

**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI**

Guwahati - 781 039, Assam

Phone: (0361) 2582061, 2692771 Fax : (0361) 2692771, 2690762



**TENDER DOCUMENT**

**NIT no: IITG/IPM/NIT/FY23-24/23 dated: 22-06-2023**

**NAME OF WORK**

Repairing of seepage from bathroom down slab of quarter no D-67 and  
F-72



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Guwahati - 781 039, Assam  
Phone : (0361) 2582061, 2692771 Fax : (0361) 2692771 , 2690762

### NOTICE INVITING TENDER

**Tender No-** IITG/IPM/NIT/FY23-24/23 dated: 22-06-2023

Sealed tenders are invited in single bid from the registered and experienced contractors for the following work. Tenders will be received up to 2:00 p.m. on 12-07-2023 and will be opened on the same day at 3.00 p.m. in presence of intending tenderers or their authorized representatives. In case, the day of submission of the tender happens to be a holiday on account of Govt. notification and tender cannot be received or opened; the tender shall be received or opened on the next working day at 3.00 p.m. for which no separate communications will be made. Other terms & conditions are enclosed herewith.

Name of works	Repairing of seepage from bathroom down slab of quarter no D-67 and F-72
Web Site for downloading tender	<a href="https://www.iitg.ac.in/iitg_tenders_all">https://www.iitg.ac.in/iitg_tenders_all</a>
Estimated Cost	₹ 3,61,021.00
Cost of tender Document	₹ 1,000.00 (Through <b>Demand draft/ Banker's cheque</b> in favour of 'IIT Guwahati' payable at 'Guwahati')
Earnest Money	₹ 7,300.00 (Rupees seven thousand five hundred only) (Through <b>Demand draft/ Banker's cheque</b> in favour of 'IIT Guwahati' payable at 'Guwahati')
Time of completion	60 (Sixty) days from the date of handing over of site
<b><u>Critical dates</u></b>	
Tender document download/ sale start	18-07-2023 to 01-08-2023 Up to 13:30 Hrs
Last Date & time for Submission	Up to 14.00 Hrs. on 01-08-2023
Date & time for tender Opening	At 15.30 Hrs. on 01-08-2023

#### **Qualifying criteria for participation in the Tender:**

- (1) The contractor/ firm should have valid Registration in CPWD, BSNL, APWD, Railways, MES, Central PSUs & other Govt. / Semi Govt. Dept. / Govt. Autonomous Body.
- (2) Minimum Annual Turnover from Construction works during last 3 consecutive years should not be less than ₹ 1.80 lakh during the immediate last three consecutive years.
- (3) Experience in Work : (i) Shall have experience in execution of similar civil works (involving waterproofing works) completed satisfactorily during the last seven years as follows:  
(a) One work of value not less than ₹ 2.90 lakh against a single work order in Govt./ Semi Govt. department / Autonomous body during last seven years.
- (4) PAN no. and GST Registration.

- (5) Tender document shall be downloaded from IIT website ([https://www.iitg.ac.in/iitg\\_tenders\\_all](https://www.iitg.ac.in/iitg_tenders_all)) only from 18-07-2023 to 01-08-2023 Up to 13:30 Hrs.
- (6) Submitted tender paper (duly signed on all pages) must be accompanied by the attested copies of the qualifying documents as stated above along with (a) Copy of PAN card (b) GST Registration certificate., (c) **DD/BC of ₹ 1000.00 (Rupees one thousand only) as a cost of tender paper** (non-refundable) in favour of "IIT Guwahati" payable at 'Guwahati' (d) **DD/BC of ₹ 7,300.00 (Rupees seven thousand five hundred only) as a EMD** in favour of "IIT Guwahati" payable at 'Guwahati' should be submitted along with the Tender document. **Price bid shall be submitted with separate sealed envelope and marked as "Price-Bid" This price bid envelope along with all other necessary documents should be sealed in another envelope which should be submitted in tender box. Over that envelope details of name of work, NIT no and contractor name should be properly written.**
- (7) Any further clarification including corrigendum, addendum, amendments, time extension etc. to the above tender will be posted in the website only. Bidders should therefore regularly visit the website [https://www.iitg.ac.in/iitg\\_tenders\\_all](https://www.iitg.ac.in/iitg_tenders_all)
- (8) IIT Guwahati does not bind itself to accept the lowest tender and reserves itself the right to reject any or all the tenders received without assigning any reason thereof.

**HoS-Maintenance  
IPM Section**

# INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

## Submission of Tender

From :.....

To

**HoS-Maintenance, IPM Section**

**Indian Institute of Technology Guwahati, GUWAHATI - 781 039**

1. I/We hereby tender for execution of the work "**Repairing of seepage from bathroom down slab of quarter no D-67 and F-72**" as per tender document within the time schedule mentioned therein and accepted by me/us, at the rates quoted by me/us for the whole work in accordance with terms and conditions, specifications, drawings, as detailed in the tender document. It has been explained to me/ us that the time stipulated for job and completion of works in all respects and in different stages mentioned in the "Time schedule" of completion of work and signed and accepted by me/us is the essence of the Contract.
2. It has been explained to me/ us that the time stipulated for job and completion of works in all respects and in different stages mentioned in the "Time schedule" of completion of work and signed and accepted by me/us is the essence of the Contract. I/We agree that in the case of failure on my/ our part to strictly observe the time of completion mentioned for work or any of them and to the final completion of works in all respects according to the schedule set out in the tender, I/We shall pay compensation to the Owners as per provision and stipulations contained in the relevant clause of Contract and I/We agree to the recovery being made as specified therein. In exceptional circumstances extension of time which shall always be in writing may, however, be granted by the Engineer-in-Charge at his entire discretion for some items of work, and I/We agree that such extension of time will not be counted for the extension of completion dates stipulated for work and for the final completion of works as stipulated in the said "Time Schedule" of Completion of work.
3. I/We agree and accept the terms and conditions laid down in the memorandum below in this respect.

### **MEMORANDUM**

- |                                       |  |
|---------------------------------------|--|
| (a) General description of work       | Repairing of seepage from bathroom down slab of quarter no D-67 and F-72.  |
| (b) Earnest Money                     | Earnest money of ₹ <b>7,300.00</b> shall be deposited along with the tender in the form of <b>Demand draft/ Banker's cheque</b> or through online i.e. Debit Card/ Credit Card/ Net Banking/ NEFT/RTGS in favour of 'IIT Guwahati' payable at 'Guwahati' |
| (c) Performance guarantee             | 3% (Three percent) of the tendered amount.   |
| (d) Time allowed for starting of work | : 60 (Sixty) days from the date of handing over of site.   |

1. Should this tender be accepted I /We hereby agree to abide by and fulfill all terms and conditions referred to above and in default thereof, to forfeit and pay to the Owner or its successors or its authorized nominees such sums of money as are stipulated in conditions contained in Notice Inviting Tender and other tender documents.
2. I/We undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/We shall be debarred for tendering in IIT Guwahati in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Performance Guarantee.
3. If I/We fail to commence the work specified in the memorandum herein above, or I/We fail to deposit the amount of Performance guarantee specified in the Memorandum, I/We agree that the said Owner and its successors without prejudice to any other right or remedy be at liberty to cancel the notice of acceptance of tender if I/We fail to deposit the Performance guarantee as aforesaid or to execute an agreement or to start work as stipulated in the tender documents.
4. I/we hereby certify that all the statement made and information supplied are true and correct.
5. I/we have furnished all information and details necessary for eligibility and have no further pertinent information to supply.

**CERTIFICATE:**

It is certified that the information given in the tender are correct. It is also certified that I/we shall be liable to be debarred, disqualified in case any information furnished by me/us found to be incorrect.

Date.....day of.....2022

Witness:

Name in Block Letters:

Address:

Signature of Tenderer(s), with the seal of Firm

**PROFORMA FOR ACKNOWLEDGEMENT LETTER OF BIDDING DOCUMENT**  
(TO BE SUBMITTED IN BIDDER'S OWN LETTER HEAD)

**Ref no.**

**Date:**

**To**

**The HoS (Maintenance), IPM Section**  
IIT Guwahati  
Guwahati-781039, Assam

**Sub:** Repairing of seepage from bathroom down slab of quarter no D-67 and F-72.

**Ref:** IITG/IPM/NIT/FY23-24/23 dated: 22-06-2023

**Dear Sir,**

We hereby acknowledge receipt of a complete set of bidding document along with all enclosures for the subject work for preparation and submission of the Bid.

We undertake that the contents of the above Bidding document shall be kept confidential, further that specifications and documents shall not be transferred, and that the said documents are to be used only for the purpose for which they are intended.

(A) We intend to bid as requested for the subject works and furnish following details with respect to our quoting office:

- (i) POSTAL ADDRESS :
- (ii) TELEPHONE NUMBER :
- (iii) MOBILE NO. :
- (iv) TELEFAX NUMBER :
- (v) CONTACT PERSON :
- (vi) DESIGNATION :
- (vii) EMAIL ADDRESS :
- (viii) REGISTERED OFFICE :

BIDDER'S NAME : .....

SIGNATURE: .....

NAME : .....

DESIGNATION : .....

DATE : .....

**INDIAN INSTITUTE OF TECHNOLOGY  
GUWAHATI, ASSAM**

**Special Terms & Conditions**



**NAME OF THE WORK**

Repairing of seepage from bathroom down slab of quarter no D-67  
and F-72

## Special Terms & Conditions

1. The scope of this contract shall include scarifying existing road, repairing of potholes of bituminous road, application of a layer of bituminous concrete including tack coat etc as per specification. The Contractor shall provide all necessary materials, equipment, labour etc. for the execution and maintenance of the work till completion unless otherwise mentioned in this tender document. All materials required for the work shall be as per technical specifications and approved by Engineer-in-Charge prior to procurement and use.
2. Rates shall be quoted in the Bill of Quantity (BOQ) furnished in figures and in words. If there is any variation between the rates quoted in figures and rates quoted in words, the rates quoted in words shall be considered.
3. The rates shall be firm up to the completion of work. No price escalation will be paid on any account.
4. The work shall be completed within **60 (Sixty) days** from the date of handing over of site.
5. The rate shall be inclusive of all taxes including GST @ 18% (eighteen). All other taxes including forest Royalty as applicable to the work as per state/central government shall be deducted from the bills. Loading, unloading and transportation etc. of all the materials to work site at IITG campus, Guwahati-39 shall be inclusive of quoted rate.
6. All the pages of the tender document shall be signed and dated at the lower right hand corner by the tenderer. If the tender is signed by a person holding power of attorney, power of attorney authorizing him to sign on behalf of the tenderer should be submitted along with the tender.
7. The documents submitted along with the application for tender in respect of Experience, registration will be verified by the Institute with respect to that stated in the NIT for qualifying for the tender. If after verification any such data/ information are not found true or has attempted to conceal any unfavorable data/ information, his/her tender shall be summarily rejected.
8. The owner reserves the right to take inputs regarding performance of a bidder on any similar work (on-going or completed) from a client whether disclosed in the tender or not. If any such report from the client is found to be unsatisfactory, the tender is liable to be rejected.
9. Any tender submitted without the qualifying documents mentioned in the relevant clause of NIT, it shall be considered as incomplete tender and the tender will be rejected for which no communication will be made.
10. The contractor shall arrange all the plants, equipment, machineries etc. required for the works for which no extra charges will be paid.
11. The Contractor shall provide all necessary materials, equipment, labour etc. for the execution and maintenance of the work till completion unless otherwise mentioned in this tender document. All materials required for the work shall be as per technical specifications and approved by Engineer-in-Charge prior to procurement and use.
12. The contractor will arrange for water and electricity at his own. However, the Institute may provide electricity on the request of the contractor on payment basis under the terms and conditions fixed by the institute.
13. Care shall be taken by the contractor to avoid damage to any part of the building or its

finishing. He/they shall be responsible for repairing all damages and resorting the same to their original finish at his own cost. He / they shall also remove at his own cost all unwanted wastage and materials arising out of his work from the site.

14. Any abnormal rate quoted in the tender will summarily be rejected for which no communication will be made.
15. Earnest money of ₹ **7,300.00** shall be deposited in the form of deposited in the form of **Demand draft/ Banker's cheque** or through online i.e. Debit Card/ Credit Card/ Net Banking/ NEFT/RTGS in favour of 'IIT Guwahati' payable at 'Guwahati
16. **Payment of Bills:** The successful bidder if desire may submit their Running Account Bill as per progress of work and actual execution. The contractor will submit RA Bill for release of payment subject to his satisfaction in progress of work.

After successful completion of work, as per specification and requirement, the contractor must submit their Final Bill including detail measurement along with Forest Department or other department clearance if necessary within one month from the date of completion of work. On submission, the site engineer will prepare the bill subject to his satisfaction and put up for payment within fifteen days.

**17. Compensation for Delay**

If the contractor fails to maintain the required progress or to complete the work and clear the site on or before the contract or justified extended date of completion as well as any extension granted in the event of any deviations resulting in additional cost over the tendered value.

The contractor without prejudice to any other right or remedy available under the law to IITG on account of such breach, pay as compensation the amount calculated at the rates stipulated below on the amount of accepted Tendered Value of the work for every completed day/month (as determined) that the progress remains below that specified or that the work remains incomplete.

Compensation for delay of work: With maximum rate @ 1% (one percent)/ month of delay to be computed on per day basis based on quantum of damage suffer due to stated delay on the part of Contractor.

Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed 10 % (ten percent) of the accepted Tendered Value of work or of the accepted Tendered Value.

18. **Defect Liability:** Twelve (12) Months Period for general items and five (5) years for waterproofing works of Liability from the Date of Issue of Completion Certificate  
The Contractor shall guarantee the installation/work for a period of 12 months for general items and five (5) years for waterproofing works from the date of issue of completion certificate. Any damage or defect that may arise or lie undiscovered at the time of issue of completion certificate, connected in any way with the equipment or materials supplied by him or in the workmanship, shall be rectified or replaced by the Contractor at his own expense as deemed necessary by the Engineer-in-Charge or in default, the Engineer-in-Charge may cause the same to be made good by other workmen and deduct expenses (of which the certificate of Engineer-in-Charge shall be final) from any sums that may be then or at any time thereafter, become due to the Contractor or from his security deposit, or the proceeds of sale thereof, or of a sufficient portion thereof.

**19. Performance Guarantee: Performance Bank Guarantee (PBG):**

- i) The successful bidder shall submit an irrevocable Performance Guarantee of 3%

(Three percent) of the tendered amount in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (not withstanding and/or without prejudice to any other provisions in the contract) within 15 days from the date of issue of letter of acceptance. This period can be further extended by the Engineer-in- Charge on written request of the contractor stating the reason for delays in procuring the Performance Guarantee, to the satisfaction of the Engineer-in-Charge. This guarantee shall be in the form of Banker's Cheque of any scheduled bank/Demand Draft of any scheduled bank/Pay Order of any scheduled bank or Government Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank or the State Bank of India in accordance with the form annexed hereto. In case a fixed deposit receipt of any Bank is furnished by the contractor to IITG as part of the performance guarantee and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to IITG to make good the deficit.

- ii) The Performance Guarantee shall be valid up to the stipulated date of completion plus minimum 12 months beyond that. To cover the defect liability period of 12 months of the work, the Performance Guarantee shall be retained as Security Deposit. The same shall be returned after expiry of the defect liability period without any interest.
- iii) The Engineer-in-Charge shall not make any claim under the performance guarantee except for amounts to which IITG is entitled under the contract (not withstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:
  - a) Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the Engineer-in-Charge may claim the full amount of the Performance Guarantee.
  - b) Failure by the contractor to pay IITG any amount due, either as agreed by the contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by Engineer-in-Charge.
- iv) In the event of the contract being determined or rescinded under provision of any of the Clause/Condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of IITG.

**Clause no.19 (i) to (iv) shall supersede clause no. 19.1 & 19.2 of the General Conditions of Contract.** The term Initial Security Deposit/Security deposit used elsewhere in the tender document shall be read as Performance Guarantee.

- 20. All legal disputes will be subjected to jurisdiction of Gauhati High Court only.
- 21. If the lowest bid is below 10% of the estimate, additional initial security deposit of value by which the quote is below 10% of the estimate will have to be submitted by the bidder along with Performance Guarantee within 15 days from the date of issue of Letter of Intent offering the work. The additional security deposit shall be refunded immediately after completion of the work. In case the lowest bidder is not able to complete the work, the performance guarantee and the additional security deposit will be forfeited and the contractor will be debarred for 2 years from participating in the tenders floated by the Institute after issuing a show case notice.
- 22. The performance guarantee and additional security deposit will be in the form as specified in the tender. In case the lowest bidder fails to submit the performance guarantee and additional security deposit within the stipulated time, the offer will be

cancelled. In such case, the work will then be offered to the next lowest bidder (L2) at L2's rate and so on.

23. Lowest quotes above 10% of the estimated cost will not be accepted in any case and fresh tender will be invited.
24. All other terms & conditions shall be as per provision of General Conditions of Contract followed by the institute.

**HoS (M), IPM Section**

## **TECHNICAL SPECIFICATIONS**

### **22.0 WATER PROOFING TREATMENT**

#### **22.0 TERMINOLOGY**

##### **Water Bars**

Water bars are preformed strips of impermeable materials which are embedded in the concrete during construction.

##### **Low Partition Walls**

Parapet walls of height less than 45 cm.

##### **Expansion Joints**

Joints provided in the structure to allow for thermal expansion/construction.

##### **Blended Cement**

Cement mixed with water proofing compound in liquid or powder form.

### **22.1 INTEGRAL CEMENT BASED TREATMENT FOR WATER PROOFING ON HORIZONTAL SURFACE OF UNDER-GROUND STRUCTURE AT ALL DEPTH**

#### **22.1.1 Water Proofing of Horizontal Internal Surfaces of Under-ground Structure (Fig. 22.1)**

##### ***(i) Preparation of Surface***

The Water Proofing Treatment over the lean concrete/levelling course surface should adhere to the surface firmly, the surface of levelling course should be roughened properly when the concrete is still green. In case the surface is not made rough before the concrete is set, the work of water proofing should not be executed till proper key is provided for the base layer of Cement Mortar 1:3.

##### ***(ii) Blending Cement/Water with Water Proofing Compound***

The required quantity of cement bags to be used for a particular portion of work should be emptied on a dry platform. Water proofing compound bearing ISI mark and conforming to IS 2645 should then be mixed properly with the cement. The quantity of water proofing compound to be mixed should be as prescribed by the manufacturer but not exceeding 3% by weight of cement. The quantity of cement and water proofing compound thus mixed should be thoroughly blended and the blended cement should again be packed in bags. For the water proofing compound in liquid form, the blending is to be done with water. This can be done by taking the just required quantity of water to be mixed in the particular batch of dry cement mortar.

The required quantity of water thus collected per batch of dry cement mortar to be prepared should be mixed with liquid water proofing compound from sealed tins with ISI mark. The water thus mixed with water proofing compound shall be thoroughly stirred so that the water is blended with water proofing compound properly.

##### ***(iii) Rough Kota Stone 22 to 25 mm Thick***

The stone slabs to be used for this item shall be in thickness of 22 mm to 25 mm. Larger size of stone slabs i.e. 550 mm x 550 mm or 550 mm x 850 mm shall be used to minimise the number of joints.

General requirement of Kota stone shall be as laid down in CPWD Specifications of Kota Stone flooring.

##### ***(iv) Preparation of Cement Slurry***

Cement slurry shall be prepared by using 2.2 kg of blended cement per sqm. area. Each time only that much quantity shall be prepared which can be covered on the surface and the surface in turn would be covered with 25 mm thick cement mortar base within half an hour. Slurry prepared and remained unused for more than half an hour shall be totally rejected.

##### ***(v) Preparation of Cement Mortar***

Cement mortar 1:3 (1 blended cement: 3 coarse sand) shall be prepared with cement/water duly blended as explained in clause 22.1.1 (ii). Only that much quantity of cement

mortar which can be consumed within half an hour, shall be prepared. Any cement mortar that is prepared and remains unused for more than half an hour shall not be used in the work and shall be rejected.

**(vi) Laying Water Proofing Course**

Before laying the base course of cement mortar 1:3, the lean concrete surface shall be cleaned neatly with water. Cement slurry prepared as per clause 22.1.1 (ii), shall be applied only on the area of the concrete surface, that can be covered with the cement mortar (1:3) base course within half an hour. The cement slurry should cover every spot of the surface and no place shall remain uncovered. Just after the application of cement slurry on the surface, the cement mortar prepared as per clause 22.1.1 (v) should be used for laying the base course. Base Course should be laid to a perfect level with wooden/aluminium straight edge of at least 2 mtrs. long. The top surface of cement mortar should be finished neatly and later scratched when green with a suitable instrument before the base course dries and gets hard that is just before the base course takes up initial set.

When the 25 mm thick base course is just getting set the cement slurry prepared as per clause 22.1.1 (iv) should be spread over the base course upto the area that shall be covered with just two to three stone slabs. The cement slurry shall be spread in such a way that the area of base course to be covered immediately shall be covered with slurry without any gap or dry spots. Immediately on applying cement slurry on the base course the Rough Kota Stone slab shall be laid over the base course and pressed gently so that the air gap can be removed. The slurry applied on the surface which gets spread when the stone slab is pressed shall get accumulated in the joints of adjacent stone slabs and if any gap still remains between the stone slabs the same should also be filled with additional quantity of cement slurry. For laying the stone slabs in perfect level, two stone slabs at adjacent concerns/ends shall be fixed firmly to the required level and a string stretched over the two slabs, the intermediate slabs shall then be set to the level of the string.

After filling all the joints of the Rough Kota stone Slabs with cement slurry the area of stone slab shall be laid with cement mortar 1:3. The surface of stone slabs shall be cleaned and lightly watered. Cement mortar 1: 3 prepared as per clause 22.1.1 (iv) shall be used for laying this course. For laying this course 25 mm high wooden strips shall be used and the top surface shall be finished smooth without using additional cement or slurry.

After laying 3rd course and before the mortar layer takes the initial set, Stone aggregate of 10 mm to 12 mm nominal size shall be uniformly spread and lightly pressed into the finished surface @ 8 cu dm./sqm. The aggregates shall not be embedded totally inside the mortar and shall be visible on the top surface.

In cases where slope is to be provided for the water proofing layer, grading with additional cement concrete/cement mortar shall be provided and then the water proofing layer shall be laid on the graded surface. Extra payment shall however be made for the grading course.

**(vii) Curing**

Immediately after completing the fourth layer, arrangements shall be made for the top RCC slab as quickly as possible and in the mean time till the top slab is casted the water proofing treatment shall be kept wet continuously. In case the concreting of slab gets delayed for more than 2 weeks the curing can be stopped after 14 days.

**(viii) Measurement**

Length and breadth shall be measured along the finished surface correct to a cm and the area shall be worked out to nearest 0.01 sqm.

**(ix) Rate**

The rate shall include the cost of all labour & materials involved in all the operations described above. The cost of grading with cement concrete / cement mortar shall be paid for separately.

**22.1.2 Water Proofing of Internal Horizontal Surfaces of Under- ground Structure (Fig. 22.2)**

Same as in 22.1.1 above except that water proofing courses will be laid on R.C.C. Slab.

**22.2 INTEGRAL CEMENT BASED WATER PROOFING TREATMENT ON THE VERTICAL SURFACE**

**OF UNDER GROUND STRUCTURES (FIG. 22.3)**

**(i) Preparing the Surface**

The surface of the structure to be treated shall be roughed either by raking of joints in case of brick/ stone masonry or by hacking the cement concrete surface with a specifically made hacking tool just after removing shuttering. Alternately, the surface should be roughened by providing spatter dash key as explained under clause 22.1.1 (i). While doing water proofing to vertical faces from inside, it shall be ensured that water proofing treatment of floor slab is not damaged. Preferably, water proofing of vertical surface shall be done before that of horizontal surface.

**(ii) Blending Cement/Water with Water Proofing Compound** Same as under clause 22.1.1(ii).

**(iii) Rough Kota Stone Slab**

Same as explained under clause 22.1.1(iii).

**(iv) Preparation of Cement Slurry**

Same as explained under clause 22.1.1(iv).

**(v) Preparation of Cement Mortar**

Same as explained under clause 22.1.1(v).

**(vi) Laying Water Proofing Course**

Same as explained under clause 22.1.1(vi). Further rough kota stone are not sufficiently rough to remain in vertical position held by cement slurry. Therefore, the grip for the stone slab has to be increased and this can be done by planting 12 mm to 15 mm nominal size stone aggregate fixed with araldite on surface of each sand stone slab.

**(vii) Curing**

Same as explained under clause 22.1.1(vii). Further till the water proofing work on vertical face is in progress, the water proofing work done on floor slab shall be kept wet for a minimum period of 14 days. Immediately after completion of water proofing on vertical faces of side walls, the water tank shall be gradually filled with water for testing.

**(viii) Measurement**

Same as explained under clause 22.1.1(viii).

**(ix) Rate**

Same as explained under clause 22.1.1(ix).

**22.3 WATER PROOFING TREATMENT TO VERTICAL AND HORIZONTAL SURFACE OF DEPRESSED PORTION OF WC, KITCHEN AND THE LIKE**

**22.3.1 Before the Water Proofing Treatment**

Before the water proofing treatment, the internal plaster of ceiling and walls of WC block leaving the portion for dado/skirting should be completed. Grooving / chasing for doing the concealed work of GI/CI pipes/Electrical conduits should be completed. Cleaning the depressed/sunken portion of WC of all debris, extra mortar sticking to the vertical and horizontal surface etc. Necessary holes for 'P' trap /Nhani trap/Water escape pipe etc should be completed.

**22.3.2 Preparing Surface and Fixing Pipes and Fittings**

Before the water proofing treatment work, proper key in the concrete surface should be provided. The depressed/sunken portion should be hacked by a hacking tool, after the concrete slab is cast and when this concrete is still green.

The vertical surfaces of the depressed /sunken portion should be hacked with a hacking tool just after the shuttering is removed.

In case of old work, the water proofing treatment on such surfaces shall be permitted after making proper spatter dash key.

Fixing the 'P' trap in position and all other pipes work including the water escape pipe shall be fixed properly and the holes should be plugged carefully before taking up the water proofing work.

**22.3.3 1st Course**

Cement duly blended with water proofing compound as explained in clause 22.1 shall be used for preparing the cement slurry.

The consistency of the slurry should be such that 4.4 kg. of blended cement with water proofing compound is used per sq. metre area of surface to be treated. The slurry should be started from the vertical faces towards the bottom of the floor as shown in Fig. 22.4. Particular care should be taken to see that the slurry is applied to corners without leaving any gap.

#### **22.3.4 2nd Course**

Immediately on applying the blended cement slurry on the surface to be treated cement plaster 20 mm thick in CM 1:3 (1 blended cement: 3 coarse sand) shall be applied both on vertical and horizontal surfaces taking particular care to complete the entire depressed/ sunken portion of WC within a day so that the plaster can be done without any joint. Junctions shall be properly rounded. The surfaces of the plaster shall be left rough but finished in one plain and cured for a week. On completion of the curing period both horizontal and vertical surfaces shall be cleaned properly and gently and allowed to dry.

#### **22.3.5 3rd Course**

Only after the surface is completely dried the blown or residual bitumen shall be applied @ 1.7 kg. of bitumen per sqm area.

#### **22.3.6 4th Course**

PVC sheet 400 micron thick shall be spread evenly without any kink immediately, so that the PVC sheet sticks to the surface firmly. PVC sheet shall be continued to be laid over the main slab upto 100 mm.

Overlapping of PVC sheet should be done with a minimum overlap of 100 mm, duly pasting the overlapped sheet with an application of bitumen @ 1.7 kg./ sqm.

The projections of pipes and 'P' trap outlet etc. inside the depressed/sunken portion of WC shall also be clad with water proofing treatment layer upto a height of 150 mm, using a coat of bitumen with PVC sheet complete.

The surfaces of depressed/sunken portion of WC shall not be left without covering with specified filling material and base concrete, otherwise the PVC sheet layer may be tampered by the labour working in the vicinity.

Fixing up of WC pan, filling specified material and the top base concrete should be done as early as possible and the top horizontal layer of water proofing may be taken up later i.e. just before laying the floor tiles.

#### **22.3.7 Measurement**

Length and breadth shall be measured along the finished surface correct to a cm. and area shall be worked out to nearest 0.01 sqm. No payment however shall be made for the 100 mm overlap of PVC Sheet over the roof slab.

#### **22.3.8 Rate**

The rate shall include the cost of labour and materials involved in all operations described above.

### **22.4 PROVIDING WATER STOPS**

**22.4.1** Water stops conforming to IS 12200 for construction/expansion joints should be fabrication from a plastic compound, the basic resin of which shall be polyvinyl chloride. The compound shall contain additional resin/ plasticizer inhibitors or other materials such that when the materials is compounded it shall meet the requirement given in IS 15058.

#### **22.4.2 Type of Joints for which Water Bars are Provided**

The water bars are provided only for the movement of joints in a water retaining structure.

Different types of movement joints are as described below:

**Complete Contraction Joint:** This is a movement joint with deliberate discontinuity both in concrete as well as the reinforcement but no initial gap is maintained between the concrete on either side of the joint. This joint is intended to accommodate the contraction of the concrete.

**Partial Contraction Joint:** This is a movement joint with deliberate discontinuity in concrete but no water bar is provided and no discontinuity is provided in steel. No initial gap is maintained between the concrete on either side of joint.

**Expansion Joint:** This is also a movement joint with complete discontinuity in both reinforcement and concrete. It is intended to accommodate either expansion or contraction of the structure.

In general such joint requires the provision of an initial gap between the adjoining parts of the structure which accommodates expansion or contraction of the structure.

#### **22.4.3 Types and Performance of Water Bars**

Water bars are performed strips of impermeable material which are embedded in the concrete during construction so as to span across the joints and provide a permanent water tight seal during the whole range of joint movement.

The most usual form of water bars are strip with a longitudinal corrugation as shown in Fig. 22.5. Another form of water bar of metallic type is Z shaped strip.

Water bars of copper, sheet lead, natural or synthetic rubber and plastic such as polyvinyl chloride (PVC) are also used. These bars comprise of central longitudinal hollow tube with thin walls and stiff wings of about 150 mm width.

Out of the metals available copper is most suitable as regards ductility, resistance to corrosion in air, water and concrete. However, it may be attacked by some wastes. If sheet lead is used it should be insulated from concrete by a good coat of bituminous or suitable composition. Natural synthetic rubber and plastics have very considerable advantage in handling, splicing and in making intersections.

Galvanized iron sheets may also be used with the specific permission of the Engineer-in-charge provided the liquid stored or the atmosphere around the liquid retaining structure is not excessively corrosive i.e. sewage.

The strip water bars described as above, while placing in position has to be passed through the end shutter of the first placed concrete with the result the shuttering at this point should be perfectly water tight otherwise cement slurry may escape from the concrete being laid and will ultimately weaken

the structure. Therefore to avoid the above problem one can prefer moulded type of water bar.

The design of the moulded water bar with several projections need to be passed through the end shutter while placing the same in position. Another main advantage of this water bar is that since it occupies bigger proportion of the thickness of the joint it would lengthen the shortest alternative water path through the concrete.

**22.4.4** It is important to ensure proper compaction of concrete around the water bar. Proper cover to all the reinforcement shall be maintained. Sometimes to increase the bond the holes are provided in the copper water bars but in the long run it proves to be disadvantageous as it shortens the path of water through concrete. Water bars should be placed at the centre of the wall or if it is to be provided away from the centre its distance from either face of the wall shall not be less than half of the width of water bar or as specified/directed by the Engineer-in-charge.

#### **22.4.5 Covers Plates for Joint**

Sometimes joint cover plates have to be used for expansion joints mainly to avoid the risk of a fault in the water bar which is embedded. The plates to be used should be either copper or sheet lead. In case the copper plates are to be used, it should be clamped to the concrete face on each side of the joint. To ensure water tightness suitable gasket shall be used. Joint cover plates of sheet lead are also used and fixed on the joints. In this case the edges may return into grooves formed in the concrete and can be made completely water tight by lead caulking. Faces of the concrete to which sheet lead is to be fixed should be painted with bituminous or other suitable composition and the lead sheet should be similarly coated before fixing.

#### **22.4.6 Spacing of Joints**

In Reinforced Concrete floors movement joints should be spaced at not more than 7.5 m apart in two directions at right angles. The wall and floor joints should occur at the base of the wall in which case corresponding vertical joint is not important.

In concrete walls, the vertical movement joints should normally be placed at a maximum spacing of 0.75 m in reinforced walls. The maximum length desirable between vertical movement joints will depend upon the tensile strength of the walls and may be increased by suitable reinforcements.

Amongst the movement joints in floors and walls as mentioned above, expansion joint should be normally be provided at spacing of not more than 30 m between successive expansion joints or between

the end of the structure and the next expansion joint, all other joints being of the contraction type.

In case of expansion joints the filling of these with bitumen filler, bitumen felt or any such material etc. shall be paid for separately in running metre. The measurement shall be taken upto two places of decimal stating the depth and width of joint.

In case joint cover plates either of copper or sheet lead with ancillaries are provided, these shall be measured and paid for separately.

#### **22.4.7 Measurement**

Length shall be measured correct to a cm and net quantities shall be calculated upto two places of decimal.

Each category of water stops/bar such as PVC, copper specifying width, thickness shall be measured and paid for separately.

#### **22.4.8 Rate**

The rate shall include all labour and materials in all the operations described above.

### **22.5 WATER PROOFING TREATMENT IN SUNKEN PORTION OF WCs, BATHROOMS ETC.**

#### **22.5.1 Preliminaries to be Attended**

The preliminaries shall be attended as described in clause 22.3.1.

#### **22.5.2 Preparing Surface, Fixing Pipes and Fittings**

In this case, unlike as described in clause 22.3.2, no hacking of surface need be made, but only extra mortar sticking to the surface should be removed and the surface should be cleaned thoroughly. Fixing 'P' trap etc. shall be done as described in Clause 22.3.2.

#### **22.5.3 Providing and Laying of Slurry for First Layer**

The consistency of the slurry should be such as to cover the desired area by using 0.488 kg of blended cement per sqm of area.

On deciding the correct quantity of water required per sqm. area the required quantity of slurry should be prepared which can be applied over the desired surface within half an hour of mixing with 0.488 kg. of grey cement + 0.253 kg. water proofing compound as per manufacturer specifications + x litres of water per sqm. area and the required quantity of slurry thus prepared should only be used for first application.

The first layer shall be applied with painting brushes over the specified and dampened area carefully including the corners, holes on the surfaces and joints of pipes in concrete etc. and the application should continue at least upto 150 mm height of fixtures of pipes from the surface. The surface on application shall be air cured for 4 hours.

#### **22.5.4 Providing and Laying of Slurry for Second Layer**

The quantity of slurry required for second application to be covered within an hour of mixing shall be prepared with 0.242 kg. cement + 0.126 kg. water proofing compound + y litres of water per sqm. area and the required quantity of slurry thus prepared should only be used for second application.

The application of 2nd layer of slurry is same as for first layer as detailed in clause 22.5.3.

The applied surface shall be allowed to air cure for 4 hours and thereafter water curing shall be done for full 48 hours.

In case no further work as described above is to be taken up immediately on completion of water proofing treatment due to any reason it is recommended to protect the treated portion with cement plaster 1:4 as a protective layer for which separate payment shall be made to the contractor.

#### **22.5.5 Measurement**

Length and breadth shall be measured along the finished surface correct to a cm and area shall be worked out to nearest 0.01 sqm.

#### **22.5.6 Rate**

The rate shall include the cost of all labour and materials involved in all the operations described above. The cost of plastering shall be measured and paid for separately.

### **22.6 WATER PROOFING TREATMENT ON ROOF SLABS**

**22.6.1** Before taking up the water proofing work the construction of parapet walls, including finishing should be completed. Similarly, the ancillary items like haunches, khurras, grooves to tack the fibre cloth layer, fixing up of all down take pipes, water pipes and electric conduits etc. should be completed and no such work should be allowed on the area to be treated during the progress of water proofing treatment or even later.

#### **22.6.2 Preparing Surface**

There is no necessity of hacking the surface but the surface to be treated shall be cleaned including removing the mortar dropping from the surface.

#### **22.6.3 Providing and Laying of Cement Slurry**

The procedure to prepare and apply the cement slurry shall be same as detailed in clause 22.5.3

except that over projected pipes etc. slurry shall be applied just upto 100 mm height instead of 150 mm height. The slurry shall be applied upto a height of 300 mm on parapet walls and in the groove where the fibre glass cloth is to be tucked.

#### **22.6.4 Providing and Laying of Fibre Glass Cloth (2nd Layer)**

The fibre glass cloth shall be of approved brand and shall be thin, flexible uniformly bonded mat composed of chemically resistant borosilicate glass fibre distributed in random open porous structure bonded together with a thermosetting resin.

Immediately on applying the slurry on a sufficiently workable area as detailed above in clause 22.6.3 when the slurry applied is still green the fibre glass as specified shall be spread evenly on the surface without any kink and pressed in such a way that no air spaces exist. The fibre glass cloth shall be taken upto a height of 30 cm on parapet walls and tucked in the groove specially prepared at that height.

A minimum overlap of 100 mm width shall be provided when the fibre cloth has to be joined. The joining of 100 mm overlap shall be done with the same slurry used for the application on surface as first layer. The fibre cloth shall also be extended upto a height of 100 mm over pipes projecting from the surface.

#### **22.6.5 Providing and Laying of Cement Slurry for Third Layer**

The quantity of water required to prepare slurry which can cover one sqm. area of the surface to be treated shall be calculated as described in clause 22.5.3 and consider this quantity as say x litres/sqm.

On deciding the correct quantity of water required, the slurry shall be prepared by mixing 1.289 kg/m<sup>2</sup> of grey cement + 0.67 kg./sqm. of Water Proofing Compound +1.289 kg./sqm. of coarse sand + x litres of water. Slurry shall be prepared for the area to be covered within half an hour of mixing.

The consistency of the slurry shall be such that in one application with a brush 1.5 mm thickness of slurry can be coated on the fibre glass cloth surface.

This slurry shall be applied evenly on the entire surface covered with fibre glass cloth so that a layer of 1.50 mm thickness of slurry is formed.

The application of slurry shall be continued over the 300 mm portion of parapet wall and also the portion tucked in the groove on top.

The entire surface shall be allowed for air curing for 4 hours and later the surface shall be cured with clean water for 7 days.

On completion of curing the grooves where the fibre glass cloth is tucked shall be closed neatly with cement mortar mixed with water proofing compound and the repaired surface should be cured by clean water for 7 days.

Fourth and final layer of brick tiling if required shall be laid and paid for separately.

#### **22.6.6 Measurement**

Length and breadth shall be measured along the finished surface correct to a cm and area shall be worked out to nearest 0.01 sqm. Overlaps and tucking in a flashing grooves shall not be measured. No deductions shall be made for openings or recess or chimney stack, roof lights or Khurras of area upto 0.40 sqm, nor anything extra shall be paid for forming such openings, recess etc. For area exceeding 0.40 sqm. deduction will be made in the measurement for the full opening and nothing extra shall be paid for making such opening.

#### **22.6.7 Rate**

The rate shall include the cost of labour and material involved in all the operations described above, however the cost of brick layer with cement mortar shall be paid for separately.

### **22.7 INTEGRAL CEMENT BASED WATER PROOFING TREATMENT WITH BRICK BAT COBA (Fig. 22.6)**

**22.7.1** Before taking up the work the preliminaries to be attended shall be exactly same as described in clause 22.6.1.

#### **22.7.2 Preparing the Surface**

The surface of the slab should be roughened by scrapping when the slab concrete is still green, however, the surface need not be hacked. In case the slab is already cast and surface fairly finished, the same shall be cleaned neatly of all mortar droppings, loose materials etc with brooms/cloth.

### **22.7.3 Providing and Laying of Slurry under Base Coat**

The quantity of water required to prepare the slurry with 2.75 kg. of blended cement to be painted over an area of 1 sqm. shall be calculated exactly as described in clause 22.5.3.

Depending upon the area of surface that has to be covered, the required quantity of slurry should be prepared using 2.75 kg. blended cement + water per sqm. area to be covered, taking particular care to see that only that much quantity of slurry shall be prepared which can be used within half an hour of preparation i.e. before the initial setting time of cement.

The prepared slurry shall be applied over the dampened surface with brushes very carefully, including the joints between the floor slab and the parapet wall, holes on the surfaces, joints of pipes, masonry/concrete etc.

The application of the slurry should continue upto a height of 300 mm on the parapet wall and also the groove as shown in Fig. 22.6. The slurry should also be applied upto a height of 150 mm over pipe projections etc.

### **22.7.4 Laying Base Coat 20 mm thick**

Immediately after the application of slurry and when the application is still green, 20 mm thick cement plaster as base coat with cement mortar 1:5 (1 blended cement : 5 coarse sand) shall be evenly applied over the concrete surface taking particular care to see that all the corners and joints are properly packed and the application of the base coat shall be continued upto a height of 300 mm over the parapet wall.

### **22.7.5 Laying Brick Bat Coba**

Brick bat of size 25 mm to 115 mm out of well burnt bricks shall be used for the purpose of brick bat coba.

The brick bats shall be properly dampened for six hours before laying.

Brick bats shall be laid to required slope/gradient over the base coat of mortar leaving 15-25 mm gap between two bats. Cement mortar 1:5 (1 blended cement: 5 coarse sand) shall be poured over the brick bats and joints filled properly. Under no circumstances dry brick bats should be laid over the base coat.

The haunches/gola at the junction of parapet wall and the roof shall be formed only with brick bat coba as shown in Fig. 22.6.

In case the brick bat coba is laid on the base coat immediately on initial set there will be no necessity of applying cement slurry over the base coat before laying the brick bat coba. However, if the brick bat coba is to be laid on the subsequent day, cement slurry prepared as described in clause 22.7.3 shall be applied over the top surface of the base coat, then only the brick bat coba shall be laid.

### **22.7.6 Application of Slurry over Brick Bat Coba**

After two days of curing of brick bat coba cement slurry prepared as per clause 22.7.3 shall be applied on the surface of brick bat coba. The application of slurry shall be the same as described in clause 22.5.3 which should cover the haunches/gola, and the remaining small portion of parapet wall and also inside the groove as shown in the figure.

### **22.7.7 Laying Finishing Layer (Protective Coat)**

Immediately on applying the cement slurry over the surface of the brick bat coba and when the slurry applied is still green, the fibre glass cloth as specified in clause 22.6.4 shall be spread evenly on the surface without any kink & pressed to see that no air spaces exist. The fibre glass cloth shall be taken up to a height of 300 mm on parapet walls & tucked in the groove specially prepared at that height. 20 mm thick layer of cement plaster, without leaving any joints shall be applied with cement mortar 1:4 (1 blended cement: 4 coarse sand) over the entire fibre glass cloth including the haunches/gola and the small portion on the parapet wall. The groove in the parapet wall over the haunches shall also be filled neatly packing the mortar firmly in the groove.

The surface of the finishing layer (protective coat) shall be neatly finished with cement slurry prepared as per clause 22.7.3. The finished surface shall be allowed to dry for a while and then pattern of 300 mm x 300 mm groove, 8 mm deep shall be made over the entire surface.

### **22.7.8 Curing and Testing the Treatment**

The entire surface thus treated shall be flooded with water by making kiaries with weak cement mortar, for a minimum period of two weeks.

### **22.7.9 Measurement**

The measurement shall be taken along the finished surface of treatment including the rounded and tapered portion at junction of parapet wall. Length and breadth shall be measured correct to a cm and area shall be worked out to nearest 0.01 sqm. No deduction in measurement shall be made for openings or recesses or chimney stacks, roof lights or khurras of area upto 0.40 sqm., nor anything extra shall be paid for making such openings, recesses etc. For areas exceeding 0.40 sqm., deduction will be made in the measurements for the full openings and nothing extra shall be paid for making such openings.

#### **22.7.10 Rate**

The rate shall include the cost of all labour and materials involved in all the operations described above.

### **22.8 WATER PROOFING TREATMENT WITH BITUMEN FELT**

**22.8.0** Water proofing treatment with self finished felt shall be four courses or six courses as described in the item. Four course water proofing treatment with self finished felt is a normal duty treatment suitable for buildings where the cost of roof treatment is required to be restricted.

Six course water proofing treatment with self finished felt is a heavy duty treatment suitable for important structures.

#### **22.8.1 Materials**

**22.8.1.1** Self finished felt (Appendix A and B) shall conform to the type and grade given in the description of the item. This shall be one of the following types:

(i) Type 3 grade 1 hessian base felt conforming in all respects to IS 1322.

(ii) Type 2 grade 1 fibre base bitumen felt conforming to IS 1322.

(iii) Type 2 grade 2 glass fibre base felt conforming in all respects to IS 7193.

**22.8.1.2 Bonding Materials:** This shall consist of blown type petroleum bitumen conforming to IS 702 or residual petroleum bitumen conforming to IS 73. The bonding material shall be so selected as to withstand the local condition of temperature and gradient satisfactorily. The penetration of bitumen used shall not exceed 40 in any case. Suitable residual type petroleum bitumen of penetration 30/40 (IS grade S-35), residual type petroleum bitumen with higher penetration and low softening point and suitable blown type petroleum bitumen of IS grade 85/25 or 90/15 of approved quality shall be used. Where proprietary brands of bonding materials are proposed to be used they shall conform in all respects to the specifications in the preceding paras.

Sl.No Description 1st course 3rd course 5th course  
kg/sqm kg/sqm kg/sqm

I. Four course treatment: 1.45 1.45 -

II. Six course treatment:

(a) With type 3 grade 1 hessian base self finished bitumen felt. 1.45 1.20 1.45

(b) With felts other than type 3 grade 1 hessian base. 1.45 1.20 1.70

**22.8.1.3 Stone Grit and Pea- sized Gravel:** Stone grit shall be 6 mm and down size. Where peasized gravel is used it shall be hard, round and free from dust, dirt etc. The stone grit or pea-sized gravel shall not be spread over vertical and sloping faces of flashings and at drain mouths. At these places the surface shall be painted with two coats of bituminous solution.

The quantity of stone grit or pea-sized gravel required for the final course of four or six course treatment with hessian base self finished bitumen felt type 3 grade 1 shall be 6 cubic decimeter/ sqm.

#### **22.8.2 Preparation of Surface**

**22.8.2.1** The surface to be treated shall have a minimum slope of 1 in 120. This grading shall be carried out with cement concrete or cement plaster with coarse sand, as per direction of Engineer-in-charge,

to the average thickness required and finished smooth. Such grading shall be paid for separately.

**22.8.2.2** Junctions between the roof and vertical faces of parapet walls, chimneys etc. shall be cased by running triangular fillets 7.5 x 7.5 cm size, in cement concrete. At the drain mouths, the fillets shall be suitably cut back and rounded off for easy application of water proofing treatment and easy flow of water. Cement concrete where used shall be 1:2:4 mix (1 cement: 2 coarse sand : 4 graded stone

aggregate 20 mm nominal size). The provision of fillets shall be deemed to be covered by the item of water proofing and shall not be measured or paid for separately.

**22.8.2.3** In existing roof where gola and drip course are provided at the junction of roof and vertical face of parapet wall, chimney stacks etc., these shall be dressed suitably and finished smooth so as to ensure an easy and gradual turning of the flashing. Any dismantlement or forming and finishing smooth the junction for forming the base of the flashing shall not be measured or paid for separately and shall be deemed to form part of the preparation of the surface in the water proofing treatment.

**22.8.2.4** While the grading of roof surface is being done, it shall be ensured that the outlet drain pipe have been fixed and mouth at the entrance have been eased and rounded off properly for easy flow of water.

**22.8.2.5** When any pipe passes through the roof to be treated, angular fillet of shape shown in Fig. 22.7 shall be built around it for the water proofing treatment to be taken over it. These fillets shall not be measured or paid for separately.

**22.8.2.6** For carrying over and tucking in the water proofing felts into the parapet walls, chimney stacks etc. a horizontal groove 6.5 cm deep, 7.5 cm wide section with its lower edge at not less than 15 cm above the graded roof surface shall be left on the inner face of the same during construction if possible. When such groove has not been left, the same shall be cut out neatly and the base at rear of the groove shall be finished smooth with cement plaster 1:4 (1 cement: 4 coarse sand). Such cutting of the groove and its finishing smooth shall be deemed to be part of the water proofing item and shall not be measured or paid for separately. No deduction shall be made either for not making the groove or when the later has already been left in the masonry by the construction agency.

**22.8.2.7** Tucking in the water proofing felt will be required where the parapet wall exceeds 45 cm in the height from the graded surface. Where the height is 45 cm or less, no groove will be required as the water proofing treatment will be carried over the top of the parapet wall to its full thickness. In the case of low dividing walls of height 30 cm or less, outlets therein shall be cut open for full height and the bottom and sides shall be rendered smooth and corners rounded and such treatment shall not be measured and paid for separately.

**22.8.2.8** Where expansion joints are left in the slab, the provision of dwarf walls and/or RCC slabs for covering them and finishing the surface smooth shall be the responsibility of the construction agency, which had laid the roof slab and will not be included the operation of water proofing.

**22.8.2.9** The graded surface of the roof and concrete fillets and the faces of walls shall be thoroughly cleaned with wire brushes and all loose scales etc. removed. The surface shall then be dusted off. Any crack in the roof shall be cut to 'V' section, cleaned and filled up flush with cement mortar slurry 1:4 (1 cement: 4 coarse sand) or blown type petroleum bitumen of IS grade 85/25, or approved quality conforming to IS 702. Such cleaning of the surface or treating the cracks shall not be paid for separately.

### **22.8.3 Priming Coat**

Where so specified, or required by the Engineer- in-Charge for example under slightly damp conditions a priming coat consisting of a bitumen primer conforming to IS 3384 should be applied with brush on the roof and wall surface at 0.24 litres per sqm to assist adhesion of the bonding material (i.e. bitumen).

Such application of primer shall be paid for separately, unless specifically included in the water proofing item.

### **22.8.4 Underlay**

Where a floating treatment of water proofing with self finished bitumen felt is required i.e. where water proofing treatment is required to be isolated from the roof structure, a layer of bitumen saturated felt (underlay) shall be spread over the roof surface and tucked into the flashing groove. No bonding material shall be used below the underlay in order to keep the underlay free of the structure. The adjoining strips of the underlay shall overlap to a minimum of 7.5 cm at sides and 10 cm at ends. The overlaps shall be sealed with the same bonding material as used for the self finished felt treatment. Unless specifically included in the water proofing item, the underlay treatment shall be paid for separately.

The underlay shall be of type 1 saturated felt conforming to IS 1322 in all respects and having a total minimum weight of the finished bitumen felt in dry condition with mica dusting powder @ 6.8 kg

per 10 sqm. The roll shall not be damaged or crack on being unrolled on a fairly smooth and flat surface.

#### **22.8.5 Treatment**

**22.8.5.1** The water proofing shall consist of a four or six course treatment, as given in the description of the item, each layer of bonding materials, self finished bitumen felt or stone grit or pea sized gravel being counted as a course.

**22.8.5.2** The choice of a four or six course treatment will depend on the climatic condition, the importance of the building, the durability required, cost and other relevant considerations.

**22.8.5.3** A four course treatment shall consist of the following layers:

- (a) Initial layer of bonding material applied hot at specified weight per unit area.
- (b) 2nd layer of self finished bitumen felt conforming to the type and grade given in the description of the item.
- (c) Third layer of bonding material.
- (d) Final layer of stone grit of pea sized gravel spread at specified volume of material per unit area.

**22.8.5.4** In a six course treatment, the first, second and third layer shall be of the same as in the four course treatment. The fourth and fifth layer shall consist of self finished felt and bonding material respectively. The sixth layer shall consist of stone grit or pea sized gravel.

**22.8.5.5** The primer or underlay where required to be provided shall not count against the number of courses specified.

#### **22.8.6 Laying**

**22.8.6.1** Bitumen bonding material of required grade shall be heated to the working temperature specified for the particular grade by the bitumen manufacturers and conveyed to the roof in buckets or pouring canes in weighed quantities.

Suitable working temperature for different grades of bitumen are as under:

- (i) Blown type petroleum bitumen of IS grade 85/25 or 90/15 - 180 degree C.
- (ii) Residual type petroleum bitumen of penetration 30/40 - 180 degree to 190 degree C (IS grade S-35).

**22.8.6.2** Drain outlets shall be given a four or six course treatment as specified for the roof in the description of the item in the manner specified for the flat roof surface. Water proofing treatment shall be carried into the drain pipe or outlets by at least 10 cm. The water proofing treatment laid on the roof surface shall overlap the upper edge of the water proofing treatment in the drain outlets by at least 10 cm.

**22.8.6.3** The self finished felt shall be cut to the required length, brushed clean of dusting material and laid out flat on the roof to eliminate curls and subsequent stretching. The felt shall normally be laid in length at right angles to the direction of the slope and laying shall be commenced at the lowest level and worked upto crest. The felt shall not be laid in single piece of very long lengths as they are likely to shrink; 6 to 8 m are suitable lengths. The roof surface shall be cleaned and dried before the felt treatment is begun. Each length of felt shall be laid in position and rolled up for a distance of half its length. The hot bonding material shall be poured on the roof across the full width of the rolled felt as the latter is steadily rolled out and pressed down. The pouring shall be so regulated that the correct weight of bonding material per unit area is spread uniformly over the surface. Excess bonding material that gets squeezed out at the ends shall be levelled up as laying proceeds. When the first half of the strip of felt has been bonded to the roof, the other half shall be rolled up and then unrolled on the hot bonding material in the same way. Subsequent strips shall also be laid in the same manner. Each strip shall overlap the preceeding one by at least 7.5 cm at the longitudinal edges and 10 cm at the ends. All overlaps shall be firmly bonded with hot bitumen. Streaks and trailings of bitumen near edges of laps shall be levelled by heating the overlap with a blow lamp and levelling down unevenness.

The third layer of bonding material in the four course treatment shall be carried out in a similar manner after the flashing has been completed.

**22.8.6.4** In a six course treatment the third and fourth layers of bonding material and self finished felt shall be laid in the manner already described, taking care that laps in the felt are staggered from those in the second layer. The fifth layer of bonding material shall be carried out after the flashing is

done (See Fig. 22.7).

**22.8.6.5 High Parapet Walls, Chimney Stacks etc.:** Felts shall be laid as flashings wherever junctions

of vertical and horizontal surfaces occur. Longitudinal laps shall be 10 cm. The lower layer of flashing felt in a six course treatment shall overlap the roof water proofing by not less than 20 cm while the upper layer shall overlap the roofing felt by 10 cm. The minimum overlap of the flashing felt in four course specification over the roofing felt shall be 10 cm.

The flashing shall consist of the same four or six course treatment as for the roof except that the final course of stone grit or pea-sized gravel shall be replaced by an application of bituminous solution of approved quality in two coats on the vertical and sloping faces only, of the flashing. The overlap along the length of flashing shall stagger with those in the second layer of flashing felt (in a six course treatment and with the joints in the roof felt).

The upper edge of the flashing felt shall be well tucked into the flashing grooves in the parapet, chimney stacks etc. to a depth of not less than 6.5 cm. Corresponding applications of bonding material shall also be made. The flashing treatment shall be firmly held in place in the grooves with wood edges at intervals and the grooves shall be filled up with cement mortar 1:4 (1 cement: 4 coarse sand) or cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 6 mm nominal size) and surface finished smooth with the rest of the wall. The cement work shall be cured for 7 days. When dry, the exposed plaster joints of grooves shall be painted with bitumen and two coats of bituminous solution shall be applied on the vertical and sloping surface of flashing (see Fig. 22.7).

After the top flashing felt layer has been fixed, the penultimate layer of bonding material shall be applied over the roofing felt and the horizontal overlaps and vertical and sloping surfaces of the flashings at the specified rate. Stone grit or pea sized gravel shall then be spread uniformly over the hot bonding material on the horizontal roof surface at the specified quantity per unit area and pressed into it with a wooden roller.

**22.8.6.6 Low Parapet Walls:** Where parapet walls are of height 45 cm or less, bitumen felt flashings shall be provided in the same manner as for flashings in the case of high parapet walls except that the upper edge shall be carried upto the full height of the wall and taken right across the top of the parapet and down on the external vertical faces to a minimum distance of 5 cm (see Fig. 22.7).

**22.8.6.7 Low Dividing Walls:** Where low dividing walls or inverted beams are met with, the same shall be covered with a four or six layer treatment as for the main roof, the latter bearing carried down both sides of the wall and overlapping the roofing treatment as in the case of flashing of high parapet walls (see Fig. 22.7).

Drain outlets where formed in the low dividing walls, shall be given water proofing treatment of the same number of courses as specified for the flat roof surface. The bottom and sides shall be so treated that all overlaps are in the direction of flow of drainage.

**22.8.6.8 Expansion Joints:** Where the expansion joints are provided in the slabs, the joints and their cover slabs shall be suitably treated with water proofing. A typical sketch of an expansion joint with the RCC slabs on either side of the joint turned vertically up and covered with precast RCC cover slabs as given in Fig. 22.7. The cover slabs shall cover the vertical turned up dwarf walls by not less than 7.5 cm and are provided with throatings on their underside along their length. The water proofing treatment shall be taken up the sloping junction fillets and the vertical faces of the walls to the underside of the cover slabs. The cover slabs are given the water proofing treatment like the roof slabs, after the cross joints between adjacent cover slabs are first sealed with 15 cm width of roofing felt struck to them with bitumen. The water proofing treatment shall be carried down the sides of the cover slabs to their full thickness. Care shall be taken to see that overlaps if any in the roofing over the cover slabs stagger with the joints between cover slabs.

The formation of the expansion joints and provision of cover slabs shall be the responsibility of the construction agency. The formation of the junction fillets and the water proofing treatment of the joint and cover slabs shall be carried out by the water proofing agency. No extra shall be paid for the junction fillers or for the sealing of the cross joints in the cover slab with 15 cm width of bitumen strips.

**22. 8.6.9 Pipes:** Where vertical pipe outlets are met with 7.5 x 7.5 cm fillets of lime or cement concrete

of the type and section shown in Fig. 22.7 shall be provided and flashing of four or six course treatment, same as for the roofing treatment shall be laid.

The upper edge of the flashing shall be laid sloping down forward and butted against the pipe and annular depression so formed shall be filled with hot bitumen. A circular metal collar in the shape of an inverted truncated cone shall be fixed on the pipe to throw off the rain water clear of the flashing and this shall be paid for separately.

**22.8.6.10 Terrace:** Where roof surfaces are expected to be used precast cement concrete tiles or 40 mm thick cement concrete shall be laid on the water proofing treatment. In such cases, the final course of stone grit or pea sized gravel shall not be laid in the water proofing treatment. Suitable adjustment in the rates will be effected for not providing the stone grit or pea sized gravel layer. Cement concrete in situ flooring shall be laid in panel not exceeding 0.4 square metres each. Precast tiles or in situ concrete flooring where laid shall be paid for separately unless included in the description

of the water proofing item.

#### **22.8.7 Measurements**

**22.8.7.1** Length and breadth shall be measured correct to a cm. The area shall be calculated in square metres correct to two places of decimal.

**22.8.7.2** Measurements shall be taken over the entire exposed area of roofing and flashing treatment including flashing over low parapet walls, low dividing walls and expansion joints and at pipe projections

etc. Overlaps and tucking into flashing grooves shall not be measured.

**22.8.7.3** Vertical and sloping surfaces of water proofing treatment shall also be measured under the four or six course treatment as the case may be, irrespective of the fact that the final course of grit or pea sized gravel is replaced by bitumen primer.

**22.8.7.4** Primer or saturated felt underlay, where provided, shall also be measured in the same manner as the water proofing treatment and paid for separately. No deduction in measurements shall be made for either openings or recesses for chimney stacks, roof lights and the like, for areas upto 40 square decimetre (0.4 sqm) nor anything shall be paid for forming such openings. For similar areas exceeding 40 sq. decimetre deductions will be made in measurements for full opening and nothing extra shall be paid for forming such openings.

#### **22.8.8 Rate**

The rate shall include the cost of all labour and materials involved in all the operations described above and the particular specifications given under the different items, with the corrections noted in the relevant sub-para.

### **22.9 GRADING ROOF WITH CEMENT CONCRETE 1:2:4**

#### **22.9.1 Materials**

Cement, coarse sand and graded stone aggregate 20 mm nominal size, shall be used as specified in the item.

The specifications for the materials and method of preparation of concrete shall conform in general to the specification described in sub-head 4.0 of CPWD Specifications.

**22.9.1.1 Laying:** Before laying cement concrete for grading, the level markings to the required slope/gradient shall be made only with cement concrete on the surface of the slab at suitable spacing with the help of string and steel tape (Measuring tape) so that the mason can lay the concrete to the required thickness, slope / gradient easily in between the two level markings.

On getting the level marking approved by the Site Engineer the surface should be sprinkled with thick cement slurry and the concrete should be laid carefully, without throwing from height, in predetermined strips.

The concrete should be consolidated by specially made wooden tamping. After the tamping is done the surface should be finished to required slope/gradient with wooden trowels without leaving any spots of loose aggregates etc.

The mixed cement concrete must be laid in position, within half an hour of its mixing. In case any quantity of concrete remains unused for more than half an hour the same should be rejected and removed from the site.

**22.9.1.2 Finishing:** The slope of finished terrace shall not be more than 1 in 120 unless a steeper

slope is desired by the Engineer-in-Charge.

The minimum thickness of the concrete at its junction with Khurra or parapets shall be 5 cm. The concrete shall be rounded at the junction of roof slab and parapet. It is desirable to provide a haunch/gola/filler at the junction of the parapet wall and the roof slab as shown in Fig. 22.8.

The finished concrete surface shall present a smooth surface with correct slopes and uniform rounding. The concrete should be free from cracks. Excess trowelling shall be avoided.

**22.9.1.3 Thickness:** Average thickness shall be as per clause 22.9.1.2 as shown in Fig. 22.8.

**22.9.1.4 Curing:** Curing shall be done either by spreading straw/Hessian cloth over the graded surface, keeping the same wet for full 10 days or flooding the graded area with water by making kiaries with weak cement mortar, for 10 days. Occasional curing by simply spraying water now and then shall not be permitted under any circumstances.

**22.9.1.5 Measurement:** Length and breadth shall be measured correct to a cm. Area shall be worked out to nearest 0.01 sqm. and the cubical contents shall be worked out to nearest 0.001 cum.

No deduction shall be made for either opening or recesses for chimney stacks, roof lights etc., Khurra for area upto 0.1 sqm. Nothing extra shall be paid either for any extra material or labour involved in forming such opening or recess or in rounding the concrete function of roof with parapet walls, chimney stack, khurra etc.

**22.9.1.6 Rate:** The rate shall include the cost of all the materials and labour involved in all the operations described above.

## **22.10 GRADING ROOF WITH CEMENT MORTAR**

### **22.10.1 Materials**

Cement and coarse sand shall be as specified in the item of work or as described in sub-head 3.0 of CPWD Specifications.

**22.10.1.1 Cement Mortar :** Cement mortar 1:3 (1 cement: 3 coarse sand) /1:4(1 cement: 4 coarse sand) specified in the item of work shall conform to the specification described in sub-head 3.0 of CPWD Specifications.

**22.10.1.2 Preparation of the Surface:** The surface shall be cleaned properly with brooms brush, cloth to remove all dirt, dust, mortar droppings.

**22.10.1.3 Laying:** Same as described in clause 22.9.1.1, except that cement mortar shall be tamped with wooden and steel trowels and surface finished with steel trowel.

### **22.10.1.4 Finishing**

(i) The slope of finished surface shall not be more than 1 in 120 unless a steeper slope is specified in the item of work.

(ii) The finished surface of the grading shall present a smooth surface with correct slopes and uniform roundings wherever they are provided. The mortar surface shall be free of cracks. Excess trowelling shall be avoided.

**22.10.1.5 Thickness:** The minimum thickness of cement mortar grading at the junction with khurra or parapet wall shall be 20 mm. The cement mortar shall be rounded at the junction of roof slab and parapet. It is desirable to provide a haunch/gola/filler at the junction of parapet wall and the roof slab. The maximum thickness that shall be adopted for grading with cement mortar shall be 50 mm. It is not at all desirable to lay the cement mortar grading for greater thickness and in that case it is advised to go in for grading with Cement Concrete. The average thickness shall be as shown in Fig. 22.9 and 22.10.

**22.10.1.6 Curing:** Curing for the grading with cement mortar shall be done exactly as described in clause 22.9.1.4.

**22.10.1.7 Measurement:** Same as specified in clause 22.9.1.5.

**22.10.1.8 Rate:** The rate shall include the cost of all the labour and material involved in all the operations described above.

**22.11 Clause shifted to Sub Head 14 (Repairs to Buildings) as clause no. 14.49**

**22.12 Clause shifted to Sub Head 14 (Repairs to Buildings) as clause no. 14.50**

**22.13 Clause shifted to Sub Head 14 (Repairs to Buildings) as clause no. 14.51**

## **22.14 WATER PROOFING TREATMENT WITH INTEGRAL CRYSTALLINE ADMIXTURE**

### **22.14.0 General**

One method that can simplify the protective process is to make concrete with Integral Crystalline Admixtures

that reduce its permeability in effect to make the concrete itself waterproof. Apart from the regular workability admixtures, Integral Crystalline durability admixtures shall be added to all concrete, structural and otherwise, to waterproof & enhance the Concrete Durability. The Crystalline Admixture shall be added either at the time of batching at the batching plant or in the drum of the transit mixer, when the concrete arrives the point of pouring.

The concrete water proofing industry redefined their terminology a short time ago. American Concrete Institute (ACI) 212-3R-10 "Report on Chemical Admixture for Concrete" documents devoted chapter 15 / page 46 to permeability reducing admixtures (PRA's) that outlines PRAH & PRAN classification or differentiates between those suitable for concrete exposed to Non Hydrostatic Conditions (PRAN) and concrete exposed to Hydrostatic Conditions (PRAH). Besides reducing permeability some PRA's impart other beneficial characteristics such as reduced drying shrinkage, reduced chloride-ion penetration, improved freeze thaw resistance and enhanced autogenous sealing.

#### **22.14.1 Material**

Integral crystalline water-proofing admixture is one part cementitious powder added to the concrete mix at the time of batching. Integral crystalline water-proofing admixture consists of **hydrophilic chemicals** such as Portland cement, very fine treated silica sand and various active, proprietary chemicals. These active chemicals react with moisture in fresh concrete and with the by-products of cement hydration to cause a

catalytic reaction, which generates a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete. Thus, the concrete becomes permanently sealed against the penetration of water or liquids from any direction. The concrete is also protected from deterioration due to harsh environmental conditions. Integral crystalline water-proofing admixture is specially formulated to meet varying project and temperature conditions. This reaction continuous over the life of the concrete serving to seal not only initial shrinkage cracks, but also cracks that occur over time.

#### **22.14.2 Technical Specifications / Parameters**

The specifications of the materials should match or exceed the requirements as mentioned in nomenclature of the item.

The water proofing compound used in integral crystalline water proofing treatment shall satisfy all the requirements indicated in relevant standards or as specified in concerned relevant codes etc. and the same shall be got tested and get approved from the Engineer-in-charge before its use at site of work.

The integral crystalline waterproofing admixtures of **hydrophilic in nature** shall confirm to the following requirements:

1. Dosage as specified in the nomenclature of item or higher as recommended by manufacturer's specification. The material shall fulfill the requirements of American Concrete Institute Guidelines ACI-212- 3R-10 Chapter 15 or European norms EN 934-2-T2 and fall under PRAH (Permeability reducing Admixtures for HYDROSTATIC conditions) and shall be capable of withstanding/resistant to 16 bar hydrostatic pressure and reduce Coefficient of Permeability of concrete by more than 90, when compared to controlled concrete and tested as per DIN 1048 Part 5 or EN 12390-8 by carrying out 4 cycles each of 5 bar hydrostatic pressure for 72 hours and drying for 48 hours between the cycles. The co-efficient of Permeability calculated as per Darcy's Formula/ Valenta equation by incorporating penetration values obtained at the end of fourth cycle pressure.
2. The crystalline admixture shall be compatible with any other concrete admixture confirming to ASTM C494, EN 934-2 or IS 9103.
3. The performance of the crystalline admixture must not be restricted by water-cement ratio of concrete mix. In other words, the crystalline admixture must perform at any water-cement ratio of the concrete mix.
4. The integral crystalline admixture shall possess CE approval as per EN934-2 and shall be procured from CE approved manufacturing unit. It shall also possess approval certificate from any national apex institution mandated to issue design codes. The product has no corrosion effect on reinforcement steel according to test norm DIN V18998. The maximum chloride content less than 0.1% and maximum alkali content less than 9.3%.
5. In addition to recognizing the use of Integrate Crystalline Admixtures. ACI 212-3R-10 has also provided some guideline in para 15.3-"Selection and Evaluation" to select the best quality PRAH's

materials as maximum permeability reducing admixtures at maximum Hydrostatic Pressure. Para 15.3 stated that the effect of the admixture can be evaluated by testing the permeability of concrete both directly and indirect methods. The US Army Corps of Engineers CRC C48-92 (1992) test method is a direct measurement of concrete permeability resistance during exposure to water under **200 psi or 13.8 bars or 1.38 MPa of hydrostatic pressure.**

6. The integral crystalline admixture must reduce Chloride diffusion Co-efficient by minimum 45% when tested as per ASTM C 1556-4 and compared with the controlled concrete, thereby prolonging the durability & service life of the treated concrete structure.

7. The integral crystalline admixture must be capable of self-healing of cracks up to a width of 0.5mm.

8. The integral crystalline admixture performance shall not be affected by wear abrasion of the treated concrete surface and crystalline treated concrete shall not require protection layer.

9. The integral crystalline admixture shall be non-toxic and shall confirm to NSF-61 USA or any other similar certification from reputable international or local third party or declaration of performance certificate supervised by a reputable European/US third party.

10. The integral crystalline admixture when used in the concrete will have no detrimental side effect interms of Alkali Silica Reaction (ASR) and corrosion of steel reinforcement etc.

11. The manufacturer shall submit guarantee in respect of crystalline admixture performance for 10 years against any leakage.

**Note:** The manufacturer shall submit test certificates in respect of all above said specification/ parameters of Integral Crystalline Admixture Material from reputed National/International laboratories as per relevant codes. To support the claim of crystal formation, national/ international test report of scanning electrons microscopic (SEM) photographs dandified and mature crystal formation to plug all the capillary track and pores of the concrete shall be provided.

Total quantity of Integral Crystalline Admixture Material required shall be arranged at site of work only after obtaining the prior approval of the Engineer-in-Charge in writing. Proper account of water proofing compound used in the work shall be maintained. It shall be ensured that the consumption of the compound is as per specified requirements. The contractor shall associate himself with anyone of the applicator of water proofing compound duly approved by the Engineer-in-Charge before start of work relating to the water proofing treatment.

#### **22.14.3 Recommended uses**

Foundations/Rafts Reservoirs, Bridges and Dams  
Sewage and Water Treatment Plants Secondary Containment Structures  
Tunnels and Subway Systems Underground Vaults  
Parking Structures Swimming Pools and water tanks  
Pre-Cast, Cast-in-situ and Shotcrete Basement Retaining Walls  
applications

#### **22.14.4 Dosage**

0.8% (minimum) to the weight of cement content per cubic meter of concrete or higher dosage as recommended by the manufacturer's specification in reinforcement cement concrete at site of work.

#### **22.14.5 Mixing**

The integral crystalline admixture shall be used @ 0.8% (minimum) to the weight of cement content per cum of concrete or higher as recommended by the manufacturer's specification desired to meet water proofing

and durability criteria. Integral crystalline Admixture must be added to the concrete at the time of batching at

the batching plant or in the drum of the transit mixer, when the concrete arrives the point of pouring.

The sequence of procedures for addition will vary according to the type of batch plant operation and equipment. The mixing shall be followed as below unless & until specified otherwise. For any detailing and mixing guidelines the manufacturer's specifications should be followed.

##### **22.14.5.1 Ready mix plant- Dry batch operation**

Add integral crystalline admixture in powder form to the drum of the ready-mix truck under the batch plant and add 60%- 70% of the required water, along with required aggregate. Mix the materials for 2-3 minutes to

ensure that the integral crystalline admixture is distributed evenly throughout the mix water. Add the balance

of materials to the ready-mix truck in accordance with standard batching practices.

#### **22.14.5.2 Ready mix plant- Central mix operation**

Mix integral crystalline admixture with water to form a very thin slurry (e.g. 18kg of powder mixed with 22.7 litre of water) or recommended by the manufacturers specification. Pour the required amount of material into the drum of the ready-mix truck. The aggregate, cement, sand and water should be batched and mixed in the plant in accordance with standard practices (taking into account the quality of water that has already been placed in the ready-mix truck). Pour the concrete into the truck and mix for at least 5 minutes to ensure even distribution of integral crystalline admixture throughout the concrete.

#### **22.14.5.3 Precast batch plant**

Add integral crystalline admixture to the aggregate and sand, then mix thoroughly for 2-3 minutes before adding the cement and water. The total concrete mass should be blended using standard practices. It is important to obtain a homogeneous mixture of integral crystalline admixture with the concrete. Therefore dry integral crystalline admixture powder should never be mixed directly to wet concrete as this may cause clumping and hence thorough dispersion in the concrete mix may not occur.

#### **22.14.5.4 Setting time and strength**

The setting time of concrete mix is directly affected by the chemical and physical composition of ingredients, temperature of the concrete and prevailing climatic conditions. Retardation of set may occur when using integral crystalline admixture. The amount of retardation will depend upon the concrete mix design and the dosage rate of integral crystalline admixture. However, under normal conditions, integral crystalline admixture will provide a normal set concrete. Concrete containing integral crystalline admixture may develop higher ultimate strengths than plain concrete. Trial mixes of the concrete should be carried out under project conditions to determine setting time and strength of the concrete.

#### **22.14.6 Precaution / Special Consideration**

When incorporating Integral Crystalline Admixture, the temperature of the concrete mix should be above 6°C for at least 24 hours from casting.

#### **22.14.7 Storage / Shelf Life**

Integral Crystalline Admixture must be stored dry at a minimum temperature of 7° C and its self life is one year when stored under proper conditions. The product/material should be stored under dry condition. The self life of the integral crystalline admixture shall be treated as one year when stored under normal conditions.

#### **22.14.8 Measurement**

The quantity i.e. weight of Integral Crystalline Admixture will be measured in kilogram correct to two places of decimal.

#### **22.14.9 Rate**

The rate shall include the cost of all labour and materials involved in all the operations described above.

### **22.15 FIBRE REINFORCED ELASTOMERIC LIQUID WATER PROOFING MEMBRANE WITH RESILIENT**

#### **ACRYLIC POLYMERS**

##### **22.15.1 Material**

Fibre reinforced elastomeric liquid water proofing membrane is a ready-to-use waterproofing, white product, with high solar reflectance and Sun Reflectivity Index (SRI) of 105, for external applications. This is made from resilient acrylic polymers and synthetic resins in water dispersion, and when dry forms a continuous, flexible waterproofing membrane. This is resistant to all atmospheric conditions and UV rays, and guarantees longlasting protection for the substrate.

##### **22.15.2 Technical Specification/ Parameters:**

1. Fibre reinforced elastomeric liquid water proofing membrane with fibers in water emulsion with high reflectance and emissivity with a solar reflectance index SRI of 105 should comply with the requirements of EN 1504-9 ("Products and systems for protecting and repairing concrete structures:

definitions, requirements, quality control and conformity assessment. General principles for the

use of products and systems”) EN 1504-2 coating (C) principles PI, MC and IR (“Concrete surface protection systems”).

2. This should possess a paste like consistency having highly reflective white colour.

3. This should have density of 1.35 with dry solid content of 61.4%.

4. This should have minimum tensile strength of 1.0N/mm<sup>2</sup> as per ISO 37 or ASTM D-412.

5. This should conform to results after testing as per EN1062-11 for exposure to artificial weather conditions.

6. The Sun Reflectivity Index when tested as per ASTM E1980 should be 105 minimum.

7. Elongation at break (% age) of 150 % minimum as per ASTM D-412.

8. Adhesion strength is more than 1.0 N/mm<sup>2</sup> as per ASTM D-4541.

### **22.15.3 Applications**

It is to be applied using a long-haired roller, brush or spray on any horizontal, sloping or vertical surfaces to form a strong, flexible, tack-free dry surface, suitable for occasional light foot traffic. This can withstand normal expansion and contraction stresses caused by temperature variations due to its flexibility. This also helps lower the working temperature of roofs and guarantees good energy performance properties of all the layers of the roof.

### **22.15.4 Preparation of Surface**

All the substrates, whether they are new or old, must be sound, clean, dry and free of all traces of oil, grease, old paint, rust, mould and any other material which could compromise the bond. Application temperature

may be from 7°C to 40°C.

Concrete and in general mineral substrates must be sound and dry with no rising damp. Any loose parts must be removed with wire brushes. All wax, water-repellent treatments, etc. must be removed from the surface of ceramic substrates with a suitable detergent and/ or by sanding. Any hollows and gaps in the surface must be repaired properly with appropriate material as described and instructed by the manufacturer

of this product. The tools to be used must be properly cleaned.

### **22.15.5 Application Procedure**

All the area of operation shall be thoroughly cleaned as described in para 22.15.3 above. Mix the content in such a manner that they are perfectly blended into a homogenous state of liquid which can be applied by long haired roller or airless spray. The fibre reinforced elastomeric liquid water proofing membrane with resilient

acrylic polymers shall be applied on top of concrete roof in three coats @ 10.76 litre/10 sqm or more as recommended by manufacturer specification. One coat i.e. first coat of self priming elastomeric water proofing

liquid. The material shall be diluted with water in the ratio of 3:1 (3 parts of elastomeric water proofing liquid and 1 part of water). Wait until the first coat is completely dry and becomes slightly darker in colour. After the

first coat has dried completely apply second coat with undiluted elastomeric water proofing liquid in a cross direction to the previous coat. After the drying of second coat completely apply the final coat of undiluted elastomeric water proofing liquid in a direction perpendicular to previous coat. The overall dry film thickness should not be less than 500 microns or more as specified in manufacturer specification. Protect the membrane

from rain unless it is completely dry. The overall consumption of the material should be as per nomenclature

of the item and should also adhere to the specifications detailed in the approved schedule of the manufacturer.

### **22.15.6 Measurement**

The length and breadth/ height shall be measured in running metre correct to two places of decimal and the area of applications should be measured in sqm correct to two places of decimal.

### **22.15.7 Rate**

The rate shall include the cost of all the labour and material involved in all the operations described above.

## **22.16 WATER PROOFING TREATMENT WITH INTEGRAL CRYSTALLINE WATER PROOFING COATING / SLURRY**

### **22.16.0 General**

This Integral crystalline water proofing coating / slurry of **hydrophilic in nature** is applied to surface of the concrete to water proof and protect the concrete in-depth. It consists of Portland cement, specially treated

quartz sand and a compound of active chemicals. Integral crystalline water proofing coating material needs only to be mixed with water prior to application.

When integral crystalline water proofing material is applied to a concrete surface, the active chemicals react with moisture and the by-products of cement hydration to cause a catalytic reaction that generates an insoluble, crystalline structure. These crystals fill the pores and minor shrinkage cracks in the concrete to prevent any further water ingress (even under pressure). However, integral crystalline water proofing material

will still allow the passage of vapor through the structure (i.e. the concrete will be able to “breathe”). Even after

the concrete has cured, integral crystalline water proofing material remains dormant in the concrete and will reactivate in the presence of moisture to seal capillary tracts and hairline cracks.

In addition to water proofing the structure, integral crystalline water proofing slurry protects concrete against seawater, wastewater, aggressive groundwater and many other aggressive chemical solutions.

Integral

crystalline water proofing material is approved for use in contact with potable water and is therefore suitable for

use in water storage tanks, reservoirs, water treatment plants, etc.

#### **22.16.1 Material:**

This Integral crystalline water proofing material consists of Portland cement, specially treated quartz sand and a compound of active chemicals.

The water proofing compound used in integral crystalline water proofing treatment shall satisfy all the requirements indicated in relevant standards or as specified in concerned relevant codes etc. and the same shall be got tested and get approved from the Engineer-in-charge before its use.

#### **Technical Specification/ Parameters:**

The integral crystalline slurry / coating material of **hydrophilic in natural** shall confirm to the following requirements:

1. Dosage as specified in the nomenclature of item or higher as recommended by manufacturer's specification. The material shall fulfill the requirements of American Concrete Institute Guidelines ACI-212- 3R-10 Chapter 15 or European norms EN 934-2-T2 and fall under PRAH (Permeability reducing Admixtures for HYDROSTATIC conditions) and shall be capable of withstanding/resistant to 16 bar hydrostatic pressure and reduce Coefficient of Permeability of concrete by more than 90, when compared to controlled concrete and tested as per DIN 1048 Part 5 or EN 12390-8 by carrying out 4 cycles each of 5 bar hydrostatic pressure for 72 hours and drying for 48 hours between the cycles. The co-efficient of Permeability calculated as per Darcy's Formula/ Valenta equation by incorporating penetration values obtained at the end of fourth cycle pressure.
2. It shall confirm to EN1504-3 (For structural repairs-R3, Compressive Strength >25MPa) supplied from an approved manufacturing unit having CE approval confirming to EN1504-3R3.
3. The product has no corrosion effect on reinforcement steel according to test norm DIN V18998. The maximum chloride content less than 0.1%.
4. The Integral Crystalline Slurry must be capable of self-healing of cracks up to a width of 0.5mm.
5. The crystalline water proofing coating/slurry, when used in the concrete, will have no detrimental side effects in terms of Alkali Silica Reaction (ASR), corrosion of Steel Reinforcement etc.
6. The product performance shall not be affected by wear abrasion of the treated concrete surface and crystalline treated concrete shall not require protection layer.
7. The crystalline water proofing coating/slurry shall be non toxic and suitable for use in potable water facilities- NSF listed as per ANSI 61 listing or DVGW-W347, Germany or equivalent and a declaration of performance certificate supervised by a reputed European/US third party.
8. The manufacturer shall submit guarantee in respect of crystalline water proofing coating/slurry performance for 10 years against any leakage.

**Note:** The manufacturer shall submit test certificates in respect of all above said specifications/ parameters of Integral Crystalline water proofing slurry material from reputed National/International laboratories as per relevant codes.

Total quantity of the Integral Crystalline water proofing slurry material required shall be arranged at site of work only after obtaining the prior approval of the Engineer-in-Charge in writing. The proper

account of water proofing compound used in the work shall be maintained. It shall be ensured that the consumption of the compound is as per specified requirements. The Contractor shall associate himself with anyone of the applicator of water proofing compound duly approved by the Engineer-in-Charge before start of work relating to the water proofing treatment.

#### **22.16.2 Recommended uses**

Foundations/Rafts Reservoirs, Bridges and Dams  
Sewage and Water Treatment Plants Secondary Containment Structures  
Tunnels and Subway Systems Underground Vaults  
Parking Structures Swimming Pools and water tanks  
Pre-Cast, Cast-in-situ and Shotcrete applications Basement Retaining Walls

#### **22.16.3 Preparation of surface**

All concrete to be treated with integral crystalline water proofing slurry material must be clean and have an "open" capillary surface. Remove laitance, dirt, grease, etc. by means of high pressure water jetting, wet sand blasting or wire brushing. Faulty concrete in the form of cracks, honeycombing, etc. must be chased out, treated with the same material and filled flush with the mortar mixture as specified by the manufacturer. Surface must be carefully pre-watered prior to the application of integral crystalline water proofing material. The concrete surface must be damp but with no wet sheen on the surface.

#### **22.16.4 Mixing**

Integral crystalline water proofing slurry / coating material should be mechanically mixed with clean water to a creamy consistency resembling to thick oil. Only that much material should be mix as can be used within

20 minutes and mixture should be stirred frequently. The mixture should not be allowed to set, if it happens, simply re-stir to restore workability but no more water should be added to it. The ratio of integral crystalline water proofing material with water should be as below

(i) **Vertical surface:** - For applying with brush the mixing ratio shall be 5 parts of integral crystalline water proofing coating material to 2 parts of water.

(ii) **Horizontal surface:** - The ratio should be 3 parts of Integral Crystalline water proofing coating material to 1 part of water. This should be applied by brush only.

#### **22.16.5 Application Procedure**

The slurry mix of the Integral Crystalline water proofing slurry material shall be applied in one or two coats as specified/ required according to work situation in the item. After preparation of surface as described in para

22.16.3, and making the surface saturated with water before application of Crystalline Slurry, then first coat of

the slurry mix shall be applied by the brush or appropriate power spray equipment. The second coat as specified shall be applied while the first coat is still green.

The other method of application known as dry powder consistency can also be applied on horizontal surfaces only. The specified amount of integral crystalline water proofing material is distributed in powder form

through a sieve or a semi mechanical barrow spreader and troweled into the freshly placed concrete as this reaches the initial set.

The integral crystalline water proofing material to be used shall be as following:-

(i) **Vertical surface:** - Two coats of integral crystalline water proofing material slurry coat shall be applied @ of 0.70 kg per sqm. per coat or more as specified by the manufacturer specification.

(ii) **Horizontal surface:** - One coat of integral crystalline water proofing material slurry coat shall be applied @ of 1.10 kg per sqm or more as specified by the manufacturer specification to harden concrete. Alternatively integral crystalline water proofing material mix can be dry sprinkled @ of 1.10 kg per sqm and trowel applied to fresh concrete when it has reached initial set.

(iii) **Construction joint:** - Integral crystalline water proofing material mix shall be applied either as slurry coat or dry powder consistency immediately prior to placing the next lift/ bay of concrete @ 1.60 kg per sqm. or more as specified by the manufacturer specification.

(iv) **Binding concrete:** - Integral crystalline water proofing material mix shall be applied either as slurry coat or dry powder consistency immediately prior to placing the overlying concrete slab.

#### **22.16.6 Curing**

The treated surfaces should be kept damp for a period of five days and must be protected against direct sun, wind and frost, by covering with polyethylene sheeting, damp burlap or similar material.

#### **22.16.7 Precaution / Special Consideration**

Do not apply Integral Crystalline Slurry at temperatures at or below freezing or to frozen or freezing surfaces. Integral Crystalline slurry cannot be used as an additive to concrete or plasters. (Integral Crystalline

Admixture should be considered for these applications).

#### **22.16.8 Storage / Shelf Life**

When properly stored in a dry place in unopened and undamaged original packaging its self life is one year.

#### **22.16.9 Measurement**

The Length & breadth/height of the coated area by Integral Crystalline slurry shall be measured in metre correct to two places of decimal. Measurement shall be made in sqm of the area.

#### **22.16.10 Rate**

The rate shall include the cost of all the labour, material and equipments involved in all the operations described above.

### **22.17 POLYMER MODIFIED FLEXIBLE CEMENTATIOUS NEGATIVE SIDE WATERPROOFING COATING**

#### **WITH ELASTIC WATERPROOFING POLYMERS**

##### **22.17.1 Material**

Flexible cementatious negative side waterproofing coating with elastic waterproofing polymers is a onecomponent, concentrated liquid admixture used to enhance the performance of cementations repair mortars, plasters, stuccos, concrete mixes and toppings for restoration of horizontal, vertical and overhead concrete; concrete masonry units (CMU); and masonry surfaces.

##### **22.17.2 Technical Specification/ Parameters:**

1. Flexible cementations negative side waterproofing coating with elastic waterproofing polymer should have PH value of 7 and consist of liquid state.
2. This should have the density of 1.02 gm per ml.
3. This should posses the property of application in undiluted as well as diluted form.
4. This should be non-reemulsifiable.

##### **22.17.3 Applications**

It is to be applied using a long-haired roller, brush or spray on any horizontal, sloping or vertical surfaces to form a string, flexible, tack-free dry surface. This is easy to use and control in construction works for water

proofing of the surface and optimizes bond to concrete substrates. It also improves resistance to abrasion and

freeze/ thaw cycles.

##### **22.17.4 Preparation of Surface**

All substrates must be structurally sound, stable and solid, with all loose material removed. Thoroughly clean the surface of any substance that could interfere with the bond of the installation material, including dirt,

paint, tar, asphalt, wax, oil, grease, latex compounds, from release agents, laitance, foreign substances pre existing paint film & loose particles till plaster is visible and any other residues. Concrete surfaces must be mechanically profiled and prepared by shotblasting, sandblasting, diamond-grinding, water-jetting, scarifying

or other engineer-approved methods to obtain an acceptable profile. Concrete substrate and ambient room temperatures must be maintained between 45°F and 95°F (7°C and 35°C) before application.

Temperatures

must be maintained within this range for at least of 72 hours after the application coating. Application temperature

varies from 7°C to 40°C.

##### **22.17.5 Application Procedure**

Apply the coating on to this sound and dry surface using a long-haired roller, brush or spray. The dilution of the compound the water should be done in a clean mixing pail. The polymer modified flexible cementatious negative side water proofing coating with elastic water proofing polymers shall be applied on interior wall plaster surface in three coats @ 14.35 kg/10 sqm or more as recommended by manufacturer specification. The ratio of mixing with water is to be done in accordance with the nomenclature of the item along with corresponding coats and manufacturer specifications. One coat i.e. first coat of self priming

cementitious water proofing polymers shall be applied on to the properly prepared and dried surface (diluted with water in the ratio of 1:1). Another coat shall be applied when the coat below is still wet. Two coats of cementitious water proofing polymers (diluted with water in the ration of 3:1) over the first coat applied. All the coats shall be applied in perpendicular direction to each other. The final surface is to be protective from excessive heat or draft conditions during the first 24 to 72 hours. Final surface should be cured for at least 5 to 7 days. Use of damp burlap, polyethylene sheeting or water-based curing compound is also recommended to be used for curing.

#### **22.17.6 Measurement**

The length and breadth/ height shall be measured in running metre correct to two places of decimal and the area of applications shall be measured in sqm correct to two places of decimal.

#### **22.17.7 Rate**

The rate shall include the cost of all the labour and material involved in all the operations described above.

### **22.18 WATER PROOFING TREATMENT WITH INTEGRAL CRYSTALLINE WATER PROOFING DRY-SHAKE**

#### **22.18.0 General**

Crystalline water proofing dry-shake of **hydrophilic in nature** is a unique Integral Crystalline chemical treatment for the waterproofing and protection of concrete. Crystalline water proofing dry-shake has been formulated for dry-shake applications on horizontal concrete surfaces where greater impact and abrasion resistance is required.

#### **22.18.1 Material**

Integral Crystalline water proofing dry-shake (dry powder) compound consists of Portland cement, various active proprietary chemicals, and a synthetic aggregate hardener that has been crushed and graded to particle

sizes suitable for concrete floors.

Crystalline water proofing dry-shake becomes an integral part of the concrete surface, thereby eliminating problems normally associated with coatings (e.g. scaling, dusting, flaking and delaminating). The active chemicals react with the moisture in the fresh concrete causing a catalytic reaction that generates a nonsoluble

crystalline formation within the pores and capillary tracts of the concrete.

#### **Technical Specification/ Parameters:**

The Integral Crystalline dry shake material of hydrophilic in nature shall confirm to the following requirements:

1. Dosage as specified in the nomenclature of item or higher as recommended by manufacturer's specification. The material shall fulfill the requirements of American Concrete Institute Guidelines ACI-212- 3R-10 Chapter 15 or European norms EN 934-2-T2 and fall under PRAH (Permeability reducing Admixtures for HYDROSTATIC conditions) and shall be capable of withstanding/resistant to 16 bar hydrostatic pressure and reduce Coefficient of Permeability of concrete by more than 90, when compared to controlled concrete and tested as per DIN 1048 Part 5 or EN 12390-8 by carrying out 4 cycles each of 5 bar hydrostatic pressure for 72 hours and drying for 48 hours between the cycles. The co-efficient of Permeability calculated as per Darcy's Formula/Valenta equation by incorporating penetration values obtained at the end of fourth cycle pressure.
2. It shall confirm to EN1504-3 (For structural repairs-R3, Compressive Strength > 25 MPa) supplied from an approved manufacturing unit having CE approval confirming to EN 1504-3R3.
3. The product has no corrosion effect on reinforcement steel according to test norm DIN V18998. The maximum chloride content less than 0.1%.
4. The Integral Crystalline dry shake shall be capable of self-healing of cracks up to a width of 0.5mm.
5. The integral crystalline dry shake, when used in the concrete, will have no detrimental side effects in terms of Alkali Silica Reaction (ASR), corrosion of Steel Reinforcement etc.
6. The integral crystalline dry shake performance shall not be affected by wear abrasion of the treated concrete surface and crystalline treated concrete shall not require protection layer.
7. The crystalline water proofing coating/slurry shall be non toxic and suitable for use in potable water facilities- NSF listed as per ANSI 61 listing or DVGW-W347, Germany or equivalent and a declaration of performance certificate supervised by a reputed European/US third party.
8. The manufacturer shall submit guarantee in respect of crystalline water proofing dry shake

performance for 10 years against any leakage.

**Note:** The manufacturer shall submit test certificates in respect of all above specification/parameter as stated

above of Integral Crystalline water proofing dry shake material from reputed National/International laboratories

as per relevant codes.

Total quantity of the Integral Crystalline water proofing dry shake material required shall be arranged at site of work only after obtaining the prior approval of the Engineer-in-Charge in writing. The proper account of

water proofing compound used in the work shall be maintained. It shall be ensured that the consumption of the

compound is as per specified requirements. Contractor shall associate himself with anyone of the applicator of water proofing compound duly approved by the Engineer-in-Charge before start of work relating to the water

proofing treatment.

### **22.18.2 Application Rate (Dose)**

Crystalline water proofing dry-shake material to be used under normal conditions should cover the application

surface sprinkled @ 0.60 kg per sqm or higher as recommended by the manufacturer specification over the lean concrete of structure depending upon the degree of abrasion resistance required.

If the surface is to be used under heavy traffic conditions or where greater abrasion resistance is required, the manufacturers recommendation should be taken into account while applying crystalline water proofing dry-shake on the concrete surface.

### **22.18.3 Application Procedure**

(i) After fresh concrete is placed. Consolidated and levelled, wait until concrete can be walked on leaving an indentation of 6-8mm.

(ii) Concrete should be free of bleed water and be able to support the weight of a power trowel. Float open the surface.

(iii) Immediately after floating open the surface and within one hour of finishing the concrete, apply onehalf of the Integral Crystalline water proofing dry-shake material by hand or mechanical spreader, in one direction only. The Integral Crystalline water proofing dry-shake material must be spread evenly.

(iv) As soon as the Integral Crystalline water proofing dry-shake material has absorbed moisture from the base slab, it should be power floated to the surface.

(v) Immediately after power floating, apply remaining Integral Crystalline water proofing dry-shake material at right angles to the first application.

(vi) Allow remaining Integral Crystalline water proofing dry-shake material to absorb moisture from the base slab and then power float the material into the surface. When concrete has hardened sufficiently, power trowel surface to the required finish.

### **22.18.4 Curing**

Curing is important and shall begin as soon as final set has occurred but before surface starts to dry. Conventional moist curing procedures such as water spray, wet burlap or plastic covers may be used.

Curing

should continue for at least 48 hours. In hot dry sunny or windy conditions, it is advisable to use an evaporation

retardant on the fresh concrete surface to prevent premature drying of the slab conditions due consultations should be made from the technical representatives of the manufacturer for specific instructions. In lieu or moist curing, concrete sealers and curing compounds may be used. In all cases, recommended guidelines for proper curing should be followed.

### **22.18.5 Recommended uses**

Basement Rafts Foundation slab

Water tank base slab Sewage and Water Treatment Plants slab

Below Grade Structures Warehouses Floors

Traffic Bearing Surfaces Parking Structures

### **22.18.6 Precaution / Special Consideration**

For the best results when applying Integral Crystalline dry shake materials, the air content of the concrete shall not exceed 3% (a high air content can make it difficult to achieve a proper application).

In hot, dry, or windy conditions, it is advisable to use an evaporation retardant on the fresh concrete

surface to prevent premature drying of the slab.

#### **22.18.7 Storage / Shelf Life**

Integral Crystalline dry shake must be stored dry at a minimum temperature of 7° C and its self life is one year when stored under proper conditions.

#### **22.18.8 Measurement**

The quantity of Integral Crystalline dry shake sprinkled area shall be calculated in sqm. The Length & breadth/height of the Integral Crystalline dry shake sprinkled area shall be measured in metre correct to two places of decimal.

#### **22.18.9 Rate**

The rate shall include the cost of all the labour, material and equipments involved in all the operations described above.

### **22.19 CRYSTALLINE WATER PROOFING MORTAR**

#### **22.19.1 Material**

Crystalline water proofing mortar consists of Portland cement, specially treated quartz sand and a compound of active chemicals.

The active chemicals react with moisture and the by-products of cement hydration to cause a catalytic reaction, which generates an insoluble integral crystalline complex. These crystalline complexes grow in the presence of water and block the capillaries of the concrete and minor shrinkage cracks, thus water proofing the concrete. Chemicals activation begins when the powder is mixed with water and may take several days to

completely block the capillaries, depending on ambient temperature and environmental conditions. It can be applied to the positive or negative water pressure sides of a structure.

#### **22.19.2 Technical Specification/ Parameters:**

1. The crystalline water proofing mortar shall conform to EN1504-3 having Compressive Strength Class R4 > 45 MPa and adhesive bond strength Class R3 > 1.5 MPa supplied from an approved manufacturing unit having CE approval confirming to EN 1504-3R3.
2. It has no corrosion effect on reinforcement steel according to test norm DIN V 18998. The maximum chloride content less than 0.1%.
3. The crystalline water proofing mortar, when used in the concrete, will have no detrimental side effects in terms of Alkali Silica Reaction (ASR), corrosion of Steel Reinforcement etc.
4. The crystalline water proofing mortar performance shall not be affected by wear abrasion of the treated concrete surface and crystalline treated concrete shall not require protection layer.
5. The crystalline water proofing mortar shall be non toxic and suitable for use in potable water facilities- NSF listed as per ANSI 61 listing or DVGW-W347, Germany or equivalent and a declaration of performance certificate supervised by a reputed European/US third party.
6. The manufacturer shall submit guarantee in respect of crystalline water proofing mortar performance for 10 years against any leakage.

Note: The manufacturer shall submit test certificates in respect of all above said specification/parameters of Crystalline mortar from reputed National/International laboratories as per relevant codes.

Total quantity of the water proofing Crystalline Mortar material required shall be arranged at site of work only after obtaining the prior approval of the Engineer-in-Charge in writing. The proper account of water proofing compound used in the work shall be maintained. It shall be ensured that the consumption of the compound is as per specified requirements. Contractor shall associate himself with anyone of the specialist firms mentioned in approved list of applicator of water proofing compound only approved by Engineer-in-Charge before start of work.

#### **22.19.3 Recommended Uses**

RCC underground structure like basement, water tanks, bridge deck etc.

This material can be applied in conjunction with crystalline water proofing coating for :

- (i) Installation of seal strips, reglets and coves at joints to assure water tightness
- (ii) Patching and filling / sealing of routed out cracks.
- (iii) Patching of tie holes and faulty construction joints.
- (iv) Repairing of spalled and honeycombed area.

#### **22.19.4 Preparation of Surface**

All surfaces to be patched, repaired or sealed with crystalline water proofing mortar must be clean and sound. **Crack** should be routed out to a U-shaped groove, size 25 mm wide and 25 mm deep. **Tie holes** should be roughened prior to filling. **Spalled and honeycombed area** must be thoroughly cleaned and

chiseled back to sound concrete prior to repair. Remove all dirt, cement laitance, form release agents, curing compounds, paints, coating, etc. by means of wet or dry sand blasting, high pressure water jet or other approved mechanical means. Surfaces must be well moistened to a dull dampness at the time of application.

The concrete should be damp with no wet sheen on the surface.

#### **22.19.5 Mixing**

(i) **For routed cracks, coves and non-moving joints:** Add water to crystalline water proofing mortar powder until a medium stiff, trowelable consistency reached. The texture of the mix should be pliable enough to be trowelled into the cracks with some pressure, but not so pliable that it would run out or sag out of the crack.

Approximate mixing ratio (by volume) is 4.5 parts crystalline water proofing mortar powder to 1 part water. Alternatively, 450gm of crystalline water proofing mortar powder to 100 ml of water is to be mixed or as specified by the manufacturer specification.

(ii) **Tie holes and pointing applications:** Add only a small amount of water. Mixed consistency should be that of "dry earth," holding a shape when squeezed in your hand but easily crumbled when pressed between fingers. Mix only as much material as can be used within 20 minutes.

#### **22.19.6 Application Procedure**

(i) **For sealing cracks and faulty construction joints,** routed out/making U-shape groove size 25x25mm and then priming the surface with integral crystalline slurry @0.05 kg per running meter and while the surface is tacky filled the groove upto surface crystalline mortar @ 1.50 kg per running meter. Once crystalline mortar is touch dry then finally applying two coats of integral crystalline slurry @0.05 kg per running meter per coat.

(ii) **For repairing spalled & honeycombed areas,** prepared the surface and chiesel back upto sound concrete and then primed the area with integral crystalline slurry @0.70 kg per sqm. and while the surface is tacky repair and level the honeycomb area with crystalline mortar @ 2.70 kg per sqm. for an average thickness of 10mm. Once crystalline mortar is touch dry then finally two coats of integral crystalline slurry @ 0.70kg per sqm. per coat.

(iii) **For patching of tie rod holes,** prepared tie rod hole surface and primed the area with integral crystalline slurry @ 0.07 kg per sqm and while the surface is tacky repair and filled the tie rod holes with crystalline mortar @ 0.040 kg per hole. The crystalline mortar shall be tightly rodded into tie rod holes or packed tightly. For 25x25x25 mm hole, use 0.040 kg per hole to fill the tie rod hole.

#### **22.19.7 Curing**

Provide protection against extreme weather conditions, such as heavy rain or freezing conditions, during the setting period. Curing is not normally required except during hot, low humidity weather. In these conditions,

a light mist of water approximately 25 hours after the repair is completed will help to ensure a controlled cure.

In extreme dry heat, water misting may be carried out at required intervals more frequently.

#### **22.19.8 Precaution / Special Consideration**

Crystalline mortar shall not applied at temperatures below 40°F (4°C), to a frozen substrate or if temperatures

will drop below freezing during the curing period (approximately 24 hours). This product is not recommended

for use in expansion or construction joints. Crystalline mortar can be applied in (13 mm) layers not exceeding

2.5 inch (approximately 6.5 cm) to prevent shrinkage cracks in the mortar.

#### **22.19.9 Storage / Shelf Life**

Crystalline mortar shall be stored in a dry enclosed area off the ground at a minimum temperature of 7°C. Self life when stored in proper conditions in unopened, undamaged packaging is one year.

#### **22.19.10 Measurement**

Faulty construction joint will be measured by measuring the length in running meter correct to two places of decimal.

Repair of honeycombed area will be measured in square meter correct to two places of decimal by measuring the length and width of treated area correct to two places of decimal.

For repair of tie rod holes, the measurement shall be done for each number of hole.

#### **22.19.11 Rate**

The rate includes the cost of all the labour and material involved in all the operations described above.

## **22.20 SWELLABLE TYPE WATER STOP TAPE**

### **22.20.0 General**

Swellable type water stop tape of size 19 mm x 25 mm thick in linear metre (expansive nature) is a unique sealing compound designed to expand rapidly when exposed to moisture, making it a self-healing joint material

for construction joint applications / treatment .

### **22.20.1 Material**

This is a swellable type sealing compound which expand rapidly after coming in to contact or exposed to moisture. This acts as a self healing material and is used for applications in construction joints.

### **22.20.2 Physical Properties**

(i) Specific gravity (ASTM D71):  $1.35 \pm 0.05$  (ASTM D-71)

(ii) Volatile matter: 1% maximum (ASTM D-6)

(iii) Penetration, 150g cone at 25°C, 5sec :  $40 \pm 5$ mm (ASTM D-217)

(iv) Rate of Rapid Expansion:

(a) Fresh Water Exposure: 24 Hours-140%, 48 Hours- 175%, 72 Hours-190% & 120 Hours-210%.

(b) Salt Water Exposure: 24 Hours-7%, 48 Hours-12%, 72 Hours-14%, 120 Hours-18%

The water stop material should meet the requirements to EU REACH Regulation (EC) No 1907/2006.

### **22.20.3 Physical Properties of Swellable Water stop Primer**

(i) % Solid : Min 20%

(ii) Flash Point: 93 deg C

(iii) Dry Time : 25 deg C:10 min

(iv) Dry Time : 4 deg C : 60 min

### **22.20.4 Recommended Uses**

Typical applications for swellable type water stop tape include building foundations, raft slabs, retaining walls, water storage tanks, at the junction of raft slab with the retaining walls and similar non-moving cold construction joints etc.

### **22.20.5 Application**

(i) The entire surface length where the water stop is to be applied is cleaned thoroughly by using blower and brush. Apply one coat of required primer throughout the length of the joint @ 3.78 litre per 240 running metre. Allow the primer to dry for 10 to 15 minutes at the temperature of 25°C. This should be allowed to dry for some longer time in the areas where the temperature are low.

(ii) By using the heel of the hand and moderate pressure, press the self expanding joint material firmly into the position on the structure on the entire area which has been primed and dried. Make sure that the product has bonded with the primed area.

(iii) Where required, splice ends to form a continuous, uninterrupted seal. For best results, cut each end at opposite 45deg. angles and tightly butt ends together. DO NOT OVERLAP ENDS. Gently knead the spliced ends creating an uninterrupted seal.

(iv) Peel the protective covering from the exposed side of the installed expandable joints sealing compound.

(v) Pour the matting structural member in position.

### **Notes:**

The manufacturer shall submit guarantee in respect of swellable type water stop tape performance for 10 years against any leakage.

Always use swellable type water stop primer to avoid displacement of the swellable type water stop tape during concrete pouring. It may be necessary to utilize masonry nails or other mechanical means to hold the sealant in place on vertical surfaces.

Place swellable type water stop tape so that it is not closer than 5 cm away from the outer surface of poured structure. If a Key way is utilized, place the swellable type water stop tape into the bottom of the formed Keyway area.

### **22.20.5 Precaution / Special Consideration**

Always use swellable type water stop primer to ensure tight adhesion and to aid in preventing swellable type water stop tape from moving during the concrete pour. For vertical surfaces, nails may be used to hold the product in place in conjunction with swellable type water stop primer. Swellable type water stop tape shall

be used at a minimum depth of 50 mm inside the concrete. When used on pipes and other structural

penetrations, swellable type water stop tape shall be cut to measured length and placed around the penetration with ends butted. In all cases, swellable type water stop tape shall be in direct contact with the substrate along the entire length of the installation. Swellable type water stop tape is not an expansion joint sealant and only suitable for non-moving concrete joints. Swellable type water stop tape should not be installed in standing water or on frozen or icy surfaces

**22.20.6 Storage / Shelf Life**

When stored in a dry enclosed area off the ground at a minimum temperature of 45°F (7°C) in unopened, undamaged cartons, its self life is unlimited.

**22.20.7 Measurement**

The measurement shall be taken by measuring the length of swellable type water stop tape in meter correct to two paces of decimal.

**22.20.6 Rate**

The rate shall include the cost of all labour and materials involved in all the operations d

**LIST OF APPROVED MANUFACTURERS/BRAND NAMES OF VARIOUS BUILDING MATERIALS :-**

<b>Name of Materials</b>	<b>Manufactures / Brand names</b>
Steel Reinforcement –TMT bars having Ultimate strength atleast 15% higher than Yield strength.	TATA TISCON Fe500 (SD)/JINDAL PANTHER Fe500D
Cement	PPC as per IS:1489 (Part-I & II) from reputed manufacturer having annual production of at-least one million tons or more.
Aluminum extruded sections for doors and windows	HINDALCO, INDAL, JINDAL
Anodized aluminum fittings for doors and windows	Crown, Alans, Classic, Argent, Bharat, IPSA.
Mild steel butt hinges, Piano hinges	JOLLY, GARG, AMIT, ASI SUPREME, L.P. WATCHMAN
Pre-laminated particle board exterior grade-confirming to I.S: 12823-1990.	Nova pan, Kit ply, Ancholam, Greenlam, Bhutan Board, Archid Ply
Water proof cement paint	Super Snowcem, ICI, Berger, Jenson & Nicholson, Asian Paint, Nerolac.
a) Synthetic enamel paints. b) Poly-urethane based paint	British Paints, Nerolac, Jenson & Nicholson, Asian Paints, Sika, Fosroc Chemicals, Degussa, Pidilite, Berger
Glass panes / sheets	Modiguard, Pelingston, Tata float, Saint Gobain
Flush Door	Kit ply, Century, Green, Archid
Vitrified tiles (only double charge allowed)	Nitco, ASIAN Granito, SOMANY, Kajaria
Ceramic tiles (digital printing minimum 300 x 450mm)	Kajaria, SOMANY, ASIAN, Granito, Johnson
Vitreous sanitary WC pan, Wash basin, urinals etc	Parryware, Hindware, Johnson, Cera (As per cat. No. mentioned in the BOQ items)
Stainless steel kitchen sinks	Parry ware, PRINCE, AMC, Nirali, Neelkanth
G.I. pipes	TATA, JINDAL
G.I fittings	R, Unik, AA.
PP-R pipes & Fittings	SFMC, WETFLOW, FINOLEX, Vectus, Kisan, Prince, Supreme
CPVC pipes & Fittings	Ashirbad, Astral

Brass/CP Brass fittings	Parrywar, Hindware, Jaquar (As per cat. No. mentioned in the BOQ items)
a) Gun metal valves of all type b) C.I. Soil waste, Vent, Rain Water Pipes & its fittings	LEADER, ZOLOTO, L&K, Jaiswal Neco, L&K
P.V.C lugs and pipes	Finolex, Prince, Supreme, Kisan
White Cement	J.K., BIRLA
Block Boards & Plywood	Greenply, Anchor, NATIONAL, Kitply, Century, Greenlam, Archid
Waterproofing compound, Admixtures & Construction chemicals	Sika, Fosroc Chemicals, Pidilite, Dr. Fixit, BASF, Asian Paint
Pre-cast Mosaic tiles & P.C.Tiles	MODERN, NITCO, JAHAR FLOORS, HERO TILE.
Pressed Steel Door frame	Behar Bobbins, AGEW Steels, Purbanchal Industries.
UPVC Window	Fenesta, Ewin, Rehau
All structural steel	TATA, SAIL
AAC Blocks	BILTECHACE, MAGICRETE, AROCON, ECO CARE, ICON, ULTRACTECH, BRIK-O-LITE

**NOTE:** Samples of all items shall be got approved from Engineer-in-Charge before bulk purchase.

## FORM "A"

### FINANCIAL INFORMATION

Financial Analysis – Details to be furnished duly supported by figures in balance sheet/ profit & loss account for the last five years duly certified by the Chartered Accountant, as submitted by the applicant to the Income Tax Department (Copies to be attached).

Years

Year	2018-19	2019-20	2020-21	2021-22
Gross Annual turnover on construction works ` in lakhs				
Profit / Loss.				

\* The bidder should give information strictly in above format.

- I Financial arrangements for carrying out the proposed work.
- II. Solvency Certificate from Bankers of the bidder in the prescribed Form "B".

Signature of Chartered Accountant with Seal

Signature of Bidder(s).

## FORM "B"

### FORM OF BANKERS' CERTIFICATE FROM A SCHEDULED BANK

This is to certify that to the best of our knowledge and information that M/s./Sh  
.....having marginally noted address,  
.....  
.....a customer  
of our bank are/is respectable and can be treated as good for any engagement  
upto a limit of  
Rs.....(Rupees.....  
.....  
.....). This certificate is issued  
without any guarantee or responsibility on the bank or any of the officers.

(Signature) For the Bank

#### NOTE

- (1) Bankers certificates should be on letter head of the Bank, addressed to tendering authority.
- (2) In case of partnership firm, certificate should include names of all partners as recorded with the Bank.
- (3) Solvency certificate should not be more than 6 months old.

**FORM 'C'**  
**DETAILS OF ELIGIBLE SIMILAR NATURE OF WORKS COMPLETED**  
**DURING THE**  
**LAST SEVEN YEARS ENDING PREVIOUS DAY OF LAST DATE OF**  
**SUBMISSION OF TENDERS**

S. No	Name of work/project and location	Owner of sponsoring organization	Cost of work	Date of commencement as per contract	Stipulated date of completion	Actual date of completion	Litigation/arbitration cases pending /in progress with	Name and address /telephone number of officer	Whether the work was done on back to back basis
1	2	3	4	5	6	7	8	9	10

\* Indicate gross amount claimed and amount awarded by the Arbitrator.

Signature of Bidder(s)

## FORM 'D'

### PERFORMANCE REPORT OF WORKS REFERRED TO IN FORMS "C"

1. Name of work/project & location
2. Agreement no.
3. Estimated cost
4. (i) Tendered cost  
(ii) Value of work done
5. Date of start
6. Date of completion
  - (i) Stipulated date of completion
  - (ii) Actual date of completion
7. (a) Whether case of levy of compensation for delay has been decided or not  
Yes/No  
  
(b) If decided, amount of compensation levied for delayed completion, if any
8. Performance Report

(1)	Quality of work	Outstanding/Very Good/Good/Poor
(2)	Financial soundness	Outstanding/Very Good/Good/Poor
(3)	Technical Proficiency	Outstanding/Very Good/Good/Poor
(4)	Resourcefulness	Outstanding/Very Good/Good/Poor
(5)	General Behaviour	Outstanding/Very Good/Good/Poor

Dated:

**Executive Engineer or Equivalent**

**Note:** If Name of Work is not clearly defining scope of work as specified in the definition of similar work, bidders are advised to upload copy of Agreement/ final bill or any other relevant document in support of their proposed completed work conforming to the definition of similar work.

**FORM "E"**  
**STRUCTURE & ORGANISATION**

1. Name & address of the bidder
2. Telephone no./Telex no./Fax no.
3. Legal status of the bidder (attach copies of original document defining the legal status)
  - (a) An Individual
  - (b) A proprietary firm
  - (c) A firm in partnership
  - (d) A limited company or Corporation
4. Particulars of registration with various Government Bodies (attach attested photocopy)

Organisation/Place of registration  
Registration No.

- 1.
- 2.
- 3.
5. Names and titles of Directors & Officers with designation to be concerned with this work.
6. Designation of individuals authorized to act for the organization
6. Has the bidder, or any constituent partner in case of partnership firm Limited Company/Joint Venture, ever been convicted by the court of law? If so, give details.
8. In which field of Civil Engineering construction the bidder has specialization and interest?
9. Any other information considered necessary but not included above.

Signature of Bidder(s)

## FORM “F”

### Affidavit

I/We undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/We shall be debarred for tendering in IIT Guwahati in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Performance Guarantee.

Signature of Bidder(s) or an  
authorized Officer of the firm with  
stamp

**FORM  
“G”**

Undertaking regarding obtaining GST registration Certificate of  
The State, in which work is to be taken up

If work is awarded to me, I/we shall obtain GST registration Certificate of the State, in which work is to be taken up within one month from the date of receipt of award letter or before release of any payment by IITG, whichever is earlier, failing which I/We shall be responsible for any delay in payments which will be due towards me/us on a/c of the work executed and/or for any action taken by IITG or GST department in this regard.

Signature of Bidder(s) or an authorized  
Officer of the firm with stamp

## **FORM "H"**

### **Compliance to requirement of tender documents:**

We confirm that our tender complies with the total techno-commercial requirements of bidding document without any deviation.

**Signature of Company/ Contractor**

## **FORM "I"**

### **TENDER VALIDITY**

Tender shall remain valid for acceptance for a period of 120 (One hundred twenty) days from the date of opening of the tender. The tenderer shall not be entitled during the said period to revoke or cancel his tender or to vary the tender given or any term thereof. In case of tenderer revoking or cancelling his tender or varying any term in regard thereof, the OWNER shall reject the tender. Tender shall be revalidated for extended period as required by Owner in writing.

**Signature of Company/ Contractor**

## **FORM "J"**

### **PROFORMA (WATER PROOFING WORKS)**

#### **TO BE EXECUTED BY CONTRACTOR FOR REMOVAL OF DEFECTS AFTER COMPLETION IN RESPECT OF WATER PROOFING WORKS**

#### **GUARANTEE BOND FOR REMOVAL OF DEFECTS AFTER COMPLETION IN RESPECT OF WATER PROOFING WORKS**

(TOILETS & BATHROOMS/HAND WASH AREA/UNDER GROUND  
TANK/OVERHEAD TANKS/ROOF)

The Agreement made this day of \_\_\_\_\_ Two thousand and \_\_\_\_\_ between  
\_\_\_\_\_ son of (hereinafter called the Guarantor on  
the one part) and the IIT Guwahati (hereinafter called the  
OWNER on the other part).

WHEREAS THIS agreement is supplementary to a contract (hereinafter called the  
contract) dated \_\_\_\_\_ and made between the GUARANTOR OF  
THE

ONE part and the OWNER of the other part, whereby the contractor, inter alia,  
undertook to render the buildings and structures in the contract recited completely  
water and leak-proof.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the effect that the  
said structures will remain water and leak-proof for 10 (Ten) years from the date  
after the maintenance period prescribed in the contract.

NOW THE GUARANTOR hereby guarantees that water proofing treatment given by  
him will render the structures completely leak proof and the minimum life of  
such water proofing treatment shall be ten years to be reckoned from the date after  
the maintenance period prescribed in the contract.

Provided that the Guarantor will not be responsible for the leakage caused by  
earthquake or structural defects or misuse of roof or alteration and for such purpose:

(a) Misuse of roof shall mean any operation which will damage proofing treatment,  
like chopping of firewood and things of the same nature which might cause damage  
to the roof.

(b) Alteration shall mean construction of an additional storey or a part of the roof or construction adjoining to existing roof whereby proofing treatment is removed in parts.

(c) The decision of the Engineer-in –charge with regard to cause of leakage/seepage shall be final.

During this period of guarantee the guarantor shall make good all defects and in case of any defect being found, render the building water proof to the satisfaction of the Engineer-in– charge at his cost and shall commence the work for the rectification within seven days from the date of issue of the notice from the Engineer-in–charge calling upon him to rectify the defects failing which the work shall be done by the department by some other agency contractor at the GUARANTOR’s risk and cost. The decision of the Engineer-in–charge as to the cost payable by the Guarantor shall be final and binding.

That if guarantor fails to make good all defects or commits breach thereunder then the Guarantor will indemnify the principal and his successors against all loss, damage, cost expense otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and/or cost incurred by the OWNER the decision of the Engineer-in-Charge will be final and binding on the parties.

IN WITNESS WHEREOF these presents have been executed by the Obliger \_\_\_\_\_ and by \_\_\_\_\_ and for and on behalf of the IIT GUWAHATI on the day, month and year first above written SIGNED, SEALED AND delivered by OBLIGOR in the presence of :

1. ....

2. ....

SIGNED FOR AND ON BEHALF OF THE IIT GUWAHATI BY in the presence of:

1. ....

2 .....

## EVALUATION CRITERIA TO QUALIFY FOR OPENING OF PRICE BID

### TENDER TECHNICAL QUALIFICATION CRITERIA

Sl. No.	Qualifying Criteria	DOCUMENTS REQUIRED FROM THE BIDDER
1	Total tender document including addenda, corrigendum etc.	Complete set of the tender document downloaded duly filled in and signed by the tenderer as prescribed in different clauses of the tender document with all addenda/corrigenda issued duly signed.
2	Certificate of registration with Govt. / Semi Govt. Dept. / Autonomous Body.	The contractor/ firm should have valid Registration in CPWD, BSNL, APWD, Railways, MES, Central PSUs & other Govt. / Semi Govt. Dept. / Govt. Autonomous Body. Valid registration certificate
3	Cost of tender paper of ₹ 1,000.00	Shall be deposited along with the tender in the form of <b>Demand draft/ Banker's cheque</b> in favour of 'IIT Guwahati' payable at 'Guwahati
4	<b>Work experience</b>	Satisfactory completion certificates supported by respective Work order / detailed BOQ/ final bill etc. for works executed in Govt./ Semi Govt. Department/ Govt. Autonomous Body.
	Shall have experience in execution of similar civil works (involving waterproofing works) completed satisfactorily during the last seven years as follows::	
	(i) One work of value not less than ₹ 2.90 lakh against a single work order in Govt./ Semi Govt. department / Autonomous body during last seven years.	
5	Minimum <b>Annual Turn Over</b> during last 3 consecutive years shall not be less than ₹ 1.80 lakh.	Certificate of Financial Turnover for the last three years from Chartered Accountant or Audited Balance sheet for the last three years
6	Earnest Money of ₹ 7,300.00	Shall be deposited along with the tender in the form of ( <b>Demand draft/ Banker's cheque</b> in favour of 'IIT Guwahati' payable at 'Guwahati)
7	GST Registration	GST registration certificate should be submitted.
8	PAN no. of the Company/ Authorized Dealer.	Copy of PAN Card

# BILL OF QUANTITIES

## NAME OF WORK

**Repairing of seepage from bathroom down slab of quarter no  
D-67 and F-72**

## Bill of Quantities

**Name of Work: Repairing of seepage from bathroom down slab of quarter no D-67 and F-72**

Sl no.	Description of Items	Unit	Qty	Rate in Rs.		Amount (Rs.)
				in figure	in words	
<b>Demolishing work</b>						
1	Demolishing cement concrete manually/ by mechanical means including disposal of material within IITG campus as per direction of Engineer - in - charge. Nominal concrete 1:4:8 or leaner mix (i/c equivalent design mix)	cum	5.50			
2	Dismantling tile work in floors and roofs laid in cement mortar including stacking material within IITG campus. For thickness of tiles 10 mm to 25 mm	sqm	72.00			
3	Raking out joints in lime or cement mortar and preparing the surface for re-pointing or replastering, including disposal of rubbish to the dumping ground, all complete as per direction of Engineer-in-Charge.	sqm	85.00			
4	Dismantling of flushing cistern of all types (C.I./PVC/Vitrious China) including stacking of useful materials near the site and disposal of unserviceable materials within 50 metres lead.	each	3.00			
5	Taking out doors, windows and clerestory window shutters (steel or wood) including stacking within IITG campus: Of area 3 sq. metres and below	each	3.00			

<b>Water proofing work</b>						
6	Providing water proofing treatment with best quality acrylic polymer modified cementitious composite slurry coating and fibre glass cloth of approved brand over sunken floors & terraces as per manufacturer's specifications and as approved by Engineer-in-charge. The waterproofing membrane applied shall be subjected to water ponding test by filling minimum 50 mm water for 2-3 days or as specified by Engineer - In charge. Areas to be observed from bottom and all wet spots & water leakage area should be marked for treatment. If the wet areas are observed, they should be treated by reapplication of waterproofing membrane.(sunken floor of toilet & kitchen, toilet walls, podium, terrace)	sqm	85.00			
7	12 mm cement plaster of mix : ( to protect waterproofing treatment) 1:4 (1 cement: 4 fine sand)	sqm	85.00			
<b>Other finishing work</b>						
8	Providing and laying cement concrete in retaining walls, return walls, walls (any thickness) including attached pilasters, columns, piers, abutments, pillars, posts, struts, buttresses, string or lacing courses, parapets, coping, bed blocks, anchor blocks, plain window sills, fillets, <b>sunken floor</b> etc., up to floor five level, excluding the cost of centering, shuttering and finishing: 1:2:4 (1 Cement : 2 coarse sand (zone-III) derived from natural sources : 4 graded stone aggregate 20 mm nominal size derived from natural sources)	cum	5.50			
9	Providing and laying rectified Glazed Ceramic floor tiles (Antiskid) of size 300x300mm or more (thickness to be specified by the manufacturer), of 1st quality conforming to IS : 15622, of approved make, in all colours, shades, except White, Ivory, Grey, Fume Red Brown, laid on 20 mm thick Cement Mortar 1:4 (1 Cement : 4 Coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including pointing the joints with white cement and matching pigments etc., complete.	sqm	23.00			

10	Providing and fixing 1st quality ceramic glazed wall tiles conforming to IS: 15622 (thickness to be specified by the manufacturer), of approved make, in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge, in skirting, risers of steps and dados, over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm, including pointing in white cement mixed with pigment of matching shade complete.	sqm	55.00			
11	Applying priming coats with primer of approved brand and manufacture, having low VOC (Volatile Organic Compound ) content. With water thinnable cement primer on wall surface having VOC content less than 50 grams/litre	sqm	75.00			
12	Distemping with 1st quality acrylic distemper, having VOC (Volatile Organic Compound ) content less than 50 grams/ litre, of approved brand and manufacture, including applying additional coats wherever required, to achieve even shade and colour. Two coats	sqm	75.00			
<b>Sanitary Fittings</b>						
13	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge. Concealed work, including cutting chases and making good the walls etc.					
(a)	15 mm nominal dia Pipes	m	9.00			

(b)	20 mm nominal dia Pipes	m	24.00			
14	Providing and fixing on wall face un-plasticised - Rigid PVC sewer pipes conforming to IS:13592 Type-B including jointing with seal ring conforming to IS:5382 leaving 10mm gap for thermal expansion single socketed pipes with all accessories as bend, door bend, horn bend etc., complete as directed.					
(a)	50 mm dia	m	10.50			
(b)	110 mm dia	m	15.00			
15	Providing and fixing white vitreous china pedestal type water closet (European type W.C. pan) with seat and lid, 10 litre low level white P.V.C. flushing cistern, including flush pipe, with manually controlled device (handle lever), conforming to IS : 7231, with all fittings and fixtures complete, including cutting and making good the walls and floors wherever required : W.C. pan with ISI marked white solid plastic seat and lid	each	3.00			
16	Providing, fixing, testing & commissioning of Bathroom Drain (Make-Viega model no.-4935.1) Article Code-557119 with Sealing flange,with removable trap,(Storage Water Height 50 mm-Water Seal),without top,with protection plug, with rotatable supply DN40, with horizontal drain socket,with outlet 100 mm. Drain capacity 1.7-1.1L/s WITH height adjustable and rotratable TOP FRAME Model-4922.4 Article Code-534523(Height adjustment piece) 150x 150 (suitable for 143x143 GRATE) WITH BACK PRESSURE SEAL.WITH STAINLESS STEEL GRATE(143x143)Model- 4933.4	each	7.00			

	Article Code- 554040. LOADING CAPACITY CLASS K=300KG Quality controlled in accordance with DIN EN -1253(Body and Top Frame made of environmental friendly PP (poly propylene) 110 mm inlet and 110 mm outlet					
17	Providing and fixing 100 mm dia S.S grating (with or without hole) for floor or Nahani trap.	each	7.00			
18	Providing and fixing factory made single extruded WPC (Wood Polymer Composite) solid door/window/clerestory windows & desertory other Frames/Chowkhat comprising of virgin PVC polymer of K value 58-60 (Suspension Grade), calcium carbonate and natural fibers (wood powder/ rice husk/wheat husk) and non toxic additives (maximum toxicity index of 12 for 100 gms) fabricated with miter joints after applying PVC solvent cement and screwed with full body threaded star headed SS screws having minimum frame density of 750 kg/ cum, screw withdrawal strength of 2200 N (Face) & 1100 N (Edge), minimum compressive strength of 58 N/mm <sup>2</sup> , modulus of elasticity 900 N/mm <sup>2</sup> and resistance to spread of flame of Class A category with property of being termite/borer proof, water/moisture proof and fire retardant and fixed in position with M.S hold fast/lugs/SS dash fasteners of required dia and length complete as per direction of Engineer-In- Charge. (M.S hold fast/lugs or SS dash fasteners shall be paid for separately). Note: For WPC solid door/window frames, minus 5mm tolerance in dimensions i.e depth and width of profile shall be acceptable. Variation in profile dimensions on plus side shall be acceptable but no extra payment on this account shall be made.					
(a)	Frame size 65 x 100 mm	Rmt	15.00			

19	Providing and fixing factory made single extruded WPC (Wood Polymer Composite) solid plain flush door shutter of required size comprising of virgin polymer of K value 58-60 (Suspension Grade), calcium carbonate and natural fibers (wood powder/ rice husk/wheat husk) and non toxic additives (maximum toxicity index of 12 for 100 gms) having minimum density of 650 kg/cum and screw withdrawal strength of 1800 N (Face) & 900 N (Edge), minimum compressive strength 50 N/mm <sup>2</sup> , modulus of elasticity 850 N/mm <sup>2</sup> and resistance to spread of flame of Class A category with property of being termite/borer proof, water/moisture proof and fire retardant and fixing with stainless steel butt hinges of required size with necessary full body threaded star headed counter sunk S.S screws, all as per direction of Engineer-In-Charge. (Note: stainless steel butt hinges and necessary S.S screws shall be paid separately) 30 mm thick	sqm	4.41			
20	Providing and fixing brass stop cock of approved quality : 15 mm nominal bore	each	9.00			
21	Providing and fixing wash basin with C.I. brackets, 15 mm C.P. brass pillar taps, 32 mm C.P. brass waste of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever require: White Vitreous China Wash basin size 630x450 mm with a single 15 mm C.P. brass pillar tap	each	3.00			
<b>Total =</b>						
<b>Rebate if any=</b>						
<b>Total after rebate=</b>						

**Seal**

**(Signature of the tenderer)**