrete shall be kept continuously wet for a minimum period of 10 days from the date of placing of concrete following a lapse of 12 to 14 hours after laying of concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin immediately the concrete has hardened. Water shall be applied uniformly to concrete surfaces within 1 hour after concrete has set. Water shall be applied to formed surfaces immediately upon removal of forms quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

v. Curing shall be assured by use of an ample water supply under pressure in pipes with all necessary appliances of hose, sprinklers and spraying devices. Continuous fine mist spraying or sprinkling shall be used, unless otherwise specified or approved by engineer.

vi. Whenever, by the judgement of Engineer, it may be necessary to omit the continuous spray method, a covering of clean sand or other approved means such as wet gunny bags which will prevent loss of moisture from the concrete, may be used. No type of covering will be approved which would stain or damage the concrete during or after the curing period. Covering shall be kept continuously wet during the curing period.

vii. For curing of concrete in pavements, side-walks floors, flat roofs or other level surfaces, the ponding method of curing is preferred. The method of containing the ponded water shall be approved by Engineer. Special attention shall be given to edges and corners of the slabs to ensure proper protection to these areas. The ponded area shall be kept continuously filled with water during the curing period.

viii. Surface coating type compounds shall be used only by special permission of Engineer, curing compounds shall be liquid type white pigmented. Other curing compounds shall be used on surfaces where future blending with concrete, water or acid proof membrane or painting is specified.

ix. All equipment and materials required for curing shall be on hand and ready for use before concrete is placed.

b) Protecting fresh concrete

Fresh concrete shall be protected from defacements and damage due to construction operation by leaving forms in place for an ample period as specified later in this specification. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by Engineer shall also be taken to protect immature concrete from damage by debris, excessive loading, vibration, abrasion or contact with

other materials etc. that may impair the strength and/or durability of the concrete. Workmen shall be warned against and prevented from disturbing green concrete during its setting period. If it is necessary that workmen enter the area of freshly placed concrete, Engineer may require that bridges be placed over the area.

c) Repair and replacement of unsatisfactory concrete

i. Immediately after the shuttering is removed, the surface of concrete shall be very carefully inspected and all defective areas called to the attention of Engineer who may permit patching of the defective areas or also reject the concrete unit either partially or entirely. Rejected concrete shall be removed and replaced by contractor at no additional expense to owner. Holes left by form bolts etc. shall be filled up and made good with mortar composed of one part of cement to one and half parts of sand passing 2.36 mm IS sieve after removing any loose stones adhering to the concrete shall be finished as described under the particular items of work.

ii. Superficial honey combed surfaces and rough patches shall be similarly made good immediately after removal of shuttering in the presence of Engineer and superficial water and air holes shall be filled in. The mortar shall be well worked into the surface with a wooden float. Excess water shall be avoided. Unless instructed otherwise by Engineer the surface of the exposed concrete placed against shuttering shall be rubbed down immediately on removal of shuttering to remove fine or other irregularities and necessary care being taken to avoid damage to the surface. Surface irregularities shall be removed by grinding.

iii. If reinforcement is exposed or the honeycombing occurs at vulnerable positions eg. ends of beams or columns it may be necessary to cut out the member completely or in part and reconstruct. The decision of Engineer shall be final in this regard. If only patching is necessary, the defective concrete shall be cut out till solid concrete is reached (or to a minimum depth of 25 mm) the edges being cut perpendicular to the affected surface or with small undercut if possible. Anchors, tees or dovetail slots shall be provided whenever necessary to attach the new concrete securely in place an area extending several centimeters beyond the edges and the surfaces of the prepared voids shall be saturated with water for 24 hours immediately before the patching material is placed.

iv. The use of epoxy for bonding fresh concrete used for repairs will be permitted upon written approval of Engineer. Epoxy shall be applied in strict accordance with the instructions of the manufacturer.

v. Small size holes having surface dimensions about equal to the depth of the hole, holes left after removal of form bottom, grout insert holes and slots cut for repair of cracks shall be repaired as follows. The hole to be patched shall be roughened and

thoroughly soaked with clean water until absorption stops.

A 5 mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched, followed immediately by the patching concrete which shall be well consolidated with a wooden float. The concrete patch shall be built up in 10 mm thick layers. After an hour or more, depending upon weather conditions, it shall be worked off flush with a wooden float and smooth finish obtained by wiping with Hessian, a steel trowel shall be used for this purpose. The mix for patching shall be of same material and in the same proportions as that used in the concrete being repaired although some reduction in the maximum size of the coarse aggregates may be necessary and the mix shall be kept as dry as possible.

Mortar filling by air pressure (gunning) shall be used for repairing of areas too large and/or too shallow for patching with mortar. Patched surfaces shall be given a final treatment to match the colour and texture of the surrounding concrete. While cement shall be substituted for ordinary cement, if so directed by Engineer, to match the shade of the patch with original concrete.

vi. The patched area shall be covered immediately with an approved non-staining water saturated material such as gunny bag which shall be kept continuously wet and protected against sun and wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously find spray of sprinkling for not less than 10 days.

vii. All materials, procedures and operations used in the repairing of concrete and also the finished repair work shall be subject to the approval of Engineer. All fillings shall be tightly bonded to the concrete and shall be sound, free from shrinkage cracks after the fillings have been cured and finished.

d) Finishing

i. The type of finish for formed concrete surface shall be as follows, unless, otherwise specified by the Engineer

For surfaces against which backfill or concrete is to be placed, no treatment is required except repairing of defective areas.

For surface below grade which will receive waterproofing treatment the concrete shall be free of surface irregularities which would interfere with proper application of the waterproofing material which is specified for use.

Unless specified, surfaces which will be exposed when the structure is in service shall receive no special finish, except repairing of damage or defective concrete removal of fins and abrupt irregularities, fillings of holes left by form ties and rods and clean up of loose or adhering debris.

ii. Surfaces which will be exposed to the weather and which would normally be level, shall be sloped for drainage. Unless the drawing specifies such as stair treads, walls shall be sloped across the width approximately 1 in 30 broader surface such as walkways, roads, parking areas and platforms shall be sloped about 1 in 50. Surfaces that will be covered by backfill or concrete subfloors to be covered either concrete topping, terrazzo or quarry tile and similar surfaces shall be smooth screeded and levelled to produce even surfaces. Surface irregularities not exceed 6 mm.

iii. Surfaces which will not be covered by backfill, concrete or tile toppings such as outside decks, floors of galleries and sumps, parapets, gutters, sidewalks floors and slabs shall be consolidated, screeded and floated. Excess water and laitance shall be removed before finishing. Floating may be done with hand or power tools and started as the screeded surface has attained a stiffness to permit finishing operation and these shall be the minimum required to produce a surface uniform in texture and free from screed marks or other imperfections. Joints edges panels and forms linings shall be of uniform size and be as large as practicable and installed with closed joints. Upon removal of forms the joint marks shall be smoothed off and all blemishes, projections etc. removed leaving the surfaces reasonably smooth and unmarred.

iv. Integral cement concrete finish

When specified on the drawings and integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded as specified on the drawings as per IS 2571. The surface shall be compacted and then floated with a wood float or power floating machine. The surface shall be tested with a straight edge and any high and low spots eliminated. Floating or trowelling of finish shall be permitted only after all surfaces water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the cement finish to absorb moisture or to stiffen the mix.

v. Exposed concrete finish/rendering.

A rubbed finish shall be provided only on exposed concrete surfaces as

specified on the drawings. Upon removal of forms, all fins and other projections on the surfaces shall be carefully removed, off-sets leveled and voids and damaged sections be immediately saturated with water and repaired by filling with a concrete or mortar of the same composition as was used in the surface. Then surface shall be thoroughly wetted and rubbed with carborundrum or other abrasive. Cement mortar may be used in the rubbing, but the finished surface shall be brush coated with either cement grout after rubbing. The finished surfaces shall present a uniform and smooth appearance.

Mode of measurement

- i. The unit rate for concrete work under various categories shall be all inclusive and no claims for extra payment on account of such items as leaving holes, embedding inserts etc. shall be entertained unless separately providing for in the schedule of quantities. No extra claim shall also be entertained due to change in the number, position end/or dimensions of holes slots or openings sleeves, inserts or on account of any increased lift or scaffolding etc. all these factors should be taken into consideration while quoting the unit rates.
- ii. Payments of concrete will be made on the basis of unit quoted for the respective items in the Schedule of Quantities. No deduction in the concrete quantity will be made for reinforcements, inserts etc. and opening less than 0.05 cum where concrete is measured in cum. Where no such deduction for concrete is made, payment for shuttering work provided for such holes, pockets etc. will not be made.
- iii. Payment for beams will be made for the quantity based on the depth being reckoned from the underside of the slabs and length measured as the clear distance between supports. Payment for columns shall be made for the quantity based on height reckoned up to the underside of slabs.

2.06 Providing laying RCC of M 20 mix for structures up to plinth level

The general specification is same as per item No.2.05 but for the design mix.

2.07 Providing and laying RCC of M 25 mix for structures up to plinth level

The general specification is same as per item No.2.05 but for the design mix.

2.08 Providing and laying RCC of M 30 mix for structures up to plinth level

The general specification is same as per item No.2.05 but for the design mix.

2.09 Providing and laying M 15 concrete in superstructure up to 12.3 M height from plinth level

The general specification is same as per item No.2.05.

2.10 Providing and laying M 20 concrete in superstructure up to 12 M height from plinth level

The general specification is same as per item No.2.05.

2.11 Providing and laying M 25 concrete in superstructure up to 12 M height from plinth level

The general specification is same as per item No.2.05.

2.12 providing and laying M 30 concrete in superstructure up to 12 M height from plinth level

The general specification is same as per item No.2.05.

2.13 Providing and laying M 15 concrete in super structure above 12 M height

The general specification is same as per item No.2.05.

2.14 Providing and laying M 20 concrete in superstructure above 12 M height

The general specification is same as per item No.2.05.

2.15 Providing and laying M 25 concrete in superstructure above 12 M height

The general specification is same as per item No.2.05.

2.16 Providing and laying M 30 concrete in superstructure above 12 M height

The general specification is same as per item No.2.05.

2.17 Providing and laying RCC for equipment/machine foundation.

The general specification is same as per item No.2.05 but for the mix of the concrete, which shall be as specified in the item. The rate is exclusive of reinforcement steel but inclusive of centering and shuttering, providing number of holes, pockets (size and as shown in the drawings/directed) and grouting the same after the machine/equipment is erected with concrete of specified mix and finishing the same as specified.

The rates shall include grouting of base plates, anchor bolts, pipe sleeves

including placing, aligning, leveling and maintaining it during the casting of cement concrete, protection of the threaded portion of bolts by acceptable means or protection of any surface from sticking of cement grout etc, welding the insert elements, handling/placing the template etc complete as per equipment drawing/structural drawing etc complete.

Mode of Measurement

As per item no. 2.05, the cost of formwork, creating pockets/grouting the bolts is included in the item

2.18 Pre-cast concrete

Pre-cast concrete shall comply with IS 456 and with the following requirements:

- a) All pre-cast units shall be cast on suitable bed or platform with firm foundation and free from wind. Contractor shall be responsible for the accuracy of the level or shape of the bed or platform. A suitable serial number and the date of casting shall be impressed or painted on each unit.
- b) Side shutters shall not be struck in less than 24 hours after depositing concrete and no precast unit shall be lifted until the concrete reaches a strength of at least twice the stress to which the concrete may be subjected to at the time of lifting.
- c) The lifting and removal of precast units shall be undertaken without causing shock, vibration or undue bending stresses to or in the units. Before lifting and removal takes place contractor shall satisfy Engineer or his representative that the methods he proposes to adopt for these operations shall not over stress or otherwise affect seriously the strength of the precast units. The reinforced side of the units shall be distinctly marked.
- d) All precast work shall be protected from the direct rays of the sun for at least 7 days after casting and during that period each unit shall be kept constantly watered or preferably be completely immersed in water if the size of the unit so permits, otherwise curing practice as given in clause 20 shall be followed.
- e) Slots, openings or holes, pockets etc. shall be provided in the concrete work in the drawings or as directed by engineer. Any deviation from the approved drawings shall be made good by Contractor at his own expense, without damaging any other work sleeves, bolts, inserts, etc. shall also be provided in concrete work where so specified.

The pavement slabs/trench covers top shall be appropriately finished i.e. either stripped finished or smooth finished with a smooth border including Chamfering as per details, finishing the exposed edges/corners.

Mode of measurement

It shall be measured as per the item schedule. The unit rate for precast concrete members shall include formwork, mouldings, finishing, hoisting and setting in position including mortar, provision of lifting arrangement, exposed concrete finish etc. complete. Only if reinforcement is used, it shall be measured and paid for separately under item rate.

2.19 Providing and erecting formwork for structures up to plinth level

a) The formwork shall consist of shores, bracings, sides of beams and columns, bottom of slabs etc. including ties anchors, hangers inserts etc. complete which shall be properly designed and planned for the work. False work shall be so constructed that necessary adjustment can be made to compensate for take up and settlements. Wedge may be used at the top or bottom of timber shores but not at both ends to facilitate vertical adjustment or dismantling of the formwork.

b) Design of form work

The design of the formwork as well as its construction shall be the responsibility of Contractor. If so instructed, the drawings and/or calculation for the design for the formwork shall be submitted to Engineer for approval before proceeding with work, at no extra cost. Engineer's approval shall not however relieve contractor of the full responsibility for the design and construction of the formwork. The design shall take into account the entire load vertical and lateral that the forms will be carrying live and vibration loadings.

c) Type of formwork

Form work may be of timber, plywood metal, plastic or concrete. For special finishes the formwork may be lined with plywood, steel sheets oil tempered hard board etc. sliding forms and slip forms may be used with the approval of engineer.

d) Form work requirements

- i. Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the drawings. Ample studs, braces, ties, straps, etc. shall be used to hold the forms in proper position without any distortion whatsoever until the concrete is set sufficiently to permit removal of forms. Forms shall be strong enough to permit the use of immersion vibrators. In special cases form vibrators may also be used. The shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps, or other surface defects in contact with concrete. Faces coming in contact with the concrete shall be free from adhering grout, plaster, paint, projecting nails, splits or other defects. Joints shall be sufficiently tight to prevent loss of water or any fine material from concrete.
- ii. Plywood shall be used for exposed concrete surfaces; where called for. Sawn and wrought timber may be used for unexposed surfaces. Inside faces of forms for concrete surfaces which are to be rubbed finished shall be planed to remove irregularities or unevenness in the face. Formwork with linings shall be permitted.
- iii. All new and used form timber shall be maintained in a good condition with respect to shape, strength, rigidity, water tightness, smoothness and cleanliness of surfaces. Form timber unsatisfactory in any respect shall not be used and if rejected by Engineer shall be removed from the site.
- iv. Shores supporting successive members shall be placed directly over those below or be so designed and placed that the load will be transmitted directly to them. Trussed supports shall be provided for shores that cannot be secured on adequate foundations.
- v. Formwork, during any stage of construction showing signs of distortion or distorted to such a degree that the intended concrete work will not conform to the exact contours indicated on the drawings, shall be repositioned and strengthened. Poured concrete affected by the faulty formwork, shall be removed completely and the formwork be corrected prior to placing of new concrete.
- vi. Excessive construction camber to compensate for shrinkage, settlement may impair the structural strength of members and shall not be permitted.
- vii. Forms shall be so designed that their removal will not damage the concrete. Face formwork shall provide true vertical and horizontal joints, conform to the architectural features of the structure as to location of joints and be as directed by engineer.
- viii. Where exposed smooth or rendered concrete finishes are required the forms shall be constructed with special care so that the resulting concrete surfaces require a minimum finish.

e) Formwork for slope surfaces

- i. Forms or sloped surfaces shall be built so that the formwork can be placed board-

by-board immediately ahead of concrete placement so as to enable ready access for placement, vibration inspection and repair of the concrete.

ii. The formwork shall also be built so that the boards can be removed one by one from the bottom up as soon as the concrete has attained sufficient stiffness to prevent sagging. Surfaces of construction joints and finished surfaces with slopes steeper than 4 horizontal: 1 vertical shall be formed as required herein.

f) Formwork for curved surfaces

i. The contractor shall interpolate intermediate sections as necessary and shall construct the forms so that the curvature will be continuous between sections. Where necessary to meet requirements for curvature, the form timber shall be built up of laminated splines cut to make tight, smooth form surfaces.

ii. After the forms have been constructed, all surface imperfections shall be corrected and all surface irregularities at matching faces of form material shall be dressed to the specified curvature.

g) Formwork for exposed concrete surfaces

i. Where it is desired, directed or shown on the drawings to have original fair face finish of concrete surface without any rendering or plastering formwork shall be carried out by using wood planks, plywood or steel plates of approved quality and as per direction of the Engineer.

ii. The contractor shall use one type of material for all such exposed concrete faces and the forms shall be constructed so as to produce uniform and consistent texture and pattern on the face of the concrete. Patches or forms for these surfaces will not be permitted. The formwork shall be placed so that all horizontal form works are continuous across the entire surface.

iii. To achieve a finish which shall be free of board marks, the formwork shall be faced with plywood or equivalent material in large sheets. The sheets shall be arranged in an approved pattern. Wherever possible, joints between sheets shall be arranged to coincide with architectural features, cells, window heads or change in direction of the surface. All joints between shuttering plates or panels shall be vertical or horizontal unless otherwise directed. Suitable joints shall be provided between sheets. The joints shall be arranged and fitted so that no blemish or mark is imparted to the finished surfaces.

iv. To achieve a finish which shall give the rough appearance of concrete cast against sawn boards, formwork boards unless otherwise stated shall be of 150 mm wide, securely jointed with tongue and grooved joints if required to prevent grout loss with tie rod positions and direction of boards carefully controlled. Sawn boards shall be set horizontally, vertically or at an inclination shown in the drawings. All

bolt holes shall be accurately aligned horizontal and vertically and shall be filled with matching mortar recessed 5mm back from the surrounding concrete face.

v. Forms for exposed concrete surfaces shall be constructed with grade strips (the underside of which indicated top of pour) at horizontal construction joints, unless the use of groove strips is specified on the drawings. Such forms shall be removed and reset from lift to lift. They shall not be continuous from lift to lift. Sheeting of reset forms shall be tightened against the concrete so that the forms will not be spread and permit abrupt irregularities or loss of mortar. Supplementary form ties shall be used as necessary to hold the reset forms tight against the concrete.

vi. For fair faced concrete, the position of through bolts will be restricted and generally indicated on the drawings.

vii. Chamber strips shall be placed in the corners of forms for exposed exterior corners so as to produce 20 mm beveled edges except where otherwise shown in the drawings. Interior corners and edges at formed joints shall not be beveled unless shown on the drgs. Mouldings for grooves, drip courses and bands shall be made in the form itself.

viii. The wood planks, plywood and steel plates used in formwork for obtaining exposed surfaces shall not be used for more than 3 times in case of wood planks, 6 times for plywood and 10 times for steel plates respectively. However, no forms will be allowed for reuse, if in the opinion of the Engineer it is doubtful to produce desired texture of exposed concrete.

ix. In order to obtain exposed concrete work of uniform colour it shall be necessary to ensure that the sand used for all exposed concrete work shall be of approved uniform colour. Moreover the cement used in the concrete for any complete element shall be from single consignment.

x. No exposed concrete surface shall be rendered or painted with cement or otherwise. Plastering of defective concrete as a means of achieving the required finish shall not be permitted, except in the case of minor porosity on the surface, the Engineer may allow a surface treatment by rubbing down with cement and sand mortar of the same richness and colour as for the concrete. This treatment shall be made immediately after removing the formwork.

xi. The contractor shall also take all precautionary measures to prevent breaking and chipping of corners and edges of completed work until the building is handed over.

h. Bracings struts and props

i. Shuttering shall be braced, strutted, propped and so supported that it shall not deform under weight and pressure of the concrete and also due to movement of men and other materials. Bamboos shall not be use as props or cross bearers.

ii. The shuttering for the beams and slabs shall be so erected that the shuttering on

the sides of the beams and under the soffit of slabs can be removed without disturbing the beam bottoms. Repropping of beams shall not be done except when props have to be reinstated to take care of construction loads anticipated to be in excess of the design load. Vertical props shall be supported on wedges or other measures shall be taken whereby the props can be gently lowered vertically while striking the shuttering. If the shuttering for a column, is erected for the full height of the column, one side shall be left open and built up in sections as placing of concrete from the sides to limit the drop of concrete to 3 M or as directed by Engineer.

j. Mould Oil

Care shall be taken to see that the faces of form work coming in contact with concrete are perfectly cleaned and two coats of mould oil or any other approved material “applied before fixing reinforcement and placing concrete. Such coating shall be insoluble in water, non-staining and no injurious to the concrete. It shall not become flaky or be removed by rain or wash water. Reinforcement and/or other items to be cast in the concrete shall not be placed until coating of the forms is complete, adjoining concrete surface shall also be protected against contamination from the coating material.

k. Chamfers and fillets

All corners and angles expected in the finished structure shall be formed with moulding to form chamfers or fillets on the finished concrete. The standard dimension of chamfers and fillets, unless otherwise specified shall be 20 mm x 20 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the mouldings shall be planned or surfaced to the same texture as the forms to which it is attached.

l. Wall ties

Wire ties passing through the walls shall not be allowed. In their place bolts through sleeves be used.

m. Reuse of forms

Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes that may leak suitably plugged and joints examined and when necessary, repaired and the inside retreated to prevent adhesion, to the satisfaction of Engineer. Warped lumber shall be resized. Contractor shall equip himself with enough shuttering material to complete the job in the stipulated time.

n. Removal of forms

i. Contractor shall record on the drawings and in a special register the date upon which the concrete is placed in each part of the work and the date on which the shuttering is removed therefrom. The contractor shall remove the shuttering after obtaining the approval of the Engineer.

ii. In no circumstances shall forms be struck until the concrete reaches a strength of at least twice the stress due to self weight and any construction/erection loading to which the concrete may be subjected at the time of striking formwork.

iii. In normal circumstances (generally where temperatures are above 20 Deg.Cent) forms may be removed after expiry of the following periods:

	Ordinary Portland Rapid hardening Cement concrete	
Portland cement		concrete.
a. Walls columns and vertical sides of beams	24 to 48 hrs as directed by the Engineer	24 hrs
b. Slabs left under	3 days	2 days
c. Beam soffits props left under	7 days	4 days
d. Removal of props to slabs:		
i. Spanning up to 4.5m days	7 days	4
ii. Spanning over 4.5m days	14 days	8
e. Removal of props to beams & arches		
i. Spanning up to 6m	14 days	8 days
ii. Spanning over 6m	21 days	12 days

For other cements and lower temperature, the stripping time

recommended above shall be suitably modified by the Engineer in conformity with the relevant code of practice or recommendations by the manufacturer.

iv. Striking shall be done slowly with utmost care to avoid damage to arise and projections and without shock or vibration, be gently easing the wedges. If after removing the form work, it is found that timber has been embedded in the concrete, it shall be removed and made good as specified earlier.

v. Reinforced temporary openings shall be provided as directed by Engineer to facilitate removal of formwork which otherwise may be inaccessible.

vi. Tie rods, clamps, form bolts etc. which must be entirely removed from walls or similar structures shall be loosened not sooner than 24 hrs nor later than 40 hrs. after the concrete has been deposited. Ties, except those required to hold forms in place, may be removed at the same time. Ties, withdrawn from walls and grade beams shall be pulled towards the inside face cutting ties back from the faces of walls and grade beams will not be permitted.

vii. For liquid retaining structures no sleeves for through bolts shall be used nor shall through bolts be removed as indicated above. The bolts, in this case, shall be cut at 25 mm depth from the surface and then the hole shall be made good by sand, cement mortar of the same proportions as the concrete just after striking the formwork.

Necessary approach/staging for ease of the access of workmen, inspection and supervision staff, in accordance with safety requirements and as per the instructions of the Engineer to be provided for all types of framework, for all the elements at all the depth/heights the cost of such arrangements detailed here above shall be deemed to be included in the quoted unit price of the item.

Mode of measurement

It shall be measured in sqm. The actually shuttered area shall be measured and paid for. The rate shall include providing and erecting form work in position as per drawings, applying oil, removal of form after the specified period.

2.20 Providing and erecting formwork for structures in super structure up to 12 M height from plinth level.

The general specification is same as per item No.2.15

2.21 Providing and erecting formwork for structures in super structure above 12M height from plinth level

The general specification is same as per item No.2.15

2.22 Providing and erecting false staging for formwork

The additional height for which it is required shall be as specified in the items specification. This shall be measured and paid for in sqm. The plan area of the structure shall be measured for all members except RCC walls and table ends. For RCC walls and gable ends the elevational area shall be measured for payment under this item.

2.23 Providing and erecting shuttering for exposed RCC work

The specification for the nature of shuttering shall be as specified in the item 2.19 under sub head shuttering for exposed concrete works. Only the surfaces which are given such finish shall be measured in sqm and paid for.

2.24 Providing and laying DPC 25-50 mm thick

This shall be plain cement concrete of mix as specified in the item specification. The top surface of the masonry shall be levelled properly before laying the concrete. The side shuttering shall be vertical and strong. There should not be any honeycombing. Curing shall be done for 7 days. After the curing period is over the surface shall be cleaned with brush and kerosene shall be applied over it. Then hot bitumen shall be applied @ 1.7 kg/sqm over the surface. It shall be applied uniformly without any blank space.

Mode of measurement

It shall be measured in sqm and paid for.

2.25 Supplying and mixing water proofing compound

The water proofing compound may be Fosroc, SIKA, Cico or of any equivalent to make. It shall be added to cement concrete or cement mortar as instructed by the Engineer. The proportion of the compound to be added shall be as per the Manufacturer's specification.

Mode of measurement

The quantity of compound added shall be measured and paid for. The unit shall be as specified in the item specification.

2.26 a. Providing, fabricating and placing in position reinforcement steel

The quality of the steel shall be as mentioned in the materials section. The

bars shall be fabricated as per the drawings. Laps and splices for reinforcement shall be as shown on the drawings. Splices in adjacent bars shall be approved by Engineer. The bars shall not be lapped unless the length required exceeds the maximum available lengths of bars at site.

Bending

- a) Reinforcing bars supplied bent or in coils, shall be straightened before they are cut to size. Straightening of bars shall be done in cold and without damaging the bars. This is considered as a part of reinforcement bending fabricating work.
- b) All bars shall be accurately bent according to the sizes and shapes shown on the detailed working drawings/bar bending schedules. They shall be bent gradually by machine or other approved means. Reinforcing bars shall not be straightened and rebent in a manner that will injure the material, bars containing cracks or splits shall be rejected. They shall be bent cold, except bars of over 32 mm in diameter which may be bent hot if specifically approved by engineer. Bars bent hot shall not be heated beyond cherry red colour (not exceeding 845 deg.C) and after bending shall be allowed to cool slowly without quenching. Bars incorrectly bent shall be used only if the means used for straightening and rebending shall not injure the material.

No reinforcement shall be bent when in position in the work without approval whether or not it is partially embedded in hardened concrete. Bars having kinks or bends other than those required by design shall not be used.

Fixing

- a) Reinforcement shall be accurately fixed by any approved means and maintained in the correct position shown in the drawings by the use of block, spacers and chairs as per IS 2502 to prevent displacement during placing and compaction of concrete. Bars intended to be in contact at crossing points shall be strongly bound together at all such points with two no. 16 gauge annealed soft iron wire. The vertical distance required between successive layers of bar in beams or other members shall be maintained by providing of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars.

Cover

- a) Unless indicated otherwise on the drawings, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish) shall be as follows:

- c. At each end of reinforcing bar, not less than 25 mm nor less than twice the diameter of the bar whichever is less.
- d. For a longitudinal reinforcing bar in a column, not less than 40mm nor less than the diameter of the bar. In case of columns of minimum dimensions of 20 cm or under, with reinforcing bars of 12 mm and less in diameter, a cover of 25 mm may be used.
 - e. For longitudinal reinforcing bars in a beam 25 mm nor less than the diameter of the bar.
 - f. For tensile, compressive, shear, or other reinforcement in a slab or wall not less than 12 mm nor less than the diameter of such reinforcement
- g. For any other reinforcement not less than 12 mm nor less than the diameter of such reinforcement
 - h. For footings and other principal structural members in which the concrete is deposited directly against the ground, cover to the bottom reinforcement shall be 75 mm. If concrete is poured on a layer of lean concrete the bottom cover may be reduced to 50 mm.
 - i. For concrete surfaces exposed to the weather or the ground after removal of forms, such as retaining walls, footing sides and top etc., not less than 50 mm for bars larger than 16 mm dia. and not less than 40 mm for bars 16 mm dia. or smaller.
- j. Increased cover thickness shall be provided, as indicated on the drawings, for surfaces exposed to the action of harmful chemicals (or exposed to earth contaminated by such chemical, acid, alkali, saline atmosphere, sulfurous smoke etc.
- k. For reinforced concrete members, totally or periodically immersed in sea water or subject to sea water spray, the cover of concrete shall be 50 mm more than those specified in (i) to (v) above
- l. For liquid retaining structures the minimum cover to all steel shall be 40 mm or the diameter of the main bars, whichever is greater. In the presence of sea water and soils and waters of a corrosive character the cover shall be increased by 10 mm.
- m. Protection to reinforcement in case of concrete exposed to harmful surroundings may also be given by providing a dense impermeable concrete with approved protective coatings, as specified by the Engineer.
- n. The correct cover shall be maintained by cement mortar cover block. Reinforcement for footings, beams and slabs on sub grade shall be supported on precast concrete blocks as approved by Engineer. The use of pebbles or stones shall not be permitted.

Inspection

Erected and secured reinforcement shall be inspected, jointly measured and recorded and approved by Engineer prior to placement of concrete.

Mode of measurement

Lengths of reinforcement steel shall be measured to the nearest centimetre. Spacers and chairs shall be measured and converted to weight using IS coefficients. The actual quantity of steel embedded in concrete as calculated and approved by engineer, irrespective of the level or the height at which the work is done shall be taken. The unit rate for reinforcement shall include all wastages, binding wire etc. for which no separate payment shall be made. Laps as shown in drawings or as approved by Engineer and minimum number of chairs and spacer bars required to keep the reinforcement in position shall be paid for. The cost of the quantity of steel plus wastage as specified in clause 5.0 of section VI shall be recovered at issue rate from the Contractor. Rolling margin shall be paid as per clause 6.0 of Section VI.

2.26 b. Providing, fabricating and placing in position Reinforcement steel - High Strength Deformed Bars

High Strength Deformed Bars - reinforcement steel shall be confirming to latest IS 1786 as per the specifications detailed under item no. 2.25. The HSDB shall be of minimum grade Fe 415 for concrete reinforcement. The chemical composition shall when analyzed as per relevant parts of IS 228 shall conform to the provisions of IS 1786.

Mode of measurement

As per item no. 2.26 a.

2.1 Providing and placing in position bitumen impregnated fibres

The bitumen impregnated fibre boards shall be placed in locations before concreting as instructed by the Engineer. The work shall be done at all levels without any extra cost. The thickness of the board shall be as specified in the item specification.

Mode of Measurement

It shall be measured in sqm. The rate quoted shall be valid for all levels.

2.2 Providing and laying bituminous mastic

This shall be of approved make and quality. This shall be filled in the expansion joints as directed by the Engineer/shown in the drawings. The joints shall be of uniform width and care shall be taken for proper bonding of the joints.

Mode of measurement

This shall be measured in RM for specified width and depth as per the item in the schedule of quantities.

Clean up

- i. Upon the completion of concrete work, all forms equipment, construction tools protective coverings and any debris resulting from the work shall be removed from the premises.
- ii. All debris, ie., empty containers, wooden pieces etc. shall be removed
- iii. The finished concrete surfaces shall be left in a clean condition satisfactory to Engineer.

2.3 Providing and laying plain cement concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate of nominal size 37 mm and down).

The general specification is same as item no.2.01.

2.4 Providing and fixing Shalitek or equivalent approved quality and make expansion parts for expansion joints, expansion columns, beams etc. complete

Mode of measurement

This shall be measured in sqm.

2.5 Supply and filling the pockets with free flow ready mix high strength cementitious grout.

Providing and Grouting the foundation bolts/pockets, base plates with ACC Shrinkkomp grade-2/GP2 of FOSROC or FLOWGROUT 60 of FAIRMATE ready mixed non shrink, free flow, self leveling, cementitious grout making holes if necessary in concrete as directed and as per the recommendations of the manufacturer. The pocket shall be cleaned off the dust or any foreign matter before grouting. The work shall be measured based on the size of pockets actually grouted and quantity in Kg consumed or quantity in Kg. corresponding to size of pockets shown in the approved drawing, whichever is less. Similarly, in case of grouting below the base plate of machine/equipment, measurement shall be based on the area of grout and the thickness or actual weight of the grout as per the drawing or as per

actual whichever is less.

Mode of Measurement

The pockets shall be measured and shall be paid for in Kg.

SECTION II

3.00 MASONRY WORK

Applicable codes and specifications

a) The following codes, standards and specifications are made a part of this specification. All standards, tentative specifications, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions.

	IS: 1077	Common burnt clay buildings bricks
	IS: 3102	Classification of burnt clay bricks
	IS: 2180	Burnt clay building bricks, heavy duty
bricks	IS: 3495	Method of sampling and testing clay building bricks
	IS: 2691	Burnt clay facing bricks
	IS: 2221	Code of practice for brick work
	IS: 2185	Load bearing hollow concrete blocks
	IS: 5498	Lime cement cinder hollow concrete blocks
	IS: 3115	Lime cement cinder solid blocks
masonry (Part I)	IS: 1597	Code of practice for construction of stone masonry (Part I)

3.01 Providing and constructing brick masonry in CM in foundation and up to

plinth level

- o. Bricks used in works shall be bricks of specified crushing strength as described in the Schedule of quantities. They shall have the following general properties:

They shall be sound, hard, homogenous in texture, well burnt in kiln without being vertrified, table moulded, deep red, cherry or copper coloured, of regular shape and size and shall have sharp and square edges and paralleled faces. The bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing unground particles and which absorb water more than 1/5th of their weight when soaked in water for twenty four hours shall be rejected. Over burnt or under burnt bricks shall be liable to rejection these bricks shall give a clear ringing sound when struck.

- b. Samples of bricks shall be submitted before starting the brickwork to the Engineer for approval. Bricks supplied shall conform to these approved samples. Brick sample shall be got tested as per IS:3495 by Contractor at no extra cost. Bricks rejected by Engineer shall be removed from the site of works within 24 hours.

- c. Mortar

i. Mix for cement mortar shall be as specified in the respective items of work. Gauge boxes for sand shall be of such dimensions that one complete bag of cement containing 50Kgs. of cement forms one unit. The sand shall be free from clay shale, loam, alkali, and organic matter and of sound, hard, clean and durable particles. Sand shall be approved by the engineer. If so directed by the engineer sand shall be thoroughly washed till it is free of any contamination.

ii. For preparing cement mortar the ingredients shall first be mixed thoroughly in dry condition. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall preferably be machine mixed, through mixing in a thorough manner may be allowed. The mortar so mixed shall be used within 30 minutes of mixing. Mortar left unused in the specified period shall be rejected.

iii. The contractor shall arrange for test on mortar samples if so directed by the engineer re-tempering of mortar shall not be permitted.

- d. Workmanship

2.0 All bricks shall be thoroughly soaked in clear water for at least one hour immediately before being laid. The cement mortar for brick masonry work shall be as specified in the respective item of work.

Brick work 230 mm thick and over shall be laid in English bond unless otherwise specified. While laying bricks shall be pressed into the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall be laid with frogs uppermost.

- 3.0 All brick work shall be plumb, square and true to dimensions. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be leveled. The thickness of brick courses shall be kept uniform. For walls of thickness greater than 230 mm both faces shall be kept in vertical planes. No broken bricks shall be used except as closers. Care shall be taken that the bricks forming the top corners and ends of the wall shall be properly radiated and keyed into position. Holes kept in masonry for scaffolding shall be closed before plastering. All interconnected brickwork shall be carried out at nearly one level (so that there is uniform distribution of pressure on the supporting structure) and no portion of the work shall be left more than one course lower than the adjacent work where this is not possible, the work shall be raked back accordingly to bond (and not saw toothed) at an angle not exceeding 45 deg.
- 4.0 Bricks shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6 mm and not more than 10 mm. The face joint shall be raked to a minimum depth of 12 mm by raking tools daily during the progress of work when the mortar is still green so as to provide a proper key for the plaster or pointing to be done. Where plastering or pointing is not required to be done the joints shall be uniform in thickness and be struck flush and finished at the time of laying. The face of brickwork shall be cleaned daily and all mortar droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top. If the mortar in the lower course has begun to set the joints shall be raked out to a depth of 12 mm before another course is laid.
- 5.0 All brick work shall be built tightly against columns, floor slabs or other structural member.
- 6.0 Where drawings indicate that structural steel columns are to be fireproofed with brick work the brick shall be built closely against all flanges and webs with all spaces between the steel and bricks works filled solid with mortar. Steel members partly embedded in brickwork and not indicated to be fireproofed with concrete shall be covered with not less than 12mm thick mortar unless directed otherwise by Engineer.
- 7.0 The work shall be cured for 15 days

- e. Miscellaneous inserts in masonry eg. Sleeves, wall ties, anchors, conduits, structural sheet, steel lintels etc. shall be installed by the Contractor. Furnishing fixing of any of these inserts by the Contractor will be paid for separately under steel work. Openings, arches, etc. shall be provided as shown on the drawings, chasses, pockets etc., shall be provided as shown on the drawings to receive rain water pipes etc. wall ties and flashings shall be built into the brickwork in accordance with drawings and specifications.
- f. Mode of measurement
 - i. Brick or of thickness one brick ie.230 mm and above shall be paid in units of cum. In all cases, the quantities measured shall be executed after making necessary deductions for openings etc. as given below:-

No deductions shall be done for openings up to 1000 sqcm, ends of dissimilar materials, drainage holes, window/door holdfasts, concrete lintel bearings, landing slab bearing, beam bearing, chimney flues, cutouts, iron fixtures, pipes up to 30 cm dia.
 - ii. It shall be clearly understood that the rates quoted by the Contractor include leaving openings, cutting chases in brickwork as per drawings/instructions of the Engineer.
 - iii. The rate includes necessary single or double scaffolding, centering, soaking of bricks, raking out joints and curing the work all complete.

3.02 Providing and brick work in CM in super structure at all levels

The general specification is same as per item No.3.01

3.03 Providing and constructing 115 mm brick masonry in partition for superstructure in CM.

The bricks shall be laid with stretchers. The proportion of the mortar shall be as specified in the item description. The quality of the bricks shall be as specified in the item 3.01. The bricks shall be well soaked in water before using them. The brick work shall be plumb and square. Two nos. of 6 mm dia MS bars of 25 mm x 1.2 mm deep iron band kept at every third course of 115 mm thick brick work. This shall be provided by the Contractor.

Mode of measurement

The brick work shall be measured in sqm. The deductions shall be as specified in the item 3.01. The rate includes necessary single or double scaffolding, centering, soaking of bricks, providing and placing of 2 Nos. of

6 mm dia MS bars or 25mm cx 1.2 mm deep iron band, raking out joints and curing the work all complete.

3.04 Providing and constructing 75 mm partition wall in CM

The general specification shall be same as per item 3.03

3.05 Providing and constructing honey comb brick work

The specification for the material and the workmanship shall be as specified in the items 3.01 or 3.03 depending on the thickness of the brick work. The proportion of the CM shall be as specified in the item description in the Schedule of Quantities.

Mode of measurement

It shall be measured as a normal brick work. No deductions shall be made for the honeycombing. Also nothing extra shall be made for the honeycombing.

3.06 Providing and constructing facing brick work

a) Facing bricks of the type specified shall be laid in the position indicated on the drawings and all facing brickwork shall be well bonded to the backing bricks. No facing brickwork shall at anytime be more than 600mm above the backing brickwork.

b) Facing work shall be pointed as the work proceeds and internal faces of the brickwork shall be pointed with neat joint to give a fair face.

c) Faced work shall be kept clean and free from damage, discolouration etc. at all times. The contractor shall carefully plug all holes with bricks similar to the surrounding.

d) For facing brickwork double scaffolding shall be used and no holes in brickwork for scaffolding shall be permitted.

Mode of measurement

It shall be measured in sqm. The rate shall include pointing, double scaffolding, curing etc. all complete.

3.07 Providing and constructing concrete block masonry

a) Concrete blocks (hollow or solid) shall generally conform to IS:2185. Blocks shall be regular in size and shape and shall be of specified strength. Blocks shall be properly cured before they are brought to site. Half or three quarter size blocks are to be used wherever required to make up length of wall and broken blocks shall not be used. The texture of the blocks shall be such that plaster will adhere to it. The contractor shall supply samples for approval.

b) Blocks supplied shall conform to approved samples.

Mortar

Mortar shall be similar to mortar in brickwork as given 3.03 herein before.

Workmanship

a) All block work shall be plumb, square and properly bonded. The joints shall be broken. The thickness of course shall be uniform with course s horizontal. All connected work shall be carried out at nearly on level and no portion of the work shall be left more than one course lower than the adjacent work.

b) Blocks shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6 mm and not more than 8 mm. The face joints shall be raked to a minimum depth of 10 mm by raking tools daily during the progress of work when the mortar is still green, so as to provide a proper key for the plaster or pointing. When plastering or pointing is not required, the joints shall be struck flush. for pointed masonry without plaster, smooth textured concrete block shall be used. The face of blocks work shall be kept clean at all times.

c) Where block are to be used for load bearing walls, the uppermost layer of block masonry supporting slab or other structured members, shall be solid or treated as directed by the Engineer.

Precast concrete screen blocks of jail work may be used for decorative purposes. The contractor shall furnish samples for approval.

Mode of measurement

a) Block work of specified thickness shall be paid in units cum. If reinforcing bars are specified in horizontal courses, it shall be measure and paid for separately at quoted rate for reinforcement in all cases, the quantities measured and paid for shall be those actually executed after making necessary deductions for openings etc.

3.08 Providing and constructing Random rubble masonry uncoursed in foundation and up to plinth level.

Stone: It shall be hard, sound, free from decay, weathering and defects like cavities, cracks, flaws, sand holes, veins, patches of soft or loose materials etc. It shall be obtained from an approved quarry and blasted rock obtained from site. Where required by the engineer the stone shall be got tested for water absorption determined as per IS 1124-1974. Stone with rounded surfaces shall not be used. The quoted rate for Random rubble masonry using blasted rock includes for sizing and dressing of blasted rock to suit the requirements of masonry construction.

a) Stones for this work shall be hard, durable rock, close or fine grained and

uniform in colour free from veins, flaws and other defects and shall conform to IS: 1597 (Part I). The stones shall be laid in mortar proportions specified for the particular item of work. Stones be got approved.

b) For all work below ground level the masonry shall be random rubble uncoursed with ordinary quarry dressed stones or hearting and faced with selected quarry dressed stones

c) For all work above ground level the masonry shall be random rubble faced with hammer dressed stones with squared quoins at joints and corners.

d) No stones shall tail in to the wall, either with a point or to length less than 1 ½ times its height. The thickness of the joints shall not exceed 12 mm.

e) Spauls and pinnings shall not be allowed to show on the face of the wall. Two bond stones each of minimum area of 500 sqcm for every 1.0 sqm of each wall face shall be provided. These shall be through stones in walls 600 mm thick and under, in walls thicker than 600 mm the length of bond stones shall be 2/3 times the thickness of walls. The stones for hearting of the wall shall not be less than 150 mm in any direction. Chips and spauls shall be wedged into avoid thick mortar beds and joints. The wall faces, corners and joints or openings shall be truly vertical the quoins shall be of selected stones, neatly dressed with chisel to form the required angle and laid header and stretcher alternatively.

f) The exposed face of the work shall be carefully and neatly pointed with mortar in all joints on the other side the joints shall be neatly struck with trowel while the mortar is fresh.

Mortar

The mortar for the work shall be as specified in the respective item of work. Curing of masonry shall continue for a minimum of ten days

Mode of measurement

The unit of measurement shall be cum or part thereof. the actual quantity of masonry shall be calculated from dimensions shown on the drawings. Less opening and shall be paid for. The cost includes providing of bond/through stones.

3.09 Providing and constructing Random rubble masonry uncoursed in superstructure

The specification shall be same item 3.08.

3.10 Providing and constructing coursed rubble masonry in foundation and up to plinth level

a) The stones used shall be hard, durable rock, free from veins, flaws and other defects and shall conform to IS:1597 (Part I). Height of each course in the masonry shall not be less than 150 mm. The stones in each course shall be of equal height. All course shall be of the same height unless otherwise specified. All stones shall be set in full cement mortar of proportion specified for the respective item of work. Stones shall be got approved by the Engineer.

b) The face stones shall be square don tall joints and beds. The beds being hammer dressed or chisel dressed type and square for at least 75mm from the face and the joints for at least 40 mm. The face of the stone shall be hammer dressed so that bushings shall not project more than 40 mm.

c) No spauls or pinnings shall be allowed on the face. All bed joints shall be horizontal and side joints vertical and no joints shall e more than 10 mm in thickness.

d) No face stone shall be less in breadth than in height or shall tail into the work to a length less than the height and at least 1/3rd the number of stones shall tail into the work to at least twice their height, or in walls over 600 mm in thickness 3 times their height

e) Through stones shall be inserted every 1.5 meters to 1.8 meters apart in every case and shall run right through when the wall is not more than 600 mm thick when the wall is more than 600 mm thick a line of two or more headers shall be laid from the face to face which shall overlap each other by at least 150 mm. A header shall have a length of at least thrice its height

f) Stones shall break joint at least half the height of the course. Quoins shall be formed of stones at least 45 cm long laid stretcher and header alternatively. They shall be laid square in their beds, which shall be fair dressed to a depth of at least 100 mm. The corner shall be chiesel dressed for a width of 25 mm.

g) The work on the interior face shall be precisely the same as on the exterior face unless the work is to be plastered in which case the side joints not be truly vertical

h) Hearting shall consist of flat bedded stones carefully laid on their proper beds and solidly bedded in mortar chips and spauls of stone being wedged in wherever necessary so as to avoid thick beds or joints of mortar. Care shall be taken so that no dry work or hollow spaces shall be left anywhere in the masonry. The face and backing shall be brought up every bed. The backing should not be leveled up at each course by the use of chips.

Mortar

The mortar for the work shall be as specified in the respective item of work. Curing of masonry shall continue for a minimum of ten days

Mode of Measurement

The unit of measurement shall be cum or part thereof. Actual quantity of masonry shall be calculated from dimensions shown on drawing less openings and shall be paid for. The cost includes the provision of bond or through stones.

3.11 Providing and constructing laterite masonry in CM 1:6 for foundation and up to plinth

Laterite stone block shall be cut from hard layer of laterite. These stones are cut to the sizes specified in the drawing. Rough cut stones shall be dressed to get the exact nominal dimensions (300 to 400mm in length, 200 to 250 mm in width and 150 to 200 mm in depth). As the blocks are specified in the single block walls, actual size of the block need not be less than nominal size to make up for joint width. The mortar used shall be of cement sand as indicated in the drawings. The masonry construction shall be following general principles of bond as adopted for brick masonry. As these blocks are relatively moist, pre-wetting of the blocks will not be necessary for construction with cement mortar. However curing of masonry shall be done for a minimum of seven days. All other details of works will be same as those specified in item no.3.01 – Brick masonry.

Mode of Measurement

This shall be measured in cum

3.12 Providing and constructing laterite stone masonry in CM 1:6 for superstructure at all levels.

The general specification is same as per item No.

SECTION III

Schedule of Quantities

PRICE BID

Tender for Civil Works- Construction of Foundation for Containerised Store Module for Products Dairy.

Tender No. EU/705/KTM/2021-22/5 dated 10.02.2022

Sl No	Description	Unit	Qty	Rate	Amount	Amount in words
1	EARTH WORK Excavation in all type of Soils up to 1.5 Mtr	Cum	6.5			
2	CONCRETE WORK:- Providing and laying PCC 1:2:4 with 40 mm metal for flooring work as per technical specification.	Cum	4.5			
3	Providing RCC Slab 10 mm thick with CM 1:2:4 with M20 metal as per the technical specifications.	Cum	5			
4	Providing fabricating and placing in position TMT steel	Kg	300			
5	MASONRY WORK:- Providing and constructing Random Rubble Masonry in CM 1:6 foundation at all level as per technical specifications..	Cum	18			
Total						
GST @						
Grand total						

Total in words:

Name :
Address for
Communications :
Cell No. :
Email :

EMD DETAILS :
UTIR NO. :
DATE :
AMOUNT :
BANK NAME :

KCM MF

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CONTRACTOR