



BID III –PART B

NAME OF WORK: e-TENDER FOR STRUCTURAL REPAIRS & ALLIED WORKS TO INVESTMENT BUILDING AT PLOT NO 54, SECTOR 11, CBD BELAPUR, NAVI MUMBAI MAHARASHTRA 400614.

FINANCIAL BID

**LAST DATE FOR SUBMISSION
ON OR BEFORE 15:00 HRS. ON **28.09.2022****

**CHIEF ENGINEER,
LIC OF INDIA
ENGINEERING DEPARTMENT,
WESTERN ZONAL OFFICE,
1ST FLOOR, WEST WING,
“YOGAKSHEMA”, JEEVAN BIMA MARG,
MUMBAI – 400 021**

**PHONE: 022-66598252,
e-mail: wz_engg@licindia.com**

FINANCIAL BID

NAME OF WORK: e-TENDER FOR STRUCTURAL REPAIRS & ALLIED WORKS TO INVESTMENT BUILDING AT PLOT NO 54, SECTOR 11, CBD BELAPUR, NAVI MUMBAI MAHARASHTRA 400614

CONTENTS

SNO	DESCRIPTION	PAGE NOS
1	Letter to Contractor from Chief Engineer	3-4
2	Letter from Contractor to Chief Engineer	5-6
3	Appendix to the Conditions of Contract & No Claim Certificate	7-9
4	Bank Account and other details	10
5	SCHEDULE OF QUANTITIES	11-21
6	Structural Audit by VJTI report dated December 2018 (soft copy attached)	22
7	Photographs	23-43
8	R.C.C Member ID/existingpropping/ distress mapping and safety planwith propping / scaffolding / safety net etc.	44-45
9	List of drawings (17 No Drawings attached separately)	46
10	General Repair methodology with materials specification.	47-72
11	Field test for materials.	73-76
12	Check list of materials etc.	77-87
13	General recommendations, safety codes, Waterproofing works etc	88-129
14	Annexure to BOQ	130

**LIFE INSURANCE CORPORATION OF INDIA
LETTER TO CONTRACTOR FROM CHIEF ENGINEER**

Date:

To,

Dear Sir / Sirs,

**NAME OF WORK: e-TENDER FOR STRUCTURAL REPAIRS & ALLIED WORKS TO
INVESTMENT BUILDING AT PLOT NO 54, SECTOR 11, CBD BELAPUR, NAVI MUMBAI
MAHARASHTRA 400614**

1) We hereby publish the TENDER on e-Tendering Portal (Website) through <http://lic.etenders.in> in **Electronic Mode** hereinafter referred as “eTendering” and consisting of following :

- (a) **BID I : PREQUALIFYING BID**
- (b) **BID II : E.M.D. & TENDER FEE BID**
- (c) **BID III : FINANCIAL BID**

Please note that copy of above e-TENDER can be downloaded from above portal (website) and should be mandatorily submitted in **Online Electronic Mode** hereinafter referred as “Online Offer”. The submission of Online offer duly Encrypted & Digitally Signed on above portal should be in prescribed Electronic Forms (Online) available on above portal for respective tender in Online Envelope(s) on or before **As per the Key Dates mentioned in the tender document and online portal for above tender.**

- 2) The drawings for the work will be available for inspection at the following Office:
- (a) Chief Engineer, Western Zonal Office. Life Insurance Corporation of India, Yogakshema, 1st floor, West wing, Jeevan Beema Marg, Mumbai - 400 021 OR at work site.
- 3) The bidders should submit required Earnest Money Deposit in a manner/mode as mentioned in e-TENDER process (ref: Pre-Qualification BID details). Tender fee. -Rs 2360/- and **Earnest Money Deposit of Rs 1,48,000.00 (Rupees One Lakh Forty Eight Thousand only)** shall be submitted in a sealed envelope separately ..
- a) Tender fee -Rs 2360/- - in the form of Crossed Demand Draft/ Pay order/ Bankers Cheque of any Nationalized/ Scheduled Bank drawn in favour of “**Life Insurance Corporation of India**” payable at “**Mumbai**”
- b) Earnest Money Deposit shall be submitted in the following form:-
- (a) i) The total amount of **Rs 1,48,000/- (Rupees One Lakh Forty Eight Thousand only)** in the form of Demand Draft/Pay Order/Banker’s Cheque in favour of “Life Insurance Corporation of India” payable at Mumbai. OR 50% amount i.e. Rs. 74,000/- in the form of Bank Guarantee of any Nationalised/Scheduled Bank & another 50% i.e. Rs. 74,000/- amount in the form of Demand Draft/Pay Order/Banker’s Cheque drawn in favour of “Life Insurance Corporation of India” payable at Mumbai (or) Bank Guarantee for the full amount i.e. for Rs. 1,48,000/- (Rupees One Lakh Forty Eight Thousand Only).

- 4) BIDs are to be submitted on the e-tendering portal **on or before As per the Key Dates** and the BID I & BID II of eTenders will be opened at **As per the Key Dates** in the presence of contractors or accredited representatives, who wish to attend the online Tender Opening process. The bidders can view the Tender Opening details through their respective Login IDs on the above mentioned eTender portal (Website). The Tenderer should ensure that their tender is received **Online Electronically** on or before the due date and time as specified in “**Key Dates**” in the Tender Document and above mentioned Portal (website). **Please note that above e-Tendering System is an automatically time locked system which will be locked immediately as soon as due date and time is over and will not accept any offer after that. So, the tenderers are strictly advised to do their process well before the due date and time to avoid any such instances.**
- 5) An annexure for Guidelines to Submit tenders on Electronic Tendering System (ETS) is attached in the Tender document. The tenderers are advised to carefully read the above document for understanding of e-Tendering System. The above Annexure will supersede all the terms & conditions mentioned for submission of tender in document.
- 6) The Life Insurance Corporation of India does not bind itself to accept the lowest or any tender.

Encl: As above.

CHIEF ENGINEER

LIFE INSURANCE CORPORATION OF INDIA

LETTER FROM CONTRACTOR TO CHIEF ENGINEER
TO BE SUBMITTED ONLINE ON OR BEFORE ON **As per the Key Dates**

Date:

From:

.....
.....
.....
.....

To

The Chief Engineer,
Life Insurance Corporation of India
Western Zonal Office
Yogakshema,
Jeevan Beema Marg,
Mumbai - 400 021

**NAME OF WORK: e-TENDER FOR STRUCTURAL REPAIRS & ALLIED WORKS TO
INVESTMENT BUILDING AT PLOT NO 54, SECTOR 11, CBD BELAPUR, NAVI MUMBAI
MAHARASHTRA 400614**

Dear Sir,

1) Having examined the Enrolment Form, Selection Criteria , Technical Specifications, schedule of Quantities, Detailed Drawings, Specifications, Conditions of Contract etc. included in the tender document for the Percentage Rate Contract relating to the above work, having visited/examined the site of the existing premises, having acquired the requisite information relating thereto as effecting the tender invited by you on behalf of the Life Insurance Corporation of India, I/We, the undersigned hereby offer to carry out the above mentioned work on Percentage Rate basis in strict accordance with the Contract Conditions and Specifications.

I/We, undertake to complete and deliver the whole of the works within a period as specified in Appendix to the Conditions of Contract from the date of issue of intimation from you that the tender has been accepted and upon receiving possession of the site. I/We shall be under the obligation to complete the entire work within the period of completion failing which to pay the sum as stated in the Appendix to the Conditions of Contract for every week that the works shall remain incomplete, damages as compensation subject to the conditions of contract relating to extension of time.

2) I/We submit herewith my/our tender with an Earnest money remittance of Rs **1,48,000/- (Rupees One Lakh Forty Eight Thousand only)** in the form of CROSSED DEMAND DRAFT /Bank Guarantee of Nationalized/ scheduled Bank PAYABLE AT Mumbai I/We, hereby agree that part of this sum shall be forfeited by the 'Life Insurance Corporation of India in the event of my/our tender being accepted and I/We fail to execute Contract when called upon to do so.

WZO

3) In the event of the tender being accepted, I/We, agree to the retention of my/our EMD as a part of Security Deposit and the balance amount of Security Deposit to be recovered at 7.5% of Gross Value of work done from my / our Running Account Bills. **OR** I/We, agree to furnish a lump sum Bank Guarantee for total Security Deposit or two Bank Guarantees each with 50% value of Security Deposit from any Nationalized/Scheduled Bank at Mumbai as per specimen given in Annexure "B" to Conditions of Contract, within 21 (twenty-one) days of acceptance of tender.

4) Performance Guarantee: - 3% on accepted tender amount in the form of Bank Guarantee.

5) I/We, note that the Earnest Money Deposit of **Rs.1,48,000/- (Rupees One Lakh Eighty Eight Thousand only)** would be refunded to me/us.

- a. On expiry of the validity of the tender or earlier at the discretion of Chief Engineer in case my/our tender is not accepted and
- b. In case my/our tender is accepted, after I/We, furnish Bank Guarantee in lieu of Security Deposit as mentioned above.

6) I/We, agree,

- a) In case my/our tender is withdrawn before expiry of the validity period or before the issue of letter of acceptance, whichever is earlier, or makes any modifications in the terms and conditions of the tender which are not acceptable to the Department, in such case 25% of the EMD will be forfeited by the department.
- b) In case my/our tender is accepted and the Performance Guarantee is not submitted within the prescribed period or approved extended period, 50% of the EMD will be forfeited automatically without any notice.

Yours faithfully,

(SIGNATURE OF THE CONTRACTOR)

Name and Seal

NAME OF THE PARTNER OF THE FIRM

OR

NAME OF THE PERSON HAVING POWER OF
ATTORNEY TO SIGN THE CONTRACT
(CERTIFIED TRUE COPY OF THE POWER
OF ATTORNEY SHOULD BE ATTACHED)

APPENDIX TO CONDITIONS OF CONTRACT

NAME OF WORK: e-TENDER FOR STRUCTURAL REPAIRS & ALLIED WORKS TO INVESTMENT BUILDING AT PLOT NO 54, SECTOR 11, CBD BELAPUR, NAVI MUMBAI MAHARASHTRA 400614

ESTIMATED COST : Rs. 295 Lakh
 PERIOD FOR COMPLETION : 06 (Six) Months
 EARNEST MONEY DEPOSIT : Rs. 1,48,000/-

Sl. No.	Clause Nos.	Description	Remarks
1	11	Minimum requirement of Technical staff ; Recovery for Non employment	Structural Engineer with minimum 3 years experience and Diploma Holder with minimum 5 years experience. Engineer Rs. 40,000/- per month. Supervisor Rs.25,000/- per month
2	13	Date of commencement	1. Either 21 (twenty one) days from the date of acceptance letter issued to the contractor OR The day on which contractor is instructed to take possession of the site, whichever is earlier
3	13 & 26	Date of completion	06 months from the date of commencement
4	19	Compensation in the form of penalty	Compensation in the form of penalty for delay of the work: Quantum of compensation: 0.5% of tendered value of work per week of delay to be computed on per day basis as mentioned in clause 19.1, and shall not exceed 10% of the tendered value of work.
5	21	Period of final measurement	60 (Sixty) days from the date of completion of contract
6	22	Interim certificate	For interim certificate of payment contractor shall complete minimum value of Rs. 40.00 Lakh during initial three months and thereafter minimum value of Rs. 50.00 Lakh or more compatible with balance value of work and period.
7	22	Period of honoring interim certificate	20 (Twenty) days

Sl. No.	Clause Nos.	Description	Remarks
8	22	Period of honoring final certificate	90 days from the date of submission of final bill with details.
9	35	a) Security Deposit	For works costing more than Rs 200 lakh up to & including Rs 800 lakh:- 2.5% of estimated tender amount as Security Deposit .
		b) Performance Guarantee (Applicable for works costing more than Rs. 200 lakh)	3% of estimated tender amount as performance guarantee (Rounded off to next Hundred Rupees)
10	35	Recovery of Security Deposit	Security Deposit shall be recovered from R.A. Bills at 7.5% of Gross amount of bill till the sum along with sum already deposited as EMD equals the total security deposit.
11	37	Interest on Lump sum Advance	10% simple interest p.a.
12	17.5	Contractor's All Risk Policy inclusive of Third Party Liability	Contractors' All Risk Policy shall be for full amount of Contract Value including third party rider of 7.5% of contract value. (Third Party Liability Policy can be standalone or can be along with CAR policy for specified value).
13	17.6	Workman's Compensation Policy	As per mutual agreement.
			Insurance policies (Workmen Compensation, Contractors all risk policy including 3 rd party liability), if not extended on time LIC may insure/ renew insurance and apply penal cost on the contractor, i.e Premium Charges plus Rs.10,000/- as Admin Charges and Rs.25,000/- as penalty.
14	27	Defects liability period	24 months from the date of virtual completion
15.	22.6	No Claim Certificate	To be given on Contractors letter head

NO CLAIM CERTIFICATE CUM RECEIPT

“Received Rupees_____ (Rupees_____)
 being the amount against my/our final bill dated_____ for_____ (Name of Work) in full
 and final settlement of bill.

Contractor
 (Signature of Contractor on Revenue stamp)

Rubber stamp/seal of the contractor /company

CONFIRMATION OF EARNEST MONEY DEPOSIT

The authenticity of the Bank Guarantee submitted as EMD will be confirmed from the respective banks. In case the BG submitted by the contractor is not genuine the contractor will be barred from participating in the tender of the corporation for 2 years and the information will be shared with Govt. of India, Banks and other financial institutions, their previous/present employers etc.

REFUND OF EARNEST MONEY DEPOSIT

The EMD will be refunded to the unsuccessful bidders within 7 workings days (excluding gazette holidays, Saturday, Sundays and any other holiday declared in NI act) of opening of the price bid. The EMD for the successful bidder will be refunded after the authenticity of the BG for Security Deposit and Performance Guarantee is confirmed.

FOREITURE OF EARNEST MONEY DEPOSIT

1) If the lowest tender withdraws his tender before the expiry of validity period or before the issue of letter of acceptance whichever is earlier or makes any modification in the terms and conditions of tender which are not acceptable to department, then the department shall, without prejudice to any other right or remedy be at liberty to forfeit 25% of the earnest money and to refund the balance.

2) If the contractor fails to furnish the prescribed performance guarantee within the prescribed period or duly approved extended period, 50% earnest money will be absolutely forfeited automatically without any notice and the balance 50% will be refunded.

LIFE INSURANCE CORPORATION OF INDIA

ANNEXURE

To be submitted along with Tender copy

1. Name of the Company/Firm/Entrepreneur
Institute, etc. _____
2. Address _____

Phone number _____ STD Code.....NO.....
E- Mail ID _____
3. Bank Account Details
A. Account No. _____
B. Type of Account _____
C. IFSC/RTGS code _____
(enclose Xerox copy of the Cheque leaf)
4. PAN No.* _____
5. VAT/TIN Registration No. * _____
6. Service tax Registration No. * _____

I declare that, the above furnished information is correct. During the contract period, if any changes took place in the above said information, the same will be informed with the valid reasons.

SIGNATURE

(* Self Attested copies to be enclosed)

LIFE INSURANCE CORPORATION OF INDIA	
SCHEDULE OF QUANTITIES	
NAME OF WORK: e-TENDER FOR STRUCTURAL REPAIRS & ALLIED WORKS TO INVESTMENT BUILDING AT PLOT NO 54, SECTOR 11, CBD BELAPUR, NAVI MUMBAI MAHARASHTRA 400614	
1	It is percentage tender and Contractors should fill/write only percentage at Par/ Above / below the estimated amount mentioned in the last page of the tender schedule. The quoted amount should be written legibly both in figure and Words All corrections should be initialed. Each page of the schedule of quantity and general summery should be signed by the Contractor. Rates/ Amount mentioned in the words shall be prefixed and suffixed by “Rs.” and “only” respectively. Tenders containing quoted amount only in figures are liable to be considered non-bona fide at the discretion of the Chief Engineer and may entail forfeiture of earnest money deposit.
2	The rates quoted are inclusive of all taxes, transportation charges, loading and un loading at all points, transit insurance and other incidentals charges but excluding GST on Works contract.
3	No reimbursement whatsoever shall be made to the contractors on account of any taxes or duties or increase in the taxes/duties by act of any legislation except GST on works contract which will be paid separately along with bill payment as per applicable rate of GST on works contract at the time of bill. GST on Works Contract shall be paid separately as per the Financial Act amended from time to time by State and Central Government.
4	a) While filling the rates contractors are requested to consider of various products/materials as given in the approved list of principal makes of materials.
	b) For all other manufactured materials for which principal makes are not mentioned the materials allowed to be used in the work shall have BIS certification and samples for which are to be got approved prior to use of the same in the work.

Item No	Description	Unit	Qty.	RATE	Amount
				(Rs.)	(Rs.)
(a)	(b)	(C)	(d)	(e)	(f)
A	Preparatory & Enabling Work				
A1	Excavation for foundations, substructures, basements, tanks, sumps, walls, chambers, manholes, trenches, poles, pits & general building works in all types of soils, vegetable earth, soft murum, running sand, shingle, turf clay, loam, peat, ash, shale, slag, chalk, garbage, muddy/ marshy/ slushy soil, marine clay, reclaimed land etc. for depths/lifts upto 1.5M measured from the ground level, including dressing/ trimming the sides, leveling and ramming of bottoms, manual dewatering, removing rank vegetation, backfilling in layers not more than 200mm thickness, watering, consolidating, compacting to achieve not less than 97% Modified Proctor density conforming to relevant IS, stacking the selected material in measurable heaps for future use within owners space or disposing within an initial lead of 150m as directed, loading, unloading, leveling excluding shoring, strutting etc. complete as directed by Engineer-in-Charge. Note: 1) The rate includes the handling/supporting the existing utilities such as cables, drains, pipes, water mains etc. 2) It also includes the royalty and other taxes applicable if any. For more details refer General Notes.	42.00	Cum	307.0	12894.00
A2	Providing & Laying dry stone Rubble Soling with average 230 mm size hard stone set in regular lines, hand packed and interstices thoroughly filled with small chips including filling in with good quality murum brought from outside, compacting with iron rammers, watering, sand spreading 12mm thk. layer of grit on top etc complete as directed by Engineer In Charge. (Note: The rate includes the royalty and other taxes if any)	26.00	Cum	2231.0	58006.00
	Providing and fixing double scaffolding system (cup lock type) on the exterior side of building/structure, including additional rows of scaffolding in stepped manner as per requirement of site, made with 40mm dia M.S. tube, placed 1.5 meter centre to centre,				

A3	horizontal & vertical tubes joint with cup & lock system with M.S. Tubes, M.S. tube challis, M.S. clamps and staircase system in the scaffolding for working platform etc. and maintaining it in a serviceable condition for execution of work of cleaning and/ or pointing and/ or applying chemical and removing it thereafter. The scaffolding system shall be stiffened with bracings, runners, connecting with the building etc, wherever required, if feasible, for inspection of work at required locations with essential safety features for the workmen etc., complete as per directions and approval of Engineer- in-charge. Note:- (1) The elevation area of the scaffolding shall be measured for payment purpose. (2) The payment will be made once only for execution of all items for such works.	4187.00	Sqm	196.00	820652.00
A4	Providing and fixing Nylon safety net of approved quality, colour & design having approx. 2mm thick twisted type double chord & 25mm mesh / opening on scaffolding face up to 30 meter height, including stitching the pieces of safety net to form a continuous piece up to full height and fixing with 12mm dia. Multi-strand Nylon rope both vertically and horizontally. The safety net is to be fixed at top, bottom and at intermediate levels by tying ropes to MS hooks on wall surface or on existing tubular scaffolding system not exceeding 4m C/C along periphery and to make proper arrangement to arrest falling debris, CC lumps & tiles etc., all complete as per direction of Engineer-in- Charge.	547.00	Sqm	300.00	164100.00
A5	Providing and fixing Jute Kantan (Tarat) screen to the scaffolding for external guniting as directed including removing the same after the work is over etc. complete.	4187.0	Sqm	60.00	251220.00
A6	Removing the existing cement plaster of any thickness without causing dust nuisance and stacking the debris upto a distance of 50 meters or spreading in the compound and cleaning the site etc. complete.	8589.0	Sqm	52.00	446628.00
A7	Chipping /removing loose concrete up to reinforcement bars, without damaging the reinforcement, removing all the loose materials and to make all the exposed surfaces free from oil, dust and all impurities etc. complete.	3209.0	Sqm	236.0	757324.00

A8	Providing and fixing in vertical position telescopic M.S. prop under deflected beam/lintel/slab/chajjas by using teak wood battens of size 1000 x 80 x 80 for packing between prop plate and the beam/lintel/slab/chajjas bottom surface as per the directions of engineer-in-charge.	803.00	Nos	2208.0	1773024.0
	Total of item A				4283848.00
B	DISMANTLING & DEMOLISHING				
B9	Removing rich mix cement concrete including stacking the spoils as directed with all leads, lifts etc, complete.	47.00	Cum	920.00	43240.00
B10	Removing lime or lean cement concrete including stacking the spoils as directed with all leads, lifts etc, complete.	10.00	Cum	551.00	5510.00
B11	Dismantling brick masonry in lime or cement mortar and stacking the materials as directed with all leads, lifts etc.	10.00	Cum	331.00	3310.00
B12	Removal of plants / ficus grown by pulling out root system embedded in masnory, cutting stem and application of high/gur/lime formulation as specified by the Architect or other patented chemical biocide treatment such as biocide 'Glycel' (ISO proplamine salt of glyphosate) or other chemical as specified by the Engineer in charge etc. complete.	100.00	Sqm	188.00	18800.00
B13	Removing existing door or windows with frame and shutters and making good etc. to the existing surface.	10.00	Nos	157.00	1570.00
B14	Breaking and removing the water proofing layers of I. P. S. with bituminous joints and brick bat concrete over the existing terrace floor, chajja, top of headroom slab and canopy including cement vata and exposing R.C.C. slab top complete.	550.00	Sqm	218.0	119900.00
	Total of Item B				192330.00
C	STRUCTURAL REPAIR WORKS				
C15	Providing & Applying Dura Clean- WR - for cleaning the TMT bars, steel structure etc. of structure by Water jet cleaning/ grinding the surface by grinder machine, wire brush, removing existing corrosion from the metal surface also removing loose particles	1765.0	Sqm	545.00	961925.00

	(using other mechanical / manual means) and apply on prepared surface of Dura Cap 2 coats corrosion preventive coat on prepared TMT bars, steel structure, metal surface etc. to protect it from corrosion etc. as per manufacturer's specification (using other manual / mechanical means) complete as per specification including cost of all materials, machinery, labour, insurance charges as directed by the Engineer in charge.				
C16	Carry out application of "Bi-polar migratory corrosion inhibitor" on concrete surface. This inhibitor has migratory kind of property which permits the material to migrate to a virtual extent of 100mm, through pores of concrete, inhibiting the corrosion etc complete.	3530.0	Sqm	788.00	2781640.00
C17	Providing and applying "high strength, non shrink free flow grout material" i.e. micro concrete (like shrink comp or equivalent) having compressive strength as 400 Kilogram/sq.cm. including finishing the surface and curing for 07 days. Etc complete. The usage of this non shrink concrete with zero slump is to allow to occupy every free space leaving no voids, thereby producing dense concrete with proper bonding with concrete (The quoted rates to be inclusive of all materials, labours, tools & tackles, transportation, taxes etc complete) to be applied for foundation and strengthening of pier etc and as per the direction of Site-In-Charge. (The product like Ultratech/ Rendroc (RGL) of FOSROC or its equivalent)	9.00	Cum	70350.00	633150.00
C18	Removing loose rust from the reinforcement bars by wire brushing, light hammering etc. and applying sulphate and chloride free inorganic single component rust remover Rusticide as approved by Engineer in charge conforming to IS 9077. The rusted surface shall become blackish non rusted colour. After 24 hours of application of rust remover, loose particles shall be removed by brush. Apply one more coat of Rusticide. Apply bonding coat slurry of high performance acrylic polymer - Methyl 2-methylpropenoate copolymer with another enoate as approved by Engineer in charge on entire surface. Mix 1Kilogram of acrylic polymer with 0.5Kilogram of cement. Finish it with ready to use repair polymer modified mortar based on special cements, aldehyde based polymers with thixotropy modifying agents as approved by Engineer in charge (The Polymer Modified	2452.0	Sqm	2293.00	5622436.00

	Mortar (PMM) should attain min. compressive strength of 20 N/mm² in 1 day and 30 N/mm² in 7 days) by adding 13 - 16 % water by weight of polymer modified mortar for treatment to the damaged RCC members. Add 1 Kilogram of Migrating Corrosion Inhibiting Admixture as approved by Engineer in charge per 25 Kilogram bag of polymer modified mortar. After mixing polymer modified mortar, it can be trowel applied or sprayed. When applying by hand, polymer modified mortar must be forced tightly into the substrate to ensure complete contact with the substrate. (If scaffolding is required, same shall be provided and will be paid under relevant item) (Up to 15 mm thickness at a time).				
C19	Removing loose rust from the reinforcement bars by wire brushing, light hammering etc. and applying sulphate and chloride free inorganic single component rust remover Rusticide as approved by Engineer in charge conforming to IS 9077. The rusted surface shall become blackish non rusted colour. After 24 hours of application of rust remover, loose particles shall be removed by brush. Apply one more coat of Rusticide. Apply bonding coat slurry of high performance acrylic polymer - Methyl 2-methylpropenoate copolymer with another innovate as approved by Engineer in charge on entire surface. Mix 1 Kilogram of acrylic polymer with 0.5 Kilogram of cement. Finish it with ready to use repair polymer modified mortar based on special cements, formaldehyde based polymer with thixotropy modifying agents as approved by Engineer in charge (The Polymer Modified Mortar (PMM) should attain min. compressive strength of 20 N/mm² in 1 day and 30 N/mm² in 7 days) by adding 13 - 16% water by weight of polymer modified mortar for treatment to the damaged RCC members. Add 1 Kilogram of Migrating Corrosion Inhibiting Admixture as approved by Engineer in charge per 25 Kilogram bag of polymer modified mortar. After mixing polymer modified mortar, it can be trowel applied or sprayed. When applying by hand, polymer modified mortar must be forced tightly into the substrate to ensure complete contact with the substrate. (If scaffolding is required, same shall be provided and will be paid under relevant item) (15-30 mm thickness at a time).	537.00	Sqm	1530.00	821610.00

C20	Providing and applying Kelox R 101 (Resin) + Kelox H 404 (Hardner) water misible epoxy of approved make for bonding old concrete to new mortar after mixing slowly in predefined ratio and applying by brush on the surface, when it is tacky then apply the mortar complete as per specification and as directed by engineer-in-charge. Work shall be executed by certified applicator only and work shall be guaranteed for 5 years and guarantee shall be provided on Rs. 500 /- stamp paper	106.00	Sqm	759.00	80454.00
C21	Shear Connectors: Make 10/12 mm dia holes using heavy duty electrically operated hammer drills in the concrete of RCC members to a depth of about 75 mm at 500 mm c/c or at suitable grid in zig-zag fashion, clean the holes using air jet and fix pre-fabricated 100 x 50 mm L-shape 8 mm dia rebar using Anti Corrosive protective coating so that 75 mm out of 100 mm is inserted inside the concrete and 25 mm remain outside along with 50 mm bend. The shear connectors are used to tie the additional reinforcement bars.	5590.00	Nos	480.00	2683200.00
C22	Providing and laying Cast in situ / Ready Mix cement concrete M-25 of trap / granite / quartzite / gneiss metal for R.C.C. slabs and landings as per detailed designs and drawings including steel centering, formwork, cover blocks laying / pumping, compaction finishing the formed surfaces with cement mortar 1:3 of sufficient minimum thickness to give a smooth and even surface or roughening if special finish is to be provided and curing etc. complete, (Excluding reinforcement and structural steel) with fully automatic micro processor based PLC with SCADA enabled reversible Drum Type mixer/concrete Batch mix plant (Pazmixer) etc. complete with fine aggregate (Crushed sand VSI Grade)	52.00	Cu.m.	14820.00	770640.00
C23	Providing and fixing in position TMT - FE - 500 bar reinforcement of various diameters for R.C.C. pile caps, footings, foundations, slabs, beams, columns, canopies, staircase, newels, chajjas, lintels, pardis, copings, fins, arches etc. as per detailed designs, drawings and schedules, including cutting, bending, hooking the bars, binding with wires or tack welding and a supporting as required complete.	11.00	M.T	75367.00	829037.00
	Total of item C				15184092.00

D24	Providing and laying in position plain cement concrete of specified grade cement with trap /granite/quartzite/gneiss metal mixing in concrete mixer including bailing out water, compacting, finishing surface, curing and including the cost of centering and shuttering at all level : Nominal Mix of 1:2:4 (1 cement OPC: 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)	26.00	Cu.m.	6821.00	177346.00
D25	Providing first class Burnt Brick masonry with conventional / I.S. type bricks in cement mortar 1:4 including scaffolding, racking out joints pointing in C.M. 1:3 and watering in pillars of rectangular or square shape as shown on the drawing or as directed	10.00	Cu.m.	9157.00	91570.00
D26	Providing anti-termite treatment around the periphery of the existing building conforming to IS-6313 (partIII) by excavating trenches of 20cm width and exposing the sides of the columns, plinth beams and wall up to a depth of 300mm, rodding for the holes of 300mm deep and at 150m c/c in the trenches, treating with chloropyrifos EC 20 Emulsion or equivalent of 1% concentration by weight at the total rate of 2.25 Liters per meter including backfilling the trenches etc. complete as directed by Engineer-in-Charge covering 2 years guaranty.	191.00	R.M.	66.00	12606.00
D27	Providing anti termite treatment conforming to IS- 6313 (part-III) to the sides of flooring of the Existing building by punching/ drilling the holes of 16 mm dia at a distance of 300mm centre to centre and injecting 150 ml until refusal or to a maximum of 1 Lit. per hole with chloropyrifos EC 20 Emulsion or equivalent of 1% concentration by weight, sealing the hole by filling the putty etc. complete as directed by Engineer-In-Charge with 2 years guaranty.	3806.00	No	27.00	102762.00
D28	Providing internal cement plaster 12mm thick in single coat in cement mortar 1:4 without neeru finish to concrete or brick surfaces, in all positions including scaffolding and curing etc. complete.	5217.00	Sq.m.	277.00	1445109.00
	Providing sand faced plaster externally in cement mortar using approved screened sand, in all positions including base coat of 15 mm thick in cement mortar 1:4 using waterproofing compound at 1 kg per cement bag curing the same for not less than 2 days and keeping the	3373.0	Sq.m.	629.00	2121617.0

CONTRACTOR

	requirement at site and the process of grouting as the capillaries present in the slab get filled by cement grout then for further grouting leaner mix (not less than 1:5 may be required for further grouting) admixed with w/p compound with required pressure not less than 0.3 kg/sq.cm by grout pump so as to seal all inherent holes, honey combs, cavities and voids and making the whole structures consistent and homogeneous solid mass resistant to seepage, dampness, moisture. When the portion of the slab covered by a hole is completely filled up with grout, allow sufficient quantity of grout to overflow from the vent holes (i.e. holes at diagonally opposite corners will act as vent hole), to ensure no air pockets left.				
	4. Taking holes one by one in the staggered form for grouting purposes and in each case holes at the diagonally opposite end will be acting as vent holes.				
	5. Filling the entire area by 15 cm. deep water for ponding test. The ponding test shall be checked after 7 days by the officer of the rank not below Executive Engineer along with Zonal Executive Engineer to ensure that there is no leakage found. The certificate to this effect shall be given by the concerned engineer.				
	6. Repeating step 2 to 5 until the entire structure is found completely waterproof.				
	7. Sealing the holes with suitable type of sealant material and curing the slab for 10 days and cleaned. The rate includes watering, tapping curing, and cleaning the top of all dust, loose materials stains etc. complete as directed. NOTE : The part portion of terrace slab shall be paid for actual area treated.				
D33	Waterproofing the terrace slab, chajja and staircase roof slab with average 100 mm thick concrete of broken brickbats and cement mortar (1:4) in the proportion of 2 parts of brick bats and 1 part of mortar, laid in proper slope (1:100) well rammed, watered and consolidated with vata 15 cm at junction of walls and Indian patent stone flooring 1:2:3 (12.5 mm chips) 40 mm thick and with admixture of approved water proofing compound as per manufacturers specifications laid after grouting the surface of brickbat coba with neat cement slurry in alternate suitable squares to required slope as directed including filling in joints with bitumen and cleaning the slab top of all dust and loose material; tamping, finishing and curing complete as directed and specified. (Horizontal measurements clear between walls will be paid	1428.00	Sq.m.	1418.00	2024904.00

	for).				
D34	Waterproofing Treatment to existing Toilet and bathrooms by using Polymeric cementitious membrane of approved make & approved by Engineer in charge and replacing the existing waterproofing treatment. Break open the existing I.P.S. and brick bat coba of the toilet and bathroom areas to expose the bare slab. (If there are cracks on the bare slab open the crack in V Groove and fill it with P.M.M. and if there are lots of honeycombs and identified bad patches of concrete the same should be grouted by grouting procedures). Clean the entire surface thoroughly and over this prepared surface, apply three coats of polymeric waterproofing coating having a breathable non toxic acrylic polymer liquid of approved make & approved by Engineer in charge over this waterproofing treatment, provide and lay brick bat coba of average 112mm thickness.	242.00	Sq.m.	2080.0	503360.0
D35	Providing and fixing single leaf panelled door shutter without fanlight and shutter 35 mm thick as per drawing consisting of T.W. top rail size 100mm x 35 mm and bottom and lock rail 200mm x 35mm insert panel 12 mm thick commercial ply faced T.W. particle board with phenolformaldehyde synthetic resin (Generally confirming to ISI 3097) excluding frame, including stainless steel fixtures fastening and T.W. beading at junction of panels inserts and as instructed by the engineer in charge including 3 coats of oil painting etc. complete.	24.00	Sq.m.	7888.00	189312.00
D36	Lowering down the debris obtained from breaking and removing the cement plaster / burnt brick masonry of the first floor by any means without causing dust nuisance and damage to structure, stacking the same as and where directed including cleaning the site complete.	561.00	Cu.m.	754.00	422994.0
D37	Removing any kind of earth, murum, building debries from building premises up to 15 km distance including loading, unloading etc. complete.	561.00	Cu.m.	344.00	192984.00
	Total of D				9844078.0
	TOTAL (A+B+C+D)				29504348.0

STRUCTURAL AUDIT BY VJTI REPORT

DATED: DECEMBER 2018

**(REPORT ATTACHED SEPERATELY
FOR REFERENCE)**

(PDF ATTACHMENT IN 43 PAGES)

PHOTOGRAPHS



Face A Full View



Face A: Surface cracks & black moss formation has been observed on wall & Chajja at all floors.



Face B: Full View, Surface cracks & black moss formation has been observed on wall & Chajja at all floors.



Face A: Spilling cover concrete & exposed reinforcement has been observed at 4th floor balcony slab.



Face C: Full view, surface cracks on plaster has been observed on wall at all floors. & vegetation growth has been observed on plinth protection.



Face C: Spilling cover concrete & exposed reinforcement has been observed at 4th floor balcony slab.



Face D: Full view, minor plaster surface cracks has been observed at few locations.



Face E: Full view.



Face E: Surface cracks on plaster & black moss formation has been observed on wall at all floors.



Face E: Spilling cover concrete & exposed reinforcement has been observed at ground floor Chajja.



Face E: Vegetation growth has been observed on plinth protection at ground floor.



Face F: Full view.



Face F: minor surface cracks on plaster & black moss formation has been observed on wall at all floors.



Face G: Full view.



Face G: Vegetation growth has been observed on plinth protection at ground floor.

GROUND FLOOR:



Spilling of cover concrete & exposed corroded & broken reinforcement has been observed on slab



At many locations, termite attacked has been observed on beam.



Wide corrosion crack has been observed at lintel beams.



Corrosion crack and air pocket has been observed on Beam.



Spilling of cover concrete & exposed corroded & broken reinforcement has been observed on slab.

FIRST FLOOR:



At most of the locations, spilling of cover concrete & exposed corroded & broken reinforcement has been observed on slab.



Wide vertical corrosion crack has been observed on column.



Repaired work will be carried out on slab & beam at most of the locations.



Air pocket and surface cracks on plaster has been observed on slabs, hollow sound observed after tapping with ebonite hammer.



At most of the locations, spilling of cover concrete & exposed corroded & broken reinforcement has been observed on slab. Props have been provided at most of the locations.

SECOND FLOOR:



At most of the locations repaired work will be carried out on beam n slab.



Spilling cover concrete & exposed reinforcement has been observed on slab at most of the locations.



The lintel beams were deteriorated due to cracks while sagging was observed at many locations due to dilation of cover concrete



Air pocket and plaster surface cracks Along with dampness have been observed on slabs, hollow sound observed after tapping with ebonite hammer.

THIRD FLOOR:



At most of the locations, spilling of cover concrete & exposed corroded & broken reinforcement has been observed on slab & beam. Props has been provided at most of the locations.



Wide corrosion crack has been observed at lintel beams.



Wide vertical corrosion crack has been observed on column.



At most of the locations repaired work will be carried out on beam n slab.



Corrosion crack has been observed on lintel beam.

FOURTH FLOOR:



At most of the locations, spilling of cover concrete & exposed corroded & broken reinforcement has been observed on slab.



Wide corrosion crack has been observed at lintel beams.



At most of the locations Lateral crack has been observed on soffit of beams.

FIFTH FLOOR:



At most of the locations, spilling of cover concrete & exposed corroded & broken reinforcement has been observed on slab.



Wide vertical corrosion crack has been observed on column.



At most of the locations Lateral crack has been observed on soffit of beams.

WZO



Air pocket and plaster surface cracks Along with dampness, seepages & leakages have been observed on slabs & beam, hollow sound observed after tapping with ebonite hammer.



The lintel beams were deteriorated due to cracks while sagging was observed at many locations due to dilation of cover concrete

SIXTH FLOOR:



At most of the locations, spilling of cover concrete & exposed corroded & broken reinforcement has been observed on slab.



Wide vertical corrosion crack & exposed reinforcement has been observed on column C4.



Dampness, seepages, plaster cracks and paint peel off has been observed on wall.



The lintel beams were deteriorated due to cracks while sagging was observed at many locations due to dilation of cover concrete.



At most of the locations slab covered with thermacol sheets.

TERRACE & HEADROOM



On terrace brick bat coba with cement slurry water proofing provided.



At most of the locations black moss formation has been on parapet walls



Wide vertical corrosion crack has been observed on column



Vegetation growth & wide vertical corrosion crack has been observed on column



On head room, plaster cracks & black moss formation has been on walls.



PVC water tanks (6 nos.) provided at terrace resting on RCC platform which is directly on the floor slab.

LIFT MACHINE ROOM



Spilling of cover concrete & exposed corroded & broken reinforcement has been observed on slab.



Lateral crack has been observed on soffit of beams.

R.C.C Member ID/Existing Propping / Distress Mapping and Safety Planwith Propping / Scaffolding / Safety Net etc.

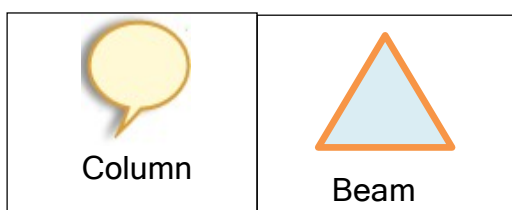
Distress mapping made it possible to assess the level of consumption of individual elements and durability of the structure. On this basis, main guidelines for necessary repairs and strengthening of structural elements which endanger the safety of exploitation were proposed. Distress mapping and detail nomenclature of the repair work has been carried out in the following manner for each of the building element.

Sr. No.	Level of Distress	Detailed Nomenclature of specialized repair Work.
1	Minor cracks to plaster/junction cracks.	Crack Filling
2	Minor cracks to structural member along with cracks to plaster.	Crack Filling + Corrosion Treatment
3	Major corrosion cracks to structural member/ cover concrete spilled in patches.	Polymer modified mortar (PMM up to 20mm)
4	Cover concrete spilled & reinforcement exposed at few locations.	Polymer modified mortar (PMM up to 20mm)
5	Cover concrete spilled & reinforcement exposed/ corroded at majority of locations.	Polymer modified mortar (PMM 20mm-40mm)
6	Structural member broken, cover concrete fallen & reinforcement broken also.	Micro Concrete jacketing (75 mm)
7	Bulging of column/ sagging of beam/ sagging of slab/ structural crack	Micro Concrete jacketing (75 mm)
8	Leakages, dampness, seepage etc.	Grouting (epoxy / cement based)
9	Hollow Sound/ Air Pockets.	Polymer modified mortar (PMM up to 20mm) if required + Re-plaster

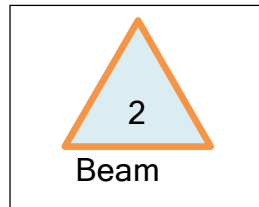
Sign Convention for distress mapping:

Following signs are used to denote the level of distress in structural members.

1) Distress in beam or column with level of distress.



e.g. Minor cracks to beam along with cracks to plaster denoted by
(the numeric value denotes the level of distress)



2) Distress in slab



3) Distress in RCC element other than Column, Beam and Slab



NAME OF WORK: e-TENDER FOR STRUCTURAL REPAIRS TO INVESTMENT BUILDING AT PLOT NO 54, SECTOR 11, CBD BELAPUR, NAVI MUMBAI MAHARASHTRA 400614

DRAWING LIST

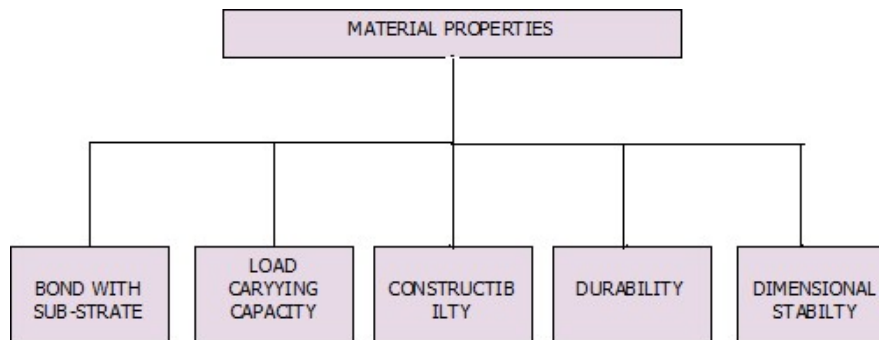
Sl. No.	Description	Drawing. No.
1	Distress Mapping - Ground Floor	FCEL/20-21/LIC/1:17
2	Distress Mapping - First Floor	FCEL/20 -21/LIC/2:17
3	Distress Mapping - Second Floor	FCEL/20 -21/LIC/3:17
4	Distress Mapping - Third Floor	FCEL/20 -21/LIC/4:17
5	Distress Mapping - Forth Floor	FCEL/20 -21/LIC/5:17
6.	Distress Mapping - Fifth Floor	FCEL/20 -21/LIC/6:17
7.	Distress Mapping - Sixth Floor	FCEL/20 -21/LIC/7:17
8	Distress Mapping - Terrace Floor	FCEL/20 -21/LIC/8:17
9	Safety Plan	FCEL/20 -21/LIC/9:17
10	Propping Plan - Ground Floor	FCEL/20 -21/LIC/10:17
11	Propping Plan - First Floor	FCEL/20 -21/LIC/11:17
12	Propping Plan - Second Floor	FCEL/20 -21/LIC/12:17
13	Propping Plan - Third Floor	FCEL/20 -21/LIC/13:17
14	Propping Plan - Forth Floor	FCEL/20 -21/LIC/14:17
15	Propping Plan - Fifth Floor	FCEL/20 -21/LIC/15:17
16	Propping Plan - Sixth Floor	FCEL/20 -21/LIC/16:17
17	Propping Plan - Terrace Floor	FCEL/20 -21/LIC/17:17

GENERAL REPAIR METHODOLOGY WITH MATERIAL SPECIFICATION

Objectives of proposed recommendations:

1. To restore the strength decreased with the time
2. To address the Environmental effects
3. To avoid major repairs in future
4. To prevent Leakages, Seepages and Dampness
5. To minimize the cracks in non-structural elements
6. To minimize the Annual maintenance cost

Material selection:



Based on Visual Inspection and Report of VJTI the following parameters for materials were considered besides their compatible properties.

1. Low shrinkage properties
2. Requisite setting / hardening properties
3. Workability Good bond strength with existing sub-strata
4. Compatible coefficient of thermal expansion
5. Compatible mechanical properties
6. Accommodates relative movement
7. Minimum curing
8. Alkaline character

WZO

9. Low water permeability
10. Aesthetics to match with surroundings
11. Cost
12. Durable, non-degradable or non-biodegradable due to various forms of energy like ultra violet rays, heat, etc.
13. Non-hazardous / non-polluting.

RCC Repairs:

To meet the above requirements the materials are selected as per need of the situation.

CATEGORY: CONCRETE REPAIR	
Cement based flow able concrete : Micro-concrete	Single component Cementitious free-flowing micro-concrete. For congested reinforcement situations or repair of complex architectural details. Self-compacting, pump or pour application, shrinkage compensated, high strength, high chloride/carbon dioxide resistance.
Two Part Polymer Modified Mortar	Polymer modified cementitious fiber enriched in-situ repair mortars for vertical / overhead situations.
High Build Fibre Reinforced Thixotropic Mortar	Single component Polymer modified cementitious fiber enriched high-build repair mortars for vertical/overhead situations. Shrinkage compensated, high-build, high chloride/carbon dioxide resistance.
Two Part Epoxy Modified Mortar	Epoxy mortar for high strength repairs for RCC
Styrene-Butadiene Rubber	Single component Bonding and curing agents for repair mortar.
Acrylic Based	Single component Bonding and curing agents for repair mortar
Epoxy Bonding Agent	Bonding agent for repair mortar. for use in critical conditions high stresses.
Zinc Epoxy Primer	Quick-drying two components Anti-corrosion steel primer.
CATEGORY: CONCRETE RE-STRENGTHENING	

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Epoxy Injection Grout	2 part low viscous epoxy resin base injection grout for structural strengthening and structural crackstitching.
Grouting Additive	Non shrinking cement additive for controlled expansion while filling honeycomb and other cavities.
PU Injection Grout	2 part very low viscous PU injection grout material for sealing fine wet cracks
E-glass Fiber Wrap	Improving the strength of concrete by providing passive confinement to the core concrete.
C-Fiber Wrap	Improving the strength of concrete by providing passive confinement to the core concrete.

CATEGORY: CONCRETE
PROTECTION

Surface Protective Coat	High performance protective/decorative coating, Flexible, excellent barrier to carbon-dioxide/ chlorides/ sulphates/ oxygen/ water, high UV resistance, allows release of water pressure.
Galvanic Protection	Inhibitor for stoppage of damage due to shift of anode and cathode.
Corrosion Inhibitor	Prophylactic corrosion protection to steel.

Materials selection is carefully done. Main task before repair of RC members is the adoption of a proper load releasing system from the RCC members under repair. Safety should be the matter of paramount importance. Next general step is the eradication of cause of damage to the RCC i.e. making the concrete in the surrounding of steel metal alkaline. This would be possible by removing the rust product and chiseling out the contaminated concrete. Chloride extraction is possible but the extraction system is cumbersome and expensive; hence, we can adopt easier and cheaper system of Cathodic Protection of Zinc Rich Epoxy Primer Sacrificial Coating in general and Sacrificial Anodic Protection at vital spots in particular. Such protection will push the deterioration countdown period at least 10 years further.

Next major task is to bond the old matured concrete and new repair material. Surface conditioning shall be done mechanically and by rotary brush which will open the micro pores of old concrete matrix and make the same conditioned to receive the new repair material by maintaining the continuity of cement matrix. Depending upon the level of deterioration the repair material shall be selected.

Common repair materials we proposed are Latex Modified Cement Mortar / Concrete, Polymer Fiber Reinforced Thixotropic Mortar, Non-shrink Super Fluid Micro-Concrete, Fiber Wrap. For repair of cold joints and structural cracks in vital RCC member high pressure grouting at 2.0 to 2.5 kg/cm² of solvent free and low viscosity epoxy is proposed.

Repair of Facade

It is required to create a mechanical barrier against the direct hit of environmental agents. It would be harmful if sound and well adhered plaster is forcibly removed. Wherever plaster is de-bonded from the substrate, new plaster treatment is proposed. Also at the locations where RCC treatment demands the removal of plaster, same shall be removed and redone after RCC treatment. The basic aims of plaster, in general, are to give a sturdy protection to the RCC / walls to stop the seepage through the walls and provide a smooth surface for decorative protective coating of paint.

Plastering scheme:

a) Plastering against RCC:

RCC being the vital element in the framed structure, an external cover is required apart from the concrete cover to the embedded reinforcing steel. For proper adhesion of concrete and plaster cement mortar a Latex Modified bonding agent will be applied before plastering. Plaster will be modified by Acrylic Polymer at a very nominal dose of 2.5%. This will eliminate the inherent impurities of mortar like silt content, which could not be removed even after washing of sand.

b) Plaster at Delam Joint:

Delam joints of RCC and masonry are most suspected spot of leakage / dampness / seepage. At such joints a suitable filler material has to be used which can accommodate the thermal movement of two different materials. Also such filler will not allow the regular plaster against the delam joint to develop the cracks in future.

c) Plaster against Masonry:

Wherever the plastering is required to be done in patches, utmost care has to be taken to match the old saturated plaster and new plaster. Filler material should be used after plastering to accommodate the shrinkage movement of interface joint. Also the adhesion of filler material has to be ensured to both old and new plaster.

d) ^{WZ9} **Plaster on Dead Walls:**

There are many dead walls without any opening. The plastering on these dead walls requires a great attention. Due to single continuous height of more than 70feet, the plaster will have a tendency to buckle under its own weight and liable to de-bond from the wall. It is proposed to create RCC false band at every floor.

Waterproofing of Terrace:

For terrace water proofing, Brick-bat coba with mosaic tile or membrane waterproofing shall be carried out.

Plumbing & Drainage

Seeing the age of existing GI pipes for fresh water supply and being the chlorine treated water, the inside damage level will be very high. Rust might have reduced the thickness to a substantial level. It should not be expected that a majority portion of pipes can be saved and reused after cleaning. The drainage and waste water pipes has to be changed from time to time. However; these pipes cannot be saved during retrofitting.

REPAIR SCHEME

After thorough deliberations, the methodology of the rehabilitation work has been finalized. The repair scheme is as follows.

Steps involved in Repairs of Buildings

Step 1: Vacate the building totally or the part thereof eliminating from the routine functions

Step 2: Tapping of RCC members with hammer.

It shall be carried out to identify the distress/damage/deterioration in RCC members not visible to naked eyes.

- a) Tap each of the structural members using single piece small metal hammer.
- b) Mark hollow sound areas as distress portion
- c) Remove plaster / concrete cover and delaminated portion of concrete.

Step 3: Grouting of RCC structural elements:

- a) Slab: cement grout with polymer admixture for non-shrinkage.
- b) Beams and columns: low viscosity epoxy grout.

Step 4: Repair of Columns

- a) Minor repair using Polymer Modified Mortar (PMM)

It is suggested for columns having up to 20% surface exposed and lesser than 10% reduction in diameter of Main Reinforcement and no multiple column stirrups are deteriorated or dislodged.

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Procedure:

- i. Remove distressed surface / loose cover.
 - ii. Apply "RUSTICIDE" to reinforcement and remove scales of corrosion after 24 hours.
 - iii. Ensure removal of "RUSTICIDE" using wire brush / cotton swab.
 - iv. Repeat this procedure again to ensure that all the corroded portion of the reinforcement is removed.
 - v. Apply the RUST PASSIVATOR to the reinforcement.
 - vi. After 24 hours apply bond coat of epoxy and prepare surface for PMM by sprinkling sand on the tacky surface.
 - vii. Use Polymer Modified Mortar as directed by the manufacture to hand-pack the voids in the concrete core / cover.
 - viii. Cure the surface for at least 7 days and finish by plastering.
- b) Filling up pockets of column using micro-concrete.
- c) Major Repair of Columns: It is suggested for columns having more than 20% surface exposed or more than 10% reduction in diameter of Main Reinforcement or multiple column stirrups are deteriorated or dislodged. It shall be done by jacketing columns using conventional RCC / Reinforcement with Micro-concrete cover / Fiber Wrapping with Micro-concrete cover.

Procedure:

- i. Remove distressed surface / loose cover.
- ii. Remove adjoining walls up to 1.0 m in width.
- iii. Provide propping.
- iv. Remove upper slab up to at least 0.60 m extra width.
- v. Excavate up to footing top.
- vi. Apply "RUSTICIDE" to reinforcement and remove scales of corrosion after 24 hours.
- vii. Ensure removal of "RUSTICIDE" using wire brush / cotton swab.
- viii. Repeat this procedure again to ensure that all the corroded portion of the reinforcement is removed.
- ix. Apply the RUST PASSIVATOR to the reinforcement.
- x. Place main reinforcement from top of footing.
- xi. Place shuttering and cast the column.

Step 5: Repair of beams

- a) Minor repair using PMM for beams

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Same procedure as mentioned for columns.

- b) Major repair with micro-concrete (with additional bottom reinforcement and U stirrups- where steel reinforcement is heavily corroded) -

Procedure similar as that for columns

Step 6: Repair of slab

- a) Minor Repair - (Minor spilling up to 40% and reinforcement reduction in diameter lesser than 10% and instant, plaster may de-bond): PMM with epoxy coat with sand sprinkling.
- b) Major - (High vibration / Deflection / Cover Concrete spall more than 40% / Reduction in diameter of rebar more than 10%)

Recasting of Slab Procedure:

- i. Immediately provide concentric propping from ground floor.
- ii. Remove slab using low amplitude, high frequency electric chippers.
- iii. Beam at slab junction to be shaped like wedge.
- iv. Provide shuttering, reinforcement & provide lapping using "HILTI" anchors.
- v. Casting of slab shall be carried out after due checking of design reinforcement, lapping of reinforcement, cover to the reinforcement and the shuttering.

Step 7: Providing External Plaster (in the location where plaster is not done in last 10 years and plaster can be chipped off easily)

Procedure-

- i. Remove plaster using electric chipper.
- ii. Clean surface. If any brick joint is accidentally removed, hand-pack cement mortar in the void, provide proper raking.
- iii. Water the face for at least 3 days, clean the surface and allow it to stand for at least 1 day.
- iv. Provide plaster in two coats; by keeping at least 7 days lag between the two coats.
- v. Cure each plaster coat for at least 7 days.

Step 8: Providing Terrace / Toilet waterproofing:

Procedure-

- i. Remove existing waterproofing using electric chipper ensuring no damage to slab below.
- ii. Clean the surface, provide cement slurry grouting.

WZO

- iii. Cure the surface for at least 3 days.
- iv. Provide a base coat using cement & W.P. (As per mfg."s specs).
- v. Cure for at least 3 days, ensure no water leakage below.
- vi. Provide brick bats in C.M. (waterproofing admixture to be used) in proper slope of 1 in 100.
- vii. Cure for at least 7 days, ensuring no dampness below.
- viii. Finish top by any finishing as per agreement.
- ix. Cure for at least 7 days.

Step 9: Flooring

- i. In the present case where the residential buildings are around 35 years old, it is recommended to remove the old flooring completely (inducing sand bedding).
- ii. It has been observed that old sand bedding for flooring tiles is the most vulnerable areas/spots where termite house and grow.
- iii. In addition to termite protection, the removals of old flooring before laying new flooring will also not induce any additional load of structure.
- iv. Upon removal of tiles the top of slabs will be exposed open and can be repaired required if any.
- v. Electrical lines can be laid in the bedding of new flooring.

Step 10: Pressure Grouting

Pressure grouting involves injecting a grout material into generally isolated pore or void space of which neither the configuration nor volume are known, and is often referred to simply as grouting. The grout may be a cementitious, resinous, or solution chemical mixture.

Surface Preparation:

- 1. Surfaces to be grouted should be clean and free from rust, grease or oil.
- 2. Determine work schedule and method of placing grout, then prepare strong, properly braced and oiled forms to retain the grout and provide relief holes, if needed.
- 3. Saturate the area to be grouted with water until it is uniformly damp and remove excess water just before placing the grout.

Mixing:

1. Consult the particular grout's individual data sheet for the proper amount of mixing water to be mixed with the grout.
2. The mixed grout should be quickly transported to the grout head box and placed immediately.
3. The amount of time the contractor has to place the grout varies from product to product. Consult the particular grout's individual data sheet for the time allotted.
4. Do not add sand or cement to the grout since this may significantly change the grout's characteristics.

Placing:

1. Some grouts set more rapidly than plain mortars, therefore, place quickly and continuously.
2. Fix flexible perforated nipples of 8 to 10 mm. diameter by drilling the holes in concrete to a depth of 100 mm for grouting.
3. Inject the Polymer modified cement slurry or the suitable grout through the nipple as fixed at a pressure not exceeding 2 kg/cm² using grouting pump as directed by the Engineer In-Charge.
4. Sealing the hole by cement Polymer or epoxy as directed by the Engineer In-Charge.
5. Carefully control the water content to be sure excess water is not added forcing the grout to bleed.
6. Place all grout from one side only to assure complete filling of the space being grouted.
7. Use a rod or strapping to assist in placement on large or difficult placements. Use a hopper to provide a constant head of grout and to assure a continuous flow into place.

Curing:

1. As soon as the sheen of water disappears and the grout has begun to stiffen, pond with water or cover with wet rags, burlap or plastic to prevent premature drying. The forms may be removed as soon as the grout has stiffened or set sufficiently to prevent sagging away from the bottom of the base plate. Cut back shoulders and finish to desired texture where required or desired.

WZO Step 11: External Plastering

1. The external plaster shall be applied in two coats and finished with sand face by sponge. Mortar for plaster must be mixed as per specifications using a mechanical mixer. Use a bond coat on surface before plastering if specified so.
2. The existing plaster, if cracked, damaged or de-bonded, the loose and damaged plasters shall be removed carefully by chipping or by light chiselling, and care should be taken not to damage the inside wall surface.
3. Joint between new & existing good plaster, should be tapered at 450 for good bond.
4. If the plaster is to be applied on repaired concrete surface, the same shall be made rough to provide a key to the new plaster. If brickwork is to be plastered, the joints shall be raked out at least 10 mm deep to get a good key effect.
5. The surface to be plastered shall be cleaned of loose dust, thoroughly watered earlier, and kept adequately wet before plastering, A suitable bond coat may be applied before plaster, if specified so.
6. If plaster is carried out in patches, approved bond coat may be applied on wall surface prior to new plaster. The external plaster shall be applied in two coats as per specifications. The first coat applied is 10 to 12mm thick mortar mix (1:4 generally). Water proofing additives & PP fibers can be mixed in 1st coat of mortar mix. The surface shall be even and without any undulations so as to have a second coat of thickness 8 to 10mm roughly. The first coat is roughened to provide a key to the second coat. The 1st coat shall be thoroughly watered and cured for seven days before the second coat is applied.
7. The second coat generally is of mortar mix (1:3) using water proofing additives. W/C ratio should be controlled and mortar applied evenly using a trowel and finished to required granular texture by a sponge. The surface of plaster should be cured for 8 days. Mortar must be prepared in mechanical mixer and used within 20 minutes of mixing.
8. In case of large panels of plaster, it is advisable to introduce "Breaker Bands" at suitable intervals to avoid cracks in plaster.

Step 12: Dash Coat Plaster

Whenever outside face of brick wall is uneven or damaged due to defective construction of wall, there could be local depressions varying even up to 20 to 60mm thickness. In such case a pre-treatment of leveling or filling the depressions by applying additional layer of "dash coat" using (1:3) C.M. 1st coat of plaster may be applied on this leveled surface. It may be necessary to apply a bond coat before dash coat to get a firm grip on brick wall. "P" gravel can be impregnated in dash coat for good grip of 1st coat. Dash coat has to be cured for 3 to 4 days. Measurement of finished plaster shall include all Grooves, Bands, Drip Moulds, and Cornices etc.

Step 13: Internal Plastering

Plaster on internal areas, which are not exposed directly to rain and weather, is applied in one coat and finished smooth. The plastering mix shall be (1:4) and process will be similar to 1st coat of external plaster. This will be finished on surface by 3 mm thick Birla white putty.

Step 14: Brick Work / Block Work:

- a) All bricks shall be immersed in a drum or tank of water till bubbles cease to come up before being used in the work. No broken bricks shall be used, excepted as closure. The course shall be truly horizontal and the work strictly plumb.
- b) Joints shall be broken vertically, and they shall not exceed 10 mm in thickness. The brick work shall not be raised more than 12 courses a day (1.0 m height). Freshly mixed mortar of specified proportion shall be used.
- c) All joints in brickwork shall be properly raked out to 10 mm as the work proceeds. The work shall be well watered three times a day for 8 days and afterwards twice a day for 10 days.
- d) Half brick interior partition walls shall be provided with 12 cm thick R.C. (1:2:4) stiffeners with 2 nos. 8mm Tor bars as reinforcement. R.C.C. stiffeners shall be provided at a spacing of 1m in vertical direction. In case, wall length is more than 3M than vertical R.C.C. stiffeners of same size shall be provided at 1.5 M C/C.

Step 15: Plumbing & Sanitary Piping

1) Plumbing Pipes:-

These are G. I. pipes to class "C" approved by Statutory Municipal Authority for

supply of Drinking water. All joints in the water lines shall be screw joints and made leak proof by use of proper plumber's putty. All fittings, bends, T's & valves should conform to relevant I. S. standards and shall be of approved quality. The G. I. piping should be hydraulically tested for safe working without leakages. Pipes should be properly clamped on G. I. Brackets.

2) Sanitary Pipes:-

Sanitary pipes and fittings should conform to relevant I.S. standard specifications for PVC /C. I. piping, wherever specified. All sanitary piping should be smoke tested for any leakage at joints. All joints should be sealed by Plumbers Putty. Sanitary pipe Fittings & Accessories shall be as per standard practice. The vertical pipes should be properly clamped on G.I. brackets to wall surface. Proper vent lines, Anti-syphon lines, Gully traps etc. should be provided as per statutory by-laws. Rain water outlets should be connected from Roof / Terrace Levels through G.I. jail and drop on to plinth. Note : Measurement should be on laid length on running meter basis.

Step 16: Painting

A. Exterior Painting:-

Exterior surface to be painted shall be level, clean, washed & free from any Dust, cracks, or Algae. Paint is classified in following 3 categories:-

(i) Cement Paint:-

These are cement based paints and are applied in 3 coats. A base coat of primer should be applied on moist surface. Primer coat shall be mixed in (1:2) (Powder:Water) proportion. After the primer coat the surface shall be applied with 2 coats of (1:1) paint. Painted surfaces shall be cured for a week.

(ii) Acrylic Emulsion Paint:

Surface cleaning process shall be similar as in (i) above. A primer coat shall be applied as specified. After the primer has set in, the surface shall be finished with Acrylic Paint in 2 coats with 10% dilution with water. The paint shall be of reputed, approved manufacturer's produce & shall be guaranteed for 5 years against fading & „water proof“ quality. The film thickness shall not be less than 75 micron.

(iii) Elastomeric Acrylic paint shall be as per reputed manufacturer's specifications & shall be of film thickness not less than 100 micron. These films

shall have stretchable qualities to bridge minor "plaster cracks", if any & paint shall be guaranteed for 8 years against fading waterproofing, etc.

B. Interior Application Paints:-

There are 2 types of interior wall paints:

a. Water Based:-

i. Distempers:-

These can be oil bound or Acrylic distempers.

ii. Plastic Paints:-

These are acrylic emulsion paints. These are washable types.

b. Solvent Based Paints:-

i. Luster Finish:-

These are Non-porous & silky finish paints & are dust free.

ii. Flat Oil Paint:-

These are Non reflective & smooth finish. Procedure for painting will involve

➤ Surface Preparation:-

Dry the surface & clean the dust by sand paper.

➤ Application of putty & primer:-

Fill all pores by putty & make the surface level. Fill all cracks. Primer will be applied for better adhesion.

➤ Application of paint:-

Generally 2 coats are applied with brush or roller. Desired finish & colour may require 3rd coat.

Note: Measurement shall be based on Actual painted area

C. Precautions during Painting Work:

1. Flaking off paint:

Surface should be dry & clean. Putty should be properly covered.

2. Blistering or Swelling of paint:

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If air, moisture or solvent is trapped between the surface & paint film, swelling takes place.

3. Spoiling of paint at some location:

This can happen due to rain water entering through plaster cracks (drying, shrinkage or separations). This can also be due to leaching of calcium hydroxide, (white salts). To avoid this, seal all cracks prior to starting painting.

Detail methodology for repair of Columns:

The following scheme is recommended for the corroded columns. A typical photograph of the damaged column after removal of old concrete is shown in the Fig. 1.

Step 1) Prop the beams on all the sides of the columns. The props shall be capable of taking the total load coming on to the column.

Step 2) For column chip open the cover concrete until all the corroded steel rods are exposed or all the concrete affected by carbonation is removed whichever is deeper. Clean the steel rods with steel wire brush to remove the rust completely.

Step 3) Chip the spalled surface of concrete to remove all loose materials. Then brush it with steel wire brush to remove all loose particles. Wash the surface with potable water.

Step 4) Measure the net diameter of corroded steel bars and assess the net area of steel available using a vernier caliper.

Step 5) The area of steel originally provided can be determined from the drawings / assessed from the physical observation of the rods existing in the columns.

Step 6) Apply coat of anticorrosive coating like manufactured by leading co. and of approved brand to all the existing reinforcements. It shall be ensured that the anticorrosive is applied/ coated all throughout the surface of the rods including all crevices.

Step 7) If the difference between the area of steel originally provided and the measured net area is more than 5 to 10% provide extra steel. The extent of taking the steel below floor level shall be decided at the site depending on the area affected by corrosion. If the steel in the column above the foundation is not corroded and sufficient length (lap length) is available then the extra steel provided can be tied to the existing rods for a length of lap lengths shown in Fig

2. If the existing steel in the column is corroded up to the top of the foundation new bars have to be anchored by drilling holes in the foundation for a length of development length in tension as shown in Fig.3, bonded with the concrete using polymer based epoxy. Anticorrosive coating can be applied to the new longitudinal bars before placing. But to the ties this coating has to be applied after placing in position in order to avoid crack in the coating. New longitudinal bars have to be tied using new column ties as shown in Fig.4, if the additional bars are provided only at the corners and also if the number of new bars is less than 12 numbers with the spacing of the corner bar and adjacent bar less than 75mm. In case more than 12 rods are provided then the ties have to be anchored into the concrete by drilling holes in the concrete and inserting the ends of the ties into the holes as shown in Fig. 5. The depth of drilling shall be such that length of the ties from the centre of new longitudinal bar is 8 times the diameter of tie. The ends of the tie rods are bonded with the concrete using polymer based epoxy grout. The arrangement of fixing the column bars at top is shown in Fig. 5.

Step 8) Leak proof form work which should not deform or leak due to pressure of micro concrete shall be fabricated and erected in position. The form work should be coated with approved mould release agent, prior to the final fixing in position. Proper supporting arrangements are to be made for keeping the shutter in correct line and length.

Step 9) The cover for the longitudinal steel has to be provided just to accommodate the funnel for pouring micro concrete. The funnel for pouring micro concrete is lifted up as the concreting proceeds. The new longitudinal steel can be drilled into the foundation or lapped to the existing steel. It may be noted that lot of local site decision have to be taken depending on the site conditions.



Fig.1. Damaged column a) and b) Before removal of cover concrete and c) After removal of cover concrete

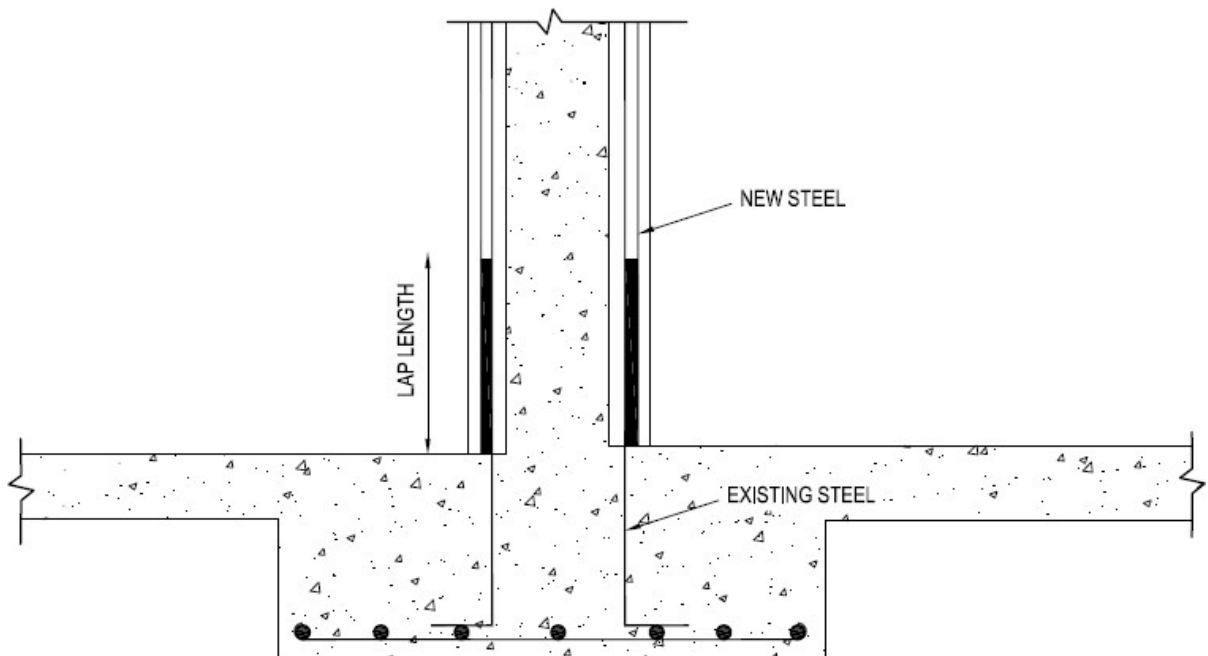


Fig. 2: Tying of the extra steel to the existing rods for a length of lap length

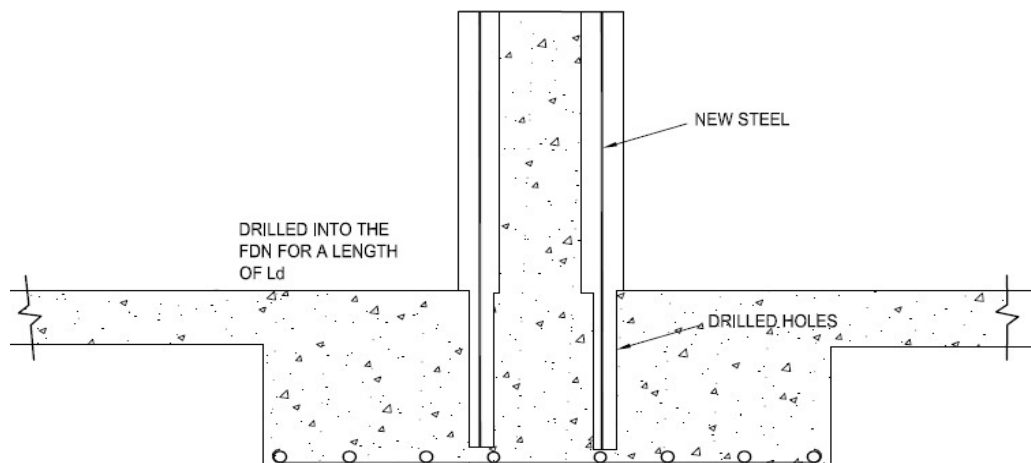


Fig. 3: Anchoring of extra steel by drilling holes in the foundation for a length of development length in tension.

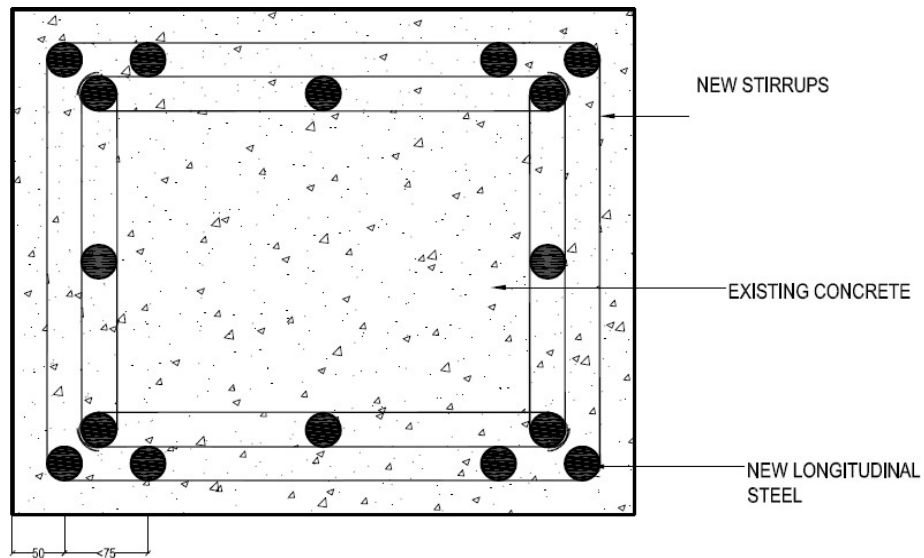


Fig. 4: New column ties in case of number of new bars are less than 12 numbers with the spacing of the corner bar and adjacent bar less than 75mm.

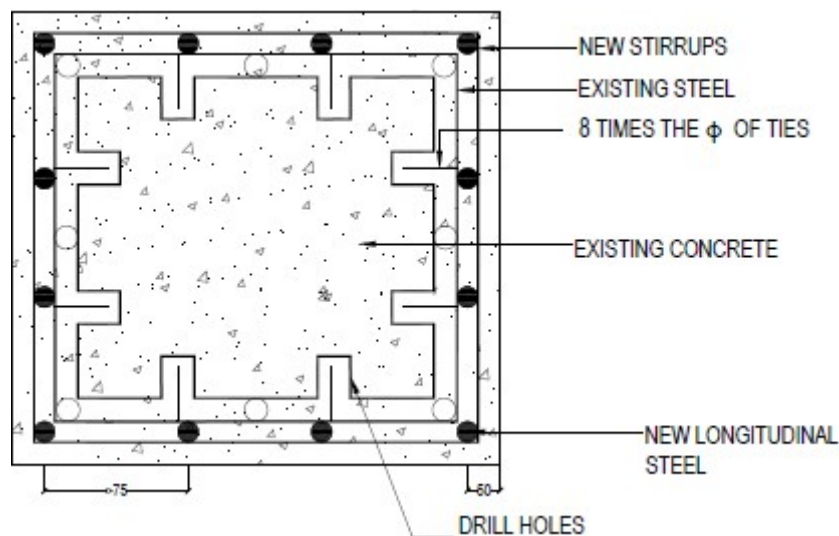


Fig. 5: New column ties with bar anchors in case of Number of new bars is more than 12 numbers

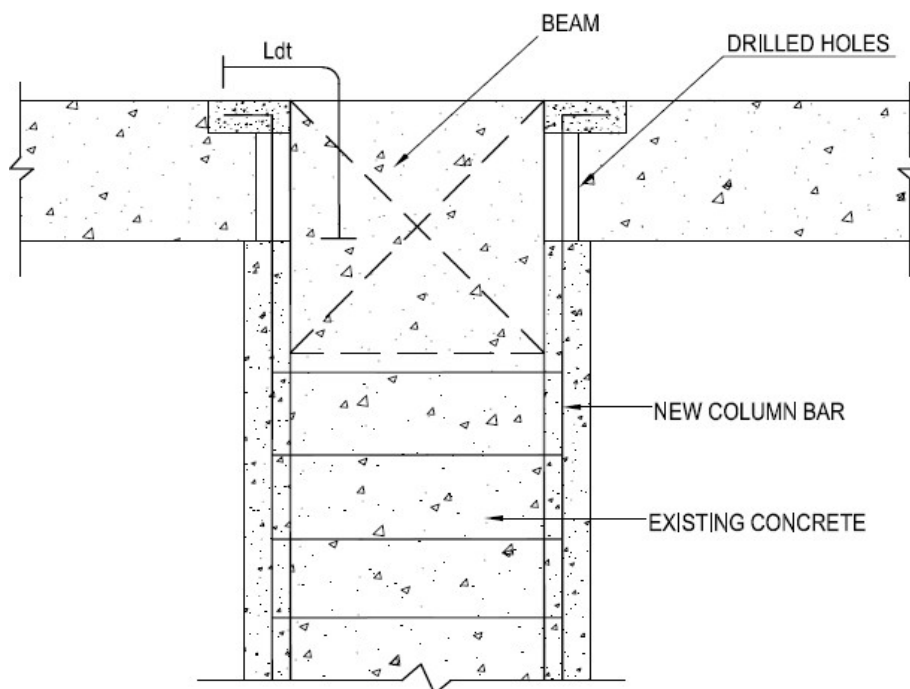


Fig. 6: Arrangement of fixing the column bars at top- discontinuous edge.

Detail methodology for repair of Beams:

The following Fig 7 and 8 depict the damage to some of the beams in the technological structure. The following repair scheme is recommended. The repair scheme is same for all the structures in general. Basic steps involved in the repair of beams are almost the same as that of columns.

Step 1) Prop the slabs with a runner on sides of the beam as shown in Fig. 9 so that even if the beam is removed the slab shall be safe. Steps indicated for columns from (2) to (6) to be followed for beams.

Step 7) If the additional area required is coming to be more than about 5-10% of the original area provided, provide extra steel. Tie the steel to the existing steel as shown in Fig. 9. The details shown in Fig.9 are adopted when the vertical leg of the stirrups is also corroded. In case the longitudinal steel and bottom leg of the ties alone are corroded without much damage to the vertical leg of the stirrups, then the following details shown in Fig.10 are adopted. Ties can be anchored by drilling holes through the slab and bonded with polymer based epoxy grout. Anticorrosive coating can be applied to new longitudinal bars before placing. But to the ties this coating has to be applied after placing in position in order to avoid crack in the coating.

Step 8) Leak proof form work which should not deform or leak due to pressure of micro concrete shall be fabricated and erected in position as shown in Fig, 11. The form work should be coated with approved mould release agent prior to the

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final fixing in position. Proper supporting arrangements are to be made for keeping the shutter in correct line and length.

Step 9) Encasement is done using approved micro concrete, with 50% aggregate (washed / cleaned) by weight of size of 6.4mm and down size. It shall be ensured that clear cover to the new steel is 40mm. The curing has to be done immediately after stripping the formwork with approved curing and bonding agent (1:1 by volume of water) at a coverage of 8-10 sq.m/lt. It may be noted that a lot of local site decision have to be taken depending on the site conditions.

Step 10) Faces of all repaired beams shall be coated with anti-carbonation painting.



Fig: 7 Damaged Beam

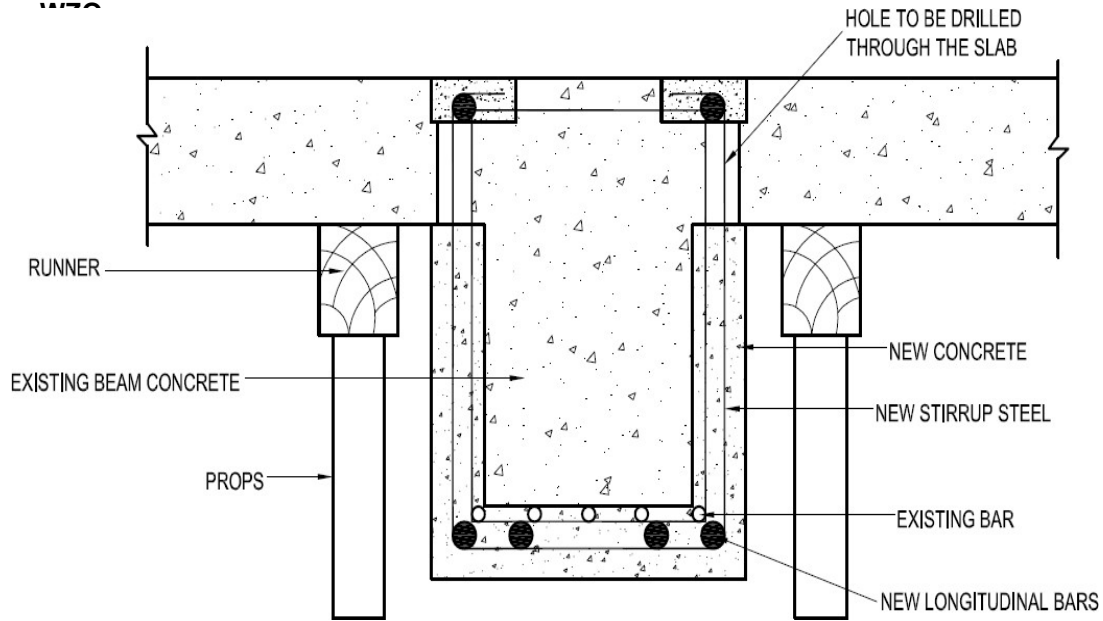


Fig:8 Typical Strengthening of Beam and propping of slabs with a runner on sides of the beam

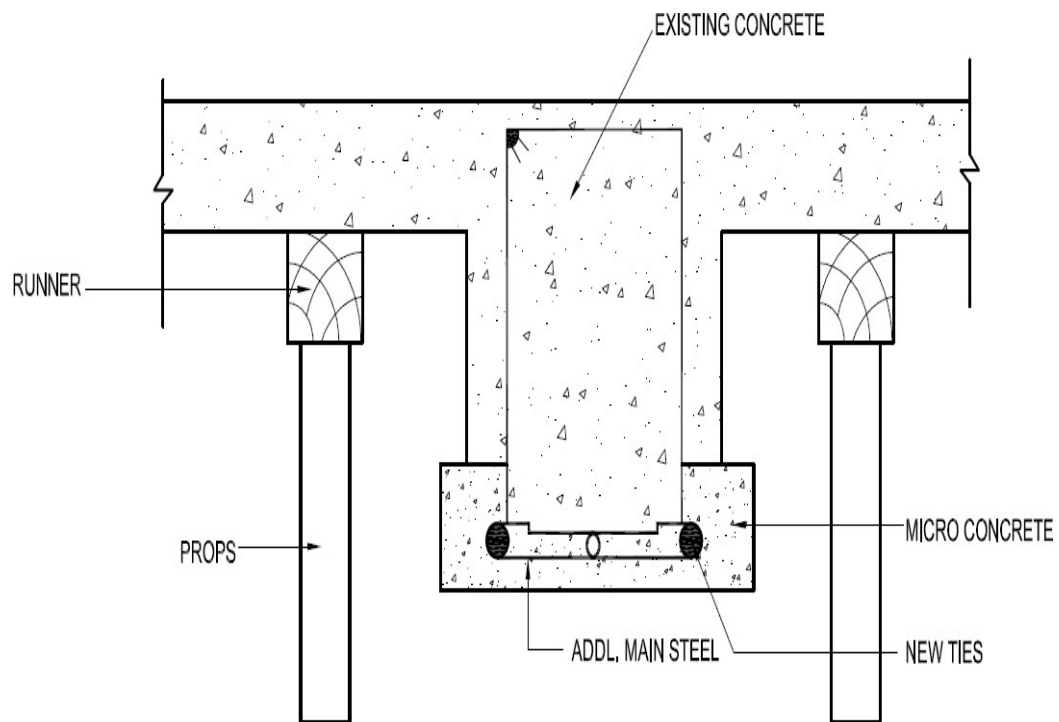


Fig: 9 Alternative Strengthening scheme for Beam

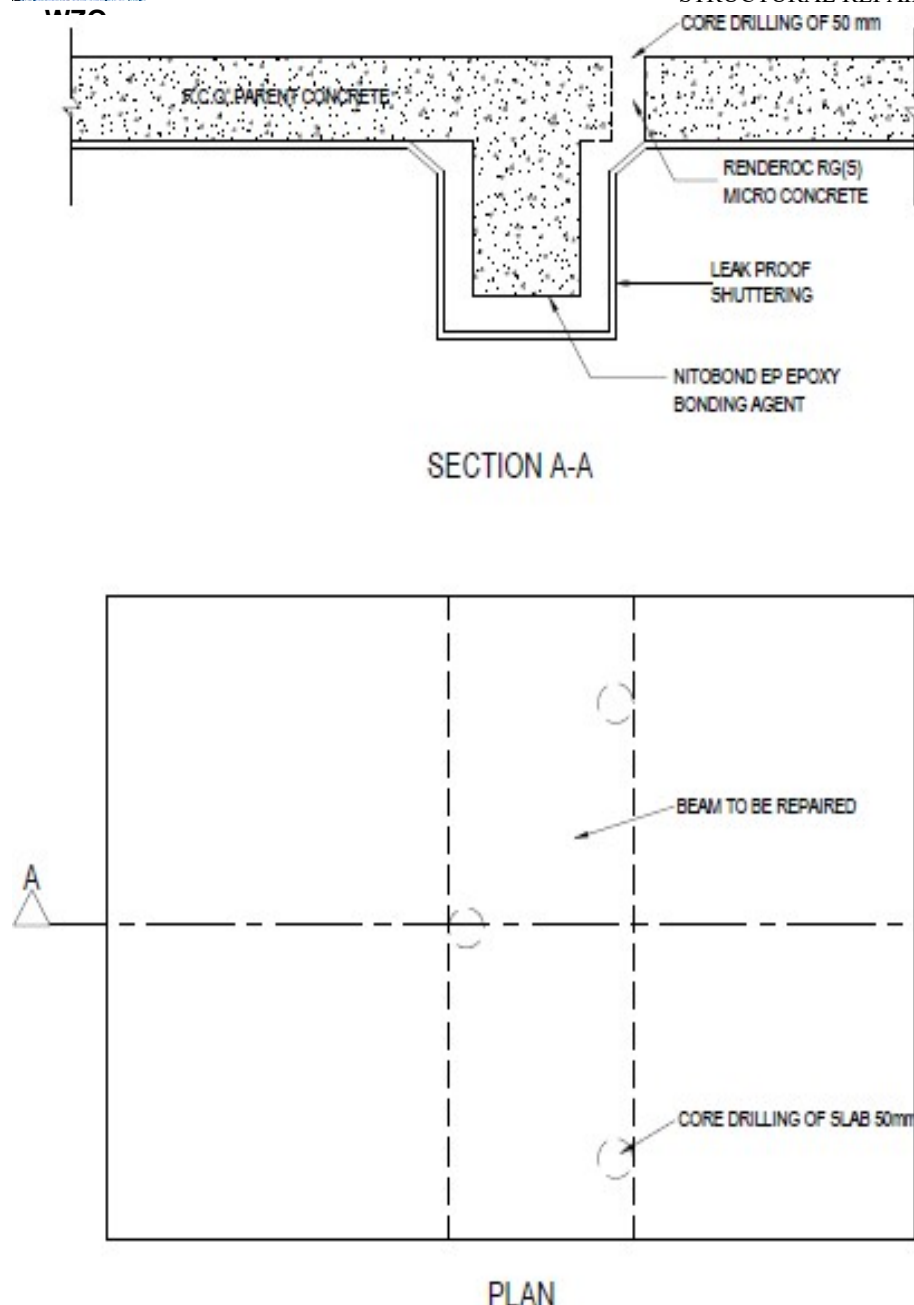


Fig: 10 Scheme for pouring of Micro-concrete for strengthening of Beams.

Detail methodology for repair of Slabs:

The following Fig 12, 13 indicate the damage to some of the slabs in the technological structures. The scheme to repair the slabs is as follows:

Step 1) Prop the slabs at intervals at about 1.5m. Propping at the centre is to be avoided. Steps indicated for Columns (2) to (6) to be followed for slabs.

Step 7) If the difference between the area of steel originally provided and the measured net area is more than 5 to 10% provide extra steel. Additional bars thus introduced are anchored to the beam for a length of $L_{dt}/3$, where L_{dt} is the

development length in tension. These additional bars are bonded to the beam by using polymer based epoxy grout. The details are shown in Fig. 14. Additional steel shall be tied to the existing steel or anchored using anchors drilled into the slab.

Step 8) Leak proof form work which should not deform or leak into the concrete of the slab due to pressure of micro concrete shall be erected in position. The form work should be coated with mould release agent prior to final fixing in position. Proper supporting arrangements are to be made for keeping the shutter in correct line and length.

Step 9) The micro concrete, with 50% aggregate of size 6.4mm and down is poured by funnels by drilling holes of about 50mm $\square$ at about 2m intervals in both directions. It shall be ensured that clear cover to the new steel is 30mm.

Step 10) Apply two coats of a high build solvent free epoxy resin of 500 μ DFT, after all the floor surface are cleaned thoroughly using a concrete cleaning and etching agent. It may be noted that lot of local site decision have to be taken depending on the site conditions. The Fig

(17) indicates the slab after inclusion of new reinforcement: The above procedure has been followed with a meticulous planning and rehabilitation work had been carried out with great care under expert supervision and skilled and specialized workers when the units are in operating condition. However, certain areas, where permit could not be obtained, due to safety of the plant work was carried out during shutdowns. The slabs after repair were intact and looking newly built. Thus, the life is enhanced. The fig. 19 depict the slab after repair.



Fig: 11 Damaged Slab



Fig: 12 Damaged Slab

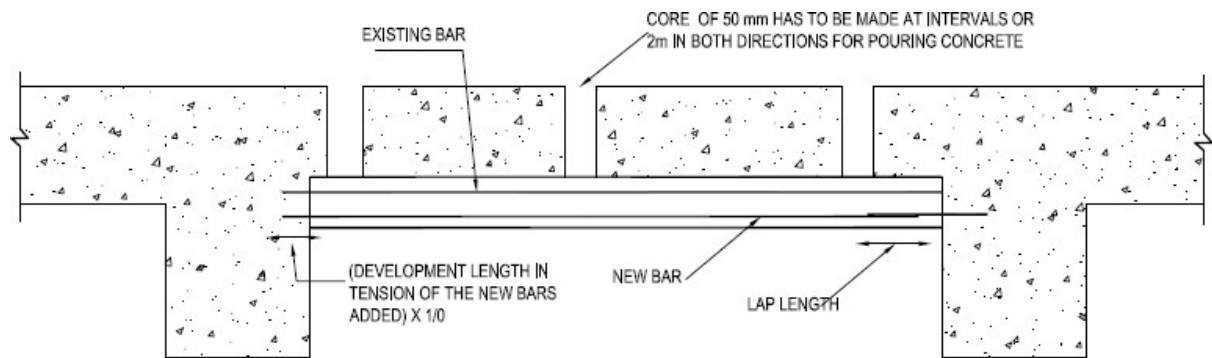


Fig: 13 Typical Strengthening of Slab

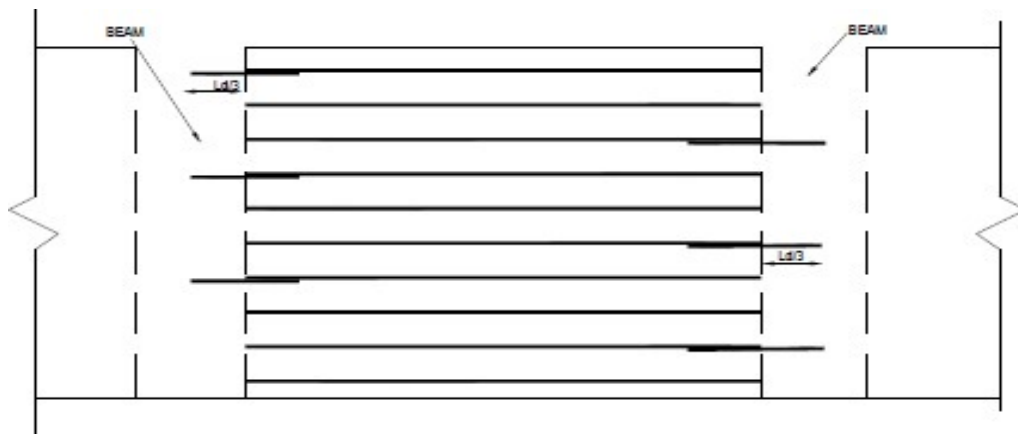


Fig: 14 Arrangement of new reinforcement (bottom) for slab

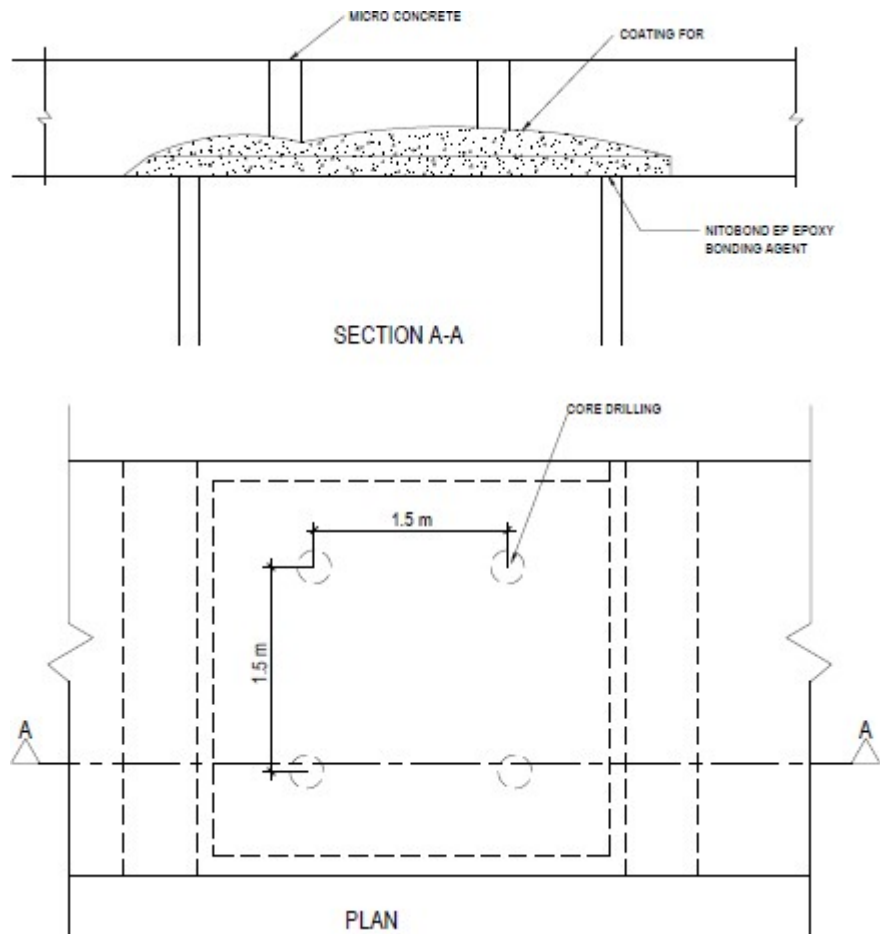


Fig: 15 Typical Strengthening of Slab

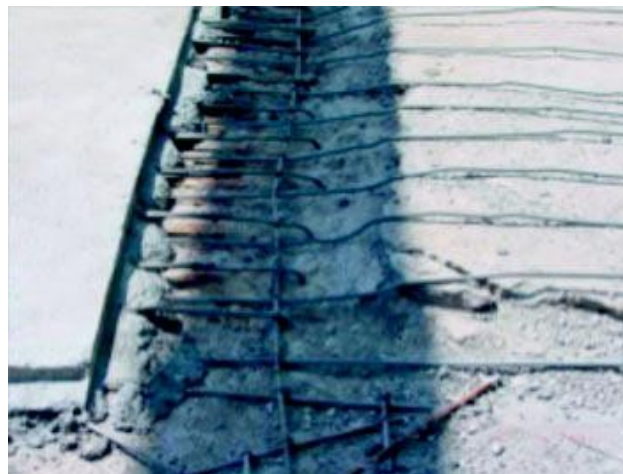


Fig: 16 Photo showing provision of negative reinforcement



Fig: 17 Slab shuttering in position



Fig: 18 Slab view from bottom after rehabilitation

Other...

Galvanic Protection & Monitoring:

There are chances that the fast propagation of damage to the sound RCC may commence immediately after the repair is carried out due to shifting of acidic zone from repaired locations to un-repaired locations. A transitional arrangement is proposed to act as an inhibitor for stoppage of damage in future.

Post Retrofitting Surface Protection:

To improve the longevity of Retrofitting and to prevent the structural elements from deterioration due to rising pollution level and environmental agents like Water Vapor, Chloride Ion, CO₂, CO and other Chemical agents application of Anti-Carbonation Coating is the option being proposed. System includes the application of wax free Acrylic Resin based multi-role sealing, protective primer membrane coat on the finished surface of concrete and plaster followed by application of two coats of Flexible, Elastomeric Coating of Acrylic Co-polymers anti-carbonation coating to form a durable, protective, waterproof membrane. The Anti-carbonation coating will resist Carbonation and prevent Chloride Ion ingress.

Required Properties	Values for Effective Protection
Water Vapor Transmission	45 gms/m ² per 24 hrs
Chloride Ion Diffusivity	4.5x10 ⁻¹⁰ cm ² /s
Chloride Ion ingress reduction	90%
CO ₂ Diffusion	R value @325μ> 160m
Chemical Resistance	Resistant to gasoline, diesel, weak acids & alkalis
Elongation	> 400%
Dried Film Thickness	700 μ compared to normal paints of DFT40 μ

The properties of coating are as follows

- Resistance to water borne chlorides & sulphates.
- Water vapour permeability unaffected & breathing is maintained.
- Penetrative & reactive action.
- Integral protection
- Flexible and stretchable.
- Capable of bridging cracks, especially moving crack

FIELD TESTS FOR MATERIALS USED IN REPAIRS

It is necessary to carry out Field Tests on materials used in „Repair jobs“ to make sure that quality of these materials is of acceptable grade before using these materials in repair work. In case, the quality of material is doubtful, when subjected to these Field Tests then, it is recommended to send these materials for laboratory testing. These doubtful materials should not be used till laboratory test results are available for scrutiny. It will be necessary to preserve the laboratory reports of doubtful materials in records. The supplier should be

instructed to replace these doubtful materials immediately. The list of some major materials& field checks to be carried out on them, on site, for Quality Assurance at site are as follows:

CEMENT

Sr. No.	Check List	Field Checks
1.	Brand name & grade of cement, as marked on manufacturer's certificate & as observed at site.	Manufacturer's certificate has to mention Brand name which should be acceptable and grade should conform to respective I. S. Codes.
2.	Inspection of Packaging Bag	Packing bag should have original factory stitching and should be water tight.
3.	Date of Manufacture	Manufacturer's certificate must specify date of manufacture of cement.
4.	Weight of one Bag	Should be 50 kg (any variation should be noted).
5.	Storage period at distributor's store.	Not more than 2 months after dispatch from factory.
6.	Check for adulteration by heating the dry cement powder.	Sprinkle dry cement on a hot steel plate for 20 minutes – If color changes – it is adulterated
7.	Ball Test	Prepare 2 balls of (cement +little water) and after 2 hrs. immerse them in water for 24 hours, If these Balls break by slight hand pressure then cement is adulterated. Sometimes with minor adulterations Balls may not break & Lab Test will be required to ensure its quality.
8.	Freshness of cement	No lumps should be present in the fine powder.
9.	Fineness of cement	Should be silky & cool to touch when hand is immersed in cement bag.
10.	Floatation Test	Cement powder should float on water when sprinkled over water in a bucket before sinking.
11.	Thick paste to be formed to get a cube mould.	Prepare a paste & make 50mm cube in a plastic mould & cure for 24 Hrs. Cube, when removed, should be strong & should have sharp edges.

SAND

To check the Quality of natural sand and its Silt content, 3 field tests are advised to be carried out at site. They are:

Dip your hand in sand pile. If hand gets dirty and dirt sticks to your hand, then, the sand contains lot of impurities, including high silt content. That sand should be rejected.

If there are "clay balls" in sand, it should be rejected & sent back to supplier.

To determine "silt content" in the sand, following site method can be adopted:-

Volumetric measure of Silt content is easy and more reliable.

- Get one 250 ml clean glass jar at site.
- Fill the cylinder up to 50 ml height with "salt water" (prepared by mixing 1 spoon of salt in 570ml of clear water & stir well).
- Fill sand in the cylinder up to 100mm.
- Again pour "salt water" & bring the level to 150ml.
- Shake the cylinder vigorously with above content without spilling.
- Keep the jar on ground & tap jar from all sides to level the sand inside.
- Wait for 3 hrs. The top layer of „SILT“ is formed clearly in the Glass Jar.
- Measure Vol. of sand & silt & calculate % silt as follows:-.

$$\% \text{SILT (Vol.)} = \frac{\text{Silt' Height in mm} \times 100}{\text{Sand Height in mm}}$$

Limits of Acceptance for the Silt content in the sand are as listed below:-

By volume Silt content should be less than 8%.

By weight Silt content should be less than 3%.

When above limits exceed it is essential to wash the sand.

When to reject sand before unloading at site:-

Measure silt content by simply pouring sand in Glass cylinder (¾ full with water). Silt content is noticed after 10 minutes & if % of Silt is > 20% then reject the sand as it is not advisable to use the supplied material.

Chloride Test in sand sample

- Pour sand in a jar & fill it with water.
- De-cant water in another jar & titrate it with silver nitrate to water.
- Precipitate (AgCl₂) will be seen if chloride is present.

POLYMER

Physical Check at Site

Sr. No.	Checks	Criteria for Doubt on Quality	Remark
1	Manufacturer's container seal	No seal seen	Reject
2	Manufacturer's Label on container with product properties & date of manufacture.	Label Absent	Reject
3	Manufacturer's user Manual	Not Available	Supplier should provide
4	If there is a Layer of Cream floating on surface.	Cream Layer seen	Product could be adulterated Refer to manufacturer
5	Colour of most of the Polymer should be Bluish White	Any other colour	Doubtful Product
6	Keep 200 ml. liquid sample in a Glass Jar for 48 Hrs.	If Powder is seen at bottom of the jar	Doubtful Product

When doubtful observations are made at site the polymer needs Laboratory tests. This is a specialty product, manufactured by chemical companies & the product in company container with all details in a certificate / label on the packing.

There is also a company brochure enclosed by the manufacturer giving all properties of the product & instructions for site use.

Generally, it is difficult to check at site the quality & acceptability of the supplied polymer product. However, a few observation checks can be carried out at site to ascertain whether the product is doubtful. These tests are listed in the check list given above. In case the product is "doubtful" then the sample should be sent to the supplier for chemical tests in their well-equipped laboratory.

It is advisable to wait for chemical test results & their report from the supplier, till that time the doubtful product should not be used at site.

REINFORCEMENT

Following site checks can be carried out to eliminate doubts on material. (Tor - Steel)

Sr. No.	Items to be checked	Check
4.1	Certificate from manufacturer with date	Brand Name of product & grade of steel.
4.2	Embossing on Reinforcement	ISI Mark
4.3	Pitch of Tor Bar	8 to 12 times dia of Bar (Count on Bar)
4.4	Colour	Steel grey & without corrosion scales on outer surface.
4.5	Weight in Kg / M of Reinforcement per meter length.	Standard weight of 1M long sample of Diameter 8mm, 10mm, 12mm, 16mm, 20mm, their weight should be 0.39, 0.62, 0.89, 1.58, 2.47 Kg.
4.6	Variation in Diameter of Bar	Note down variations, if any, and it should be within acceptable limits as specified in IS 1786.
4.7	Bend Test on Bar	Bar should be possible to bend at 90° (Cold Bend) without cracking at the bend.

FORMAT-1

Sr. No.	Check List	Activity	Approved		Remarks
1. Check on Materials (Polymer, additives, chemicals)					
i.	Brand Name	Checked			
ii.	Company Packing should be water Tight with Manufacturer's seal	Checked	Yes	No	
iii.	Manufacturer's user Manual Availability at site	Checked	Yes	No	
iv.	Sample field test on product a) Product sample field test as per specifications. b) Lab test (If necessary)	Checked	Yes	No	
2. Check on Materials (Cement)					
	Brand Name	Checked	Yes	No	
	Company Packing seal and date	Checked	Yes	No	
	Field Test on product sample if required...	Checked	Yes	No	
3. Check on Surface Preparation					
i.	Fixing of adequate steel Props near the repair location	Steel Prop fixing	Yes	No	
ii.	Removal of Damaged R.C.C. portion carefully	Careful removal of damaged concrete	Yes	No	
iii.	Exposed corroded Reinforcement for further Treatment	De – rusted & Passivator coat applied	Yes	No	
iv.	R.C.C. Exposed Surface cleaned & washed for further Treatment	Wire Brushed OR Water jet cleaned	Yes	No	
v.	Additional Reinforcement (if found necessary) is fixed in position using new binding wire.	Additional Reinforcement Cleaned & Passivator coat applied	Yes	No	

vi.	Proper anchoring of additional Reinforcement provided with G.I. hooks	Anchoring of reinforcement	Yes	No	
vii.	Surface Ready for application of PMM	Checked	Yes	No	

Note: Mixing, application and curing shall be in accordance with Manufacturer's usermanual and the consumption shall be cross checked as per the guidelines given.

FORMAT-2 FOR JACKETING WITH MICRO - CONCRETE

Sr. No.	Check List	Activity	Approved	Remarks
1. Check on Materials (Micro – Concrete Powder, grouting material, Polymers, Chemicals etc.)				
i.	Brand Name	Checked	Yes	No
ii.	Company Packing should be water Tight with Manufacturer's seal	Checked	Yes	No
iii.	Manufacturer's user Manual Availability at site	Checked	Yes	No
iv.	Sample field test on product If necessary	Checked	Yes	No
Check on Surface Preparation				
i.	Fixing of adequate steel Props near the repair location	Steel props fixing	Yes	No
ii.	Removal of damaged R.C.C. portion carefully	Removal	Yes	No
iii.	Exposed corroded Reinforcement for treatment	De - rusted & Passivated	Yes	No
iv.	R.C.C. exposed surface, cleaned & washed with water	Wire brushed / Water jet cleaned	Yes	No
v.	Additional reinforcement (if found necessary) is fixed in position using new binding wire.	Reinforcement cleaned & Passivated	Yes	No
vi.	Proper anchoring of additional reinforcement using G.I. hooks	Anchored	Yes	No
vii.	Leak proof shuttering for jacketing is to be provided with proper cover to reinforcement	Shuttering inspected	Yes	No

Note: Mixing, application and curing shall be in accordance with Manufacturer's user manual and the consumption shall be cross checked as per the guidelines given.

FORMAT-3

FOR SAND FACE PLASTER

Sr. No.	Check List	Activity	Approved		Remarks
1. Check on Materials (Cement, water proof additives, PP fibers, Bond coat etc.)					
i.	Brand Name	Checked	Yes	No	
ii.	Company Packing should be water Tight with Manufacturer's seal	Checked	Yes	No	
iii.	Manufacturer's user Manual Availability at site	Checked	Yes	No	
iv.	Sample field test on product If necessary	Checked	Yes	No	
v.	For PP fibers, Dosage in cement in 1st coat (125 gm per Bag)	Checked	Yes	No	
vi.	For SAND Screening at site as specified	Checked	Yes	No	
vii.	Washing machine used for washing sand at site	Checked	Yes	No	
viii.	Field check for SILT Content	Checked	Yes	No	
2. Check on Surface Preparation					
i.	Exposed wall surface to be cleaned by wire / coir brush	Surface Cleaning	Yes	No	
i.	Joints between Brickwork raked carefully.	Joints raked	Yes	No	
ii.	Surface to be sprinkled with water & wetted 6 hrs prior to plaster	Wetting the surface	Yes	No	
iii.	In case of patch plaster edges are to be chamfered for better grip with old plaster	Edges chamfered	Yes	No	
iv.	Dash Coat to be provided in case of uneven Brick wall.(Bond coat to be used, UNO)	Dash Coat provided on a Bond Coat	Yes	No	
3. Mixing			Yes	No	

v.	Mixed in Mechanical Mixer	Checked	Yes	No	
vi.	Mix Proportion as specified (1:4) UNO	Checked	Yes	No	
vii.	Approved additives added as per Dosage (2% UNO)	Checked	Yes	No	
viii.	Water (Potables) to Cement ratio should be about 0.45 (Approx 20 to 22 Lts. Per Bag of cement)	Checked	Yes	No	
4. Application of Plaster					
ix.	coat application (12 to 15 mm thickness) in line and level Use Bond Coat (If Specified)	Checked	Yes	No	
x.	Curing of 1st coat (For 7 days) (3 to 4 times a day)	Checked	Yes	No	
xi.	2nd coat (sponged) of 6 to 8 mm (In line and level)	Checked	Yes	No	
xii.	Curing of 2nd coat (For 10 days, 3-4 times a day)	Checked	Yes	No	
xiii.	Provide a sealer coat of Birla White cement paint on cured surface (mixed with 2 % Acrylic Polymer)	Checked	Yes	No	

FORMAT-4

WATER PROOFING WITH POLYMER MEMBRANE COATING, B. B. COBA &CHINA MOSAIC

Sr. No.	Check List	Activity	Approved		Remarks
1. Breaking and Removal of Existing Coba					
	Careful Breaking and removal by light weight tools without damaging R.C.C. slab.(Coba may be soaked in water for easy removal)	Checked	Yes	No	
2. Surface Preparation					
i.	Cleaning of top exposed R.C.C. surface with Brush / Blower	Checked	Yes	No	
ii.	Repairing R.C.C. slab (PMM Repair & crack grouting)	Checked	Yes	No	

iii.	Leveling of the top surface to get smooth surface for coating with membrane (W.P.)	Checked	Yes	No	
iv.	Rain water pipe outlets secured Temporarily during water proofing &	Checked	Yes	No	
pond Test					
3. Check on Materials (Polymer membrane, Cement, Brick, Sand, China Mosaic etc.)					
i.	Brand Name	Checked	Yes	No	
ii.	Company Packing should be water Tight with Manufacturer's seal	Checked	Yes	No	
iii.	Manufacturer's user Manual Availability at site	Checked	Yes	No	
iv.	Sample field test on product If necessary	Checked	Yes	No	
For SAND					
v.	Screening at site as specified	Checked	Yes	No	
vi.	Washing machine used for washing sand at site	Checked	Yes	No	
vii.	Field check for SILT Content	Checked	Yes	No	
China Mosaic					
viii.	Source	Checked	Yes	No	
ix.	Size & Thickness	Checked	Yes	No	
x.	Colour	Checked	Yes	No	
Brick					
xi.	Well Burnt & hard as per specifications	Checked	Yes	No	
xii.	Immersed in water Drum to check Absorption & should not dissolve in water	Checked	Yes	No	
Cement mortar					
xiii.	Mixed in specified proportion in mixer	Checked	Yes	No	
xiv.	W / C ratio (0.45, UNO)	Checked	Yes	No	
xv.	Transporting & Laying of mortar in place within 20 minutes	Checked	Yes	No	
Brick Bat Coba					
xvi.	Bricks Soaked in water before used	Checked	Yes	No	

xvii.	Pressed in laid cement mortar to slope	Checked	Yes	No	
xviii.	Gaps between bricks half filled with mortar	Checked	Yes	No	
3. Mixing			Yes	No	
i.	Mixed in Mechanical	Checked	Yes	No	
	Mixer				
ii.	Mix Proportion as specified (1:4) UNO	Checked	Yes	No	
iii.	Approved additives added as per Dosage (2% UNO)	Checked	Yes	No	
iv.	Water (Potables) to Cement ratio should be about 0.45 (Approx 20 to 22 Lts. Per Bag of cement)	Checked	Yes	No	
4. Application of Plaster					
i.	coat application (12 to 15 mm thickness) in line and level Use Bond Coat (If Specified)	Checked	Yes	No	
ii.	Curing of 1st coat (For 7 days) (3 to 4 times a day)	Checked	Yes	No	
iii.	2nd coat (sponged) of 6 to 8 mm (In line and level)	Checked	Yes	No	
iv.	Curing of 2nd coat (For 10 days, 3-4 times a day)	Checked	Yes	No	
v.	Provide a sealer coat of Birla White cement paint on cured surface (mixed with 2 % Acrylic Polymer)	Checked	Yes	No	
5. Water Ponding on Coba next day					
vi.	Water ponding with minimum 150 mm head Over B. B. Coba for 4 to 5 days & check for no leakage.	Checked	Yes	No	
6. IPS on levelled surface of Mortar					
vii.	Mix and provide (1:1:2) concrete in concrete mixer in layer about 35mm thick over B. B. Coba in pattern and panels	Checked	Yes	No	
viii.	Curing IPS as per specifications for 4 days	Checked	Yes	No	
ix.	China Mosaic laid as specified (Pressed on Cement Float)	Checked	Yes	No	

x.	Gaps in China Mosaic filled with White Cement & Cleaned	Checked	Yes	No	
xi.	Water cleaning & curing the joints for 3 to 4 days.	Checked	Yes	No	

Note: Mixing, application and curing shall be in accordance with Manufacturer's usermanual and the consumption shall be cross checked as per the guidelines given.

FORMAT-2 FOR JACKETING WITH MICRO - CONCRETE

Sr. No.	Check List	Activity	Approved	Remarks
1. Check on Materials (Micro – Concrete Powder, grouting material, Polymers, Chemicals etc.)				
i.	Brand Name	Checked	Yes	No
ii.	Company Packing should be water Tight with Manufacturer's seal	Checked	Yes	No
iii.	Manufacturer's user Manual Availability at site	Checked	Yes	No
iv.	Sample field test on product If necessary	Checked	Yes	No
Check on Surface Preparation				
i.	Fixing of adequate steel Props near the repair location	Steel props fixing	Yes	No
ii.	Removal of damaged R.C.C. portion carefully	Removal	Yes	No
iii.	Exposed corroded Reinforcement for treatment	De - rusted & Passivated	Yes	No
iv.	R.C.C. exposed surface, cleaned & washed with water	Wire brushed / Water jet ceaned	Yes	No
v.	Additional reinforcement (if found necessary) is fixed in position using new binding wire.	Reinforcement cleaned & Passivated	Yes	No
vi.	Proper anchoring of additional reinforcement using G.I. hooks	Anchored	Yes	No
vii.	Leak proof shuttering for jacketing is to be provided with proper cover to reinforcement	Shuttering inspected	Yes	No

Note: Mixing, application and curing shall be in accordance with Manufacturer's user manualand the consumption shall be cross checked as per the guidelines given.

FORMAT-3

FOR SAND FACE PLASTER

Sr. No.	Check List	Activity	Approved		Remarks
1. Check on Materials (Cement, water proof additives, PP fibres, Bond coat etc.)					
i.	Brand Name	Checked	Yes	No	
ii.	Company Packing should be water Tight with Manufacturer's seal	Checked	Yes	No	
iii.	Manufacturer's user Manual Availability at site	Checked	Yes	No	
iv.	Sample field test on product If necessary	Checked	Yes	No	
v.	For PP fibers, Dosage in cement in 1st coat (125 gm per Bag)	Checked	Yes	No	
vi.	For SAND Screening at site as specified	Checked	Yes	No	
vii.	Washing machine used for washing sand at site	Checked	Yes	No	
viii.	Field check for SILT Content	Checked	Yes	No	
2. Check on Surface Preparation					
i.	Exposed wall surface to be cleaned by wire / coir brush	Surface Cleaning	Yes	No	
i.	Joints between Brickwork raked carefully.	Joints raked	Yes	No	
ii.	Surface to be sprinkled with water & wetted 6 hrs prior to plaster	Wetting the surface	Yes	No	
iii.	In case of patch plaster edges are to be chamfered for better grip with old plaster	Edges chamfered	Yes	No	
iv.	Dash Coat to be provided in case of uneven Brick wall.(Bond coat to be used, UNO)	Dash Coat provided on a Bond Coat	Yes	No	
3. Mixing			Yes	No	
v.	Mixed in Mechanical Mixer	Checked	Yes	No	

vi.	Mix Proportion as specified (1:4) UNO	Checked	Yes	No	
vii.	Approved additives added as per Dosage (2% UNO)	Checked	Yes	No	
viii.	Water (Potables) to Cement ratio should be about 0.45 (Approx 20 to 22 Lts. Per Bag of cement)	Checked	Yes	No	
4. Application of Plaster					
ix.	coat application (12 to 15 mm thickness) in line and level Use Bond Coat (If Specified)	Checked	Yes	No	
x.	Curing of 1st coat (For 7 days) (3 to 4 times a day)	Checked	Yes	No	
xi.	2nd coat (sponged) of 6 to 8 mm (In line and level)	Checked	Yes	No	
xii.	Curing of 2nd coat (For 10 days, 3-4 times a day)	Checked	Yes	No	
xiii.	Provide a sealer coat of Birla White cement paint on cured surface (mixed with 2 % Acrylic Polymer)	Checked	Yes	No	

FORMAT-4

WATER PROOFING WITH POLYMER MEMBRANE COATING, B. B. COBA & CHINA MOSAIC

Sr. No.	Check List	Activity	Approved		Remarks
1. Breaking and Removal of Existing Coba					
	Careful Breaking and removal by light weight tools without damaging R.C.C. slab.(Coba may be soaked in water for easy removal)	Checked	Yes	No	
2. Surface Preparation					
i.	Cleaning of top exposed R.C.C. surface with Brush / Blower	Checked	Yes	No	
ii.	Repairing R.C.C. slab (PMM Repair & crack grouting)	Checked	Yes	No	
iii.	Leveling of the top surface to get smooth surface for coating with membrane (W.P.)	Checked	Yes	No	

iv.	Rain water pipe outlets secured Temporarily during water proofing &	Checked	Yes	No	
	pond Test				
3. Check on Materials (Polymer membrane, Cement, Brick, Sand, China Mosaic etc.)					
i.	Brand Name	Checked	Yes	No	
ii.	Company Packing should be water Tight with Manufacturer's seal	Checked	Yes	No	
iii.	Manufacturer's user Manual Availability at site	Checked	Yes	No	
iv.	Sample field test on product If necessary	Checked	Yes	No	
For SAND					
v.	Screening at site as specified	Checked	Yes	No	
vi.	Washing machine used for washing sand at site	Checked	Yes	No	
vii.	Field check for SILT Content	Checked	Yes	No	
China Mosaic					
viii.	Source	Checked	Yes	No	
ix.	Size & Thickness	Checked	Yes	No	
x.	Colour	Checked	Yes	No	
Brick					
xi.	Well Burnt & hard as per specifications	Checked	Yes	No	
xii.	Immersed in water Drum to check Absorption & should not dissolve in water	Checked	Yes	No	
Cement mortar					
xiii.	Mixed in specified proportion in mixer	Checked	Yes	No	
xiv.	W / C ratio (0.45,UNO)	Checked	Yes	No	
xv.	Transporting & Laying of mortar in place within 20 minutes	Checked	Yes	No	
Brick Bat Coba					
xvi.	Bricks Soaked in water before used	Checked	Yes	No	
xvii.	Pressed in laid cement mortar to slope	Checked	Yes	No	
xviii.	Gaps between bricks half filled with mortar	Checked	Yes	No	

3. Mixing			Yes	No	
i.	Mixed in Mechanical	Checked	Yes	No	
	Mixer				
ii.	Mix Proportion as specified (1:4) UNO	Checked	Yes	No	
iii.	Approved additives added as per Dosage (2% UNO)	Checked	Yes	No	
iv.	Water (Potables) to Cement ratio should be about 0.45 (Approx 20 to 22 Lts. Per Bag of cement)	Checked	Yes	No	
4. Application of Plaster					
i.	coat application (12 to 15 mm thickness) in line and level Use Bond Coat (If Specified)	Checked	Yes	No	
ii.	Curing of 1st coat (For 7 days) (3 to 4 times a day)	Checked	Yes	No	
iii.	2nd coat (sponged) of 6 to 8 mm (In line and level)	Checked	Yes	No	
iv.	Curing of 2nd coat (For 10 days, 3-4 times a day)	Checked	Yes	No	
v.	Provide a sealer coat of Birla White cement paint on cured surface (mixed with 2 % Acrylic Polymer)	Checked	Yes	No	
5. Water Ponding on Coba next day					
vi.	Water ponding with minimum 150 mm head Over B. B. Coba for 4 to 5 days & check for no leakage.	Checked	Yes	No	
6. IPS on levelled surface of Mortar					
vii.	Mix and provide (1:1:2) concrete in concrete mixer in layer about 35mm thick over B. B. Coba in pattern and panels	Checked	Yes	No	
viii.	Curing IPS as per specifications for 4 days	Checked	Yes	No	
ix.	China Mosaic laid as specified (Pressed on Cement Float)	Checked	Yes	No	
x.	Gaps in China Mosaic filled with White Cement & Cleaned	Checked	Yes	No	
xi.	Water cleaning & curing the joints for 3 to 4 days.	Checked	Yes	No	

General Recommendations

1. Water supply, sanitary & drainage pipes needs to be replaced during repair with proper clamping arrangement to avoid leakages and to stop further deterioration of structural member.
2. Vegetation growth should be removed every year after rainy season.
3. Carbonated (internal & external) plaster should be removed & re-plastered.
4. Distress columns, beams & slabs should be repaired using ready mix polymer modified mortar (PMM), micro concrete, petty/patch work shall be avoided.
5. Acrylic/Elastomeric painting should be use for painting internal/external faces, watertank etc.
6. Damaged/broken plumbing joints should be maintained/replaced to avoid vegetation growth and dampness on brick masonry walls

Phasing-out priority wise repair/retrofitting measures:

1. Repairs of Structural Frame (Columns, Peripheral Beams, internal beams, Slabs, RCC pardi and chajjas).
2. Grouting & waterproofing treatment for leakages, seepages and pores members with honeycombing.
3. Repair/re-fixing/replacement of plumbing & drainage system.
4. Repair of non-structural walls & allied civil work
5. Interior work.

Safety Code

- A) Scaffolds:-** Suitable **STEEL** scaffolds shall be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration work which can be done safely from ladders. When a ladder is used, it shall be of rigid construction made either of good quality wood or steel. The steps shall have a minimum width of 450 mm. and maximum rise of 300 mm. Suitable hand and holds of good quality wood or steel shall be provided and ladder shall be given an inclination not steeper than $\frac{1}{4}$ to 1 ($\frac{1}{4}$ Horizontal and 1 Vertical).
- B)** Scaffolding or staging more than 4 m. above the ground floor swung or suspended from an overhead support or erected with stationery support shall have a guard rail properly bolted, braced or otherwise secured at least 1 m. above the floor or platform of such scaffolding or

- WZO** staging and extending along the entire length of the outside and ends thereof with only openings as may be necessary for the delivery of materials, such scaffoldings or staging shall be so fastened as to prevent it from swaying from the building or structure.
- C) Working platforms, gangways and stairway shall be so constructed that they do not sag unduly or unequally and if the height of platform, gangway or stairway is more than 4 m. above ground level or floor level, they shall be closely boarded and shall have adequate width and suitably fenced as described above.
- D) Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 1 m. Wherever there are open excavations in ground they shall be fenced off by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.
- E) Safe means of access shall be provided to all working places. Every ladder shall be secured fixed. No portable single ladder shall be over 9 m. in length while the width than 290 mm. for ladder up to and including 3 m. in length. For longer ladder this width shall be increased at least 20 mm. for each additional meter of length.
- F) A sketch of ladder and scaffolding proposed to be used shall be prepared and approval of Engineer-in-charge obtained prior to starting the work.

Other Safety Measures:

1. All personnel of the Contractor working within the site shall be provided with safety helmets & personnel climbing on scaffolding must be provided with safety belts. All welders shall wear welding goggles while doing welding work and all metal workers shall be provided with safety gloves. Persons employed on metal cutting and grinding shall wear safety glasses.
2. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the site of the work shall be so stacked or placed to cause danger or Inconvenience to any person or the public.
3. The Contractor shall take all measures on the site of the work to protect the Public from accidents and shall be bound to bear the expenses of defense of every suit, action or other proceedings at Law that may be brought by any persons for injury sustained owing to neglect of the above precautions and to pay any such person or which may with consent of the Contractor, be paid to compromise any claim by any such person 83.

Demolition:

1. Before any demolition work is commenced and also during the process of the work :-

- a) All roads and open areas adjacent to the work site shall either be closed or suitably protected.
- b) No electric cable or apparatus which is liable to be a source of danger over a cable or apparatus used by the operator shall remain electrically charged.
- c) All practical steps shall be taken to prevent danger to persons employed from the risk or explosion or flooding. No floor roof or other part of the building shall so over loaded with the debris or materials as to render it unsafe.

Material Specification**❖ ANTI-TERMITE TREATMENT TO THE PERIPHERY OF THE EXISTING BUILDING**

GENERAL:- The item pertains to providing anti-termite treatment around the periphery of the existing building as per provision in IS:6313 (Part-III).

❖ TREATMENT AROUND THE PERIPHERY OF THE EXISTING BUILDING:-

The soil in contact with the external wall of the building shall be treated with chemical emulsion at the rate of 2.25 Lit. per meter length of the sub-structure to a depth of 300 mm. To facilitate this treatment a shallow trench of 20 mm shall be excavated along and close to the wall face. The chemical emulsion shall be directed towards the wall at 1.75 Lit. per running meter of the channel. Roding with 12 mm diameter mild steel rods a 150 mm apart shall be done in the channel, if necessary, for uniform dispersion of the chemical to 300 mm depth from the ground level. The balance chemical of 0.5 Lit. per running meter shall then be used to treat the backfill earth as it is returned to the channel directing the spray towards the wall surface.

If there is a concrete to masonry apron around the building, approximately 20 mm diameter holes shall be drilled as close as possible to the plinth wall about 300 mm apart, deep enough to reach the soil below and the chemical emulsion pumped into these holes to soak the soil below at the rate of 2.25 Lit. per linear meter.

In case of RCC framed structures, the soil (backfill) in contact with the column sides and plinth beams along the external perimeter of the building shall be treated with chemical emulsion at the rate of 7.5 Lit./sq m. of the vertical surface of the structure. To facilitate this treatment, trenches shall be excavated equal to the width of the shovel exposing the sides of the column and plinth beams up to a depth of 300 mm or up to the plinth beams, if this level is less than 300 mm. The chemical emulsion shall be sprayed on the backfill earth as is returned into the trench direction the spray again the concrete surface of the beam as the case may be.

I. TREATMENT OF VOIDS IN MASONRY:-

The movement of termites through the masonry wall may be arrested by drilling holes in masonry work at plinth level and squirting chemical emulsions into the holes to soak the masonry. The holes shall be drilled at angle of 45° from the both sides of the plinth wall at 1000 mm intervals and emulsion squirted through the holes to soak the masonry using a hand operated pump. This treatment shall also be extended to internal walls having foundations in the soil. Holes shall also be drilled at wall corners and where door and window frames are embedded in the masonry or floor at ground. Emulsion shall be squirted throughout the holes till saturation or to a maximum of one Lit. per hole. Care shall be taken to seal the holes after the treatment.

II. ITEM TO INCLUDE:-

The item includes providing all labour, material, tools & equipments etc. for anti-termite treatment around the periphery of the existing building. Item also includes all precautions while dealing with the poisonous chemicals. The two years service guarantee in writing supplemented by a separate and unilateral guarantee from the specialized agency is also covered in the item.

III. MEASUREMENT:

All measurements shall be number of holes drilled and treated as per the specifications.

❖ ANTI-TERMITE TREATMENT TO SIDES OF THE FLOORING OF THE EXISTING BUILDING

I. TREATMENT OF SOIL UNDER FLOORS:-

Chemical treatment shall be done by drilling or punching 6 mm holes near the junction of floor and walls along the cracks of the floor if any and at the interval of 30 cm to reach the soil below. Chemical chlordane emulsion shall be squirted into these holes using a hand operated pressure pump to soak the soil below up to a 50 ml per hole. The holes shall then be sealed proper with cement mortar 1:2 (1 cement: 2 coarse sand) finished to match the existing floors. The cement mortar applied shall be cured for at least 10 days per instruction of Engineer-in-Charge.

II. ITEM TO INCLUDE:-

The item includes providing all labour, material, tools & equipments etc. for anti-termite treatment of soils under the floor. Item also includes all precautions while dealing with the poisonous chemicals. The two years service guarantee in writing supplemented by a separate and unilateral guarantee from the specialized agency is also covered in the item.

III. MEASUREMENT:-

All measurements shall be perimeter in meter of the building treated as per the specifications.

❖ TREATMENT OF JUNCTION OF WALL AND THE FLOOR

To achieve continuity of the vertical chemical barrier on inner wall surfaces from the ground level, a small channel 30 x 30 mm shall be made at all the

junctions of walls and columns with the floor (before laying the sub-grade) and rod holes made in the channel up to ground level 150 mm apart and the chemical emulsion poured along the channel @ 7.5 liters per m² of the vertical wall or column surface so as to soak the soil right to bottom. The soil shall be tamped back into place after this operation.

❖ CEMENT PLASTERING WORK

I. MATERIALS:-

The proportions of the cement mortar for plastering shall be 1:4 (one part of cement to four parts of sand) unless otherwise specified under the respective item of work. Cement and sand shall be mixed thoroughly in dry condition and then water added to obtain a workable consistency. The quality of water and cement shall be as per relevant IS. The quality and grading of sand for plastering shall conform to IS:1542. The mixing shall be done thoroughly in a mechanical mixer unless hand mixing is specifically permitted by the Engineer-in-charge. If so desired by the Engineer-in-charge, sand shall be screened and washed to meet the specification requirements. The mortar thus mixed shall be used as soon as possible preferably within 30 minutes from the time water is added to cement. In case the mortar has stiffened due to evaporation of water this may be re-tempered by adding water as required to restore consistency but this will be permitted only up to 30 minutes from the time of initial mixing of water to cement. Any mortar which is partially set shall be rejected and removed forthwith from the site **at no extra cost**. Droppings of plaster shall not be re-used under any circumstances.

II. INTERIOR PLAIN FACED PLASTER:-

This plaster shall be laid in a single coat of 12mm thickness unless otherwise specified in the respective item. The mortar shall be dashed against the prepared surface with a trowel. The dashing of the coat shall be done using a strong whipping motion at right angles to the face of the wall or it may be applied with a plaster machine. The coat shall be trowelled hard and tight forcing it to surface depressions to obtain a permanent bond and finished to smooth surface. Interior plaster shall also be carried out on jambs, lintel and sill faces, etc. as shown in the drawing and as directed by the Engineer-in-charge. Rate quoted for plaster work shall be deemed to include for plastering of all these surfaces.

III. PLAIN FACED CEILING PLASTER:-

This plaster shall be applied in a single coat of 6mm thickness unless otherwise specified in the respective item. Application of mortar shall be as stipulated in clause 3.2.4.

Interior plain faced plaster 20mm thick if specified for uneven faces of brick walls or for random/coursed rubble masonry walls shall be executed in 2 coats similar to the procedure stipulated in clause 3.2.6.

IV. EXTERIOR PLAIN FACED PLASTER:-

This plaster shall be applied in 2 coats. The first coat or the rendering coat shall be approximately 14 mm thick. The rendering coat shall be applied as stipulated in clause 3.2.4 except finishing it to a true and even surface and then lightly roughened by cross scratch line to provide bond for the finishing coat. Each coat shall be kept damp continuously for at least two days. The

second coat or finishing coat shall be 6 mm thick. Before application of the second coat, the rendering coat shall be evenly damped. The second coat shall be applied from top to bottom in one operation without joints and shall be finished leaving an even and uniform surface. The mortar proportions for the coats shall be as specified in the respective item of work. The finished plastering work shall be cured for at least 7 days.

V. EXTERIOR SAND FACED PLASTER:-

This plaster shall be applied in 2 coats. The first coat shall be 14mm thick and the second coat shall be 6mm thick. These coats shall be applied as stipulated in clause 3.2.6. However, only approved quality sand shall be used for the second coat and for the finishing work. Sand for the finishing work shall be coarse and of even size and shall be dashed against the surface and sponged. The mortar proportions for the first and second coats shall be as specified in the respective items of work. 3.2.9. Wherever more than 20mm thick.

Wherever more than 20mm thick plaster has been specified, which is intended for purposes of providing beading, bands, etc. this work shall be carried out in two or three coats as directed by the Engineer-in-charge duly satisfying the requirements of curing each coat (rendering/floating) for a minimum period of 2 days and curing the finished work for at least 7 days.

For external plaster, the plastering operations shall be commenced from the top floor and carried downwards. For internal plaster, the plastering operations for the walls shall commence at the top and carried downwards. Plastering shall be carried out to the full length of the wall or to natural breaking points like doors/windows etc. Ceiling plaster shall be completed first before commencing wall plastering.

Double scaffolding having two sets of vertical supports shall be provided to facilitate execution of the masonry works. The scaffolding shall be designed adequately considering all the dead, live and possible impact loads to ensure safety of the workmen, in accordance with the requirements stipulated in IS:2750 and IS:3696 (Part 1). Scaffolding shall be properly maintained during the entire period of construction. Single scaffolding shall not be used on important works and will be permitted only in certain cases as decided by the Engineer-in-charge. Where single scaffolding is adopted, only minimum number of holes, by omitting a header shall be left in the masonry for supporting horizontal scaffolding poles. All holes in the masonry shall be carefully made good by plastering.

The finished plaster surface shall not show any deviation more than 3.2mm when checked with a straight edge of 2m length placed against the surface.

To overcome the possibility of development of cracks in the plastering work, following measures shall be adapted.

Plastering work shall be deferred as much as possible so that fairly complete drying shrinkage in concrete and masonry works takes place.

Steel wire fabric shall be provided at the junction of brick/block masonry and concrete to overcome reasonably the differential drying shrinkage/thermal movement. This steel item shall be measured and paid for separately.

Ceiling plaster shall be done, with a trowel cut at its junction with wall plaster. Similarly trowel cut shall be adopted between adjacent surfaces where discontinuity of the background exists.

IV. MEASUREMENTS:-

Measurement for plastering work shall be in square meter correct to two places of decimal. Unless a separate item is provided for grooves, moldings, etc., these works are deemed to be included in the unit rates quoted for plastering work. The quantity of work to be paid for under these items shall be calculated by taking the projected surface of the areas plastered after making necessary deductions for openings for doors, windows, fan openings etc as per latest issue of IS 1200-1976 (part 12). The actual plaster work carried out on jambs /sills of windows, openings, etc. shall be measured for payment.

❖ PAINTING WORK

❖ MATERIALS

Oil bound distemper shall conform to IS: 428. The primer shall be alkali resistant primer of the same manufacture as that of the distemper. Cement paint shall conform to IS: 5410. The primer shall be a thinned coat of cement paint. Acrylic emulsion paint shall be of an approved manufacture. Plastic emulsion paint shall conform to IS: 5411. Lead free acid, alkali and chlorine resisting paint shall conform to IS: 9862. All the materials shall be of the best quality from an approved manufacturer. CONTRACTOR shall obtain prior approval of the ENGINEER for the brand of manufacture and the colour / shade. All materials shall be brought to the site of works in sealed containers.

Paints, oils varnishes etc. of approved brand and manufacture shall be used. Ready Mixed paints as recovered from the manufacturer without any admixture shall be used.

If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the Engineer-in-charge shall be used. Approved paints, oils or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The materials shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnights work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-charge. The empties shall not be removed from the site for work, till the relevant item of work has been completed and permission obtained from the Engineer-in-charge.

The contractor shall associate the chemist of paint manufacturers before commencement of work, during and after the completion of work who shall certify the suitability of the surface to receive painting and the paint before use etc.

❖ COMMENCING WORK

I. SCAFFOLDING:-

Wherever scaffolding is necessary, it shall be erected on double supports ties together by horizontal pieces, over which scaffolding planks shall be fixed. No bellies, bamboos or planks shall rest on or touch the surface which is being painted. Where ladders are used, pieces of old gunny bags shall be ties on their tops to avoid damage or scratches to walls. For painting of the ceiling, proper stage scaffolding shall be erected. Painting shall not be started until and unless the Engineer-in-charge has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work. Painting, except the priming coat,

shall generally be taken in hand after all other builders work, practically finished. The rooms should be thoroughly swept out entire building cleaned up at least one day in advance of the paint work being started.

II. PREPERATION OF SURFACE:-

CONTRACTOR shall obtain the approval of the Engineer-in-charge regarding the readiness of the surfaces to receive the specified finish, before commencing the work on painting.

Painting of new surfaces shall be deferred as much as possible to allow for thorough drying of the sub-strata.

The surfaces to be treated shall be prepared by thoroughly brushing them free from dirt, mortar droppings and any loose foreign materials. Surfaces shall be free from oil, grease and efflorescence. Efflorescence shall be removed only by dry brushing of the growth. Cracks shall be filled with Gypsum or in C.M. as specified in respective item at no extra cost to the Municipal Corporation of Greater Mumbai. Workmanship of painting shall generally conform to IS: 2395.

Surfaces of doors, windows etc. shall be protected suitably to prevent paint finishes from splashing on them.

❖ WORKMANSHIP

I. WHITE WASH:-

The prepared surfaces shall be wetted and the finish applied by brushing. The operation for each coat shall consist of a stroke of the brush first given horizontally from the right and the other from the left and similarly, the subsequent stroke from bottom upwards and the other from top downwards, before the first coat dries. Each coat shall be allowed to dry before the next coat is applied. Minimum of two coats shall be applied unless otherwise specified in the item of work. The dry surface shall present a uniform finish without any brush marks.

II. COLOUR WASH:-

Colour wash shall be applied in the same way as for white wash. A minimum of two coats shall be applied unless otherwise specified in the item of work.

The surface shall present a smooth and uniform finish without any streaks. The finished dry surface shall not show any signs of peeling/powdery and come off readily on the hand when rubbed.

III. CEMENT PAINT:-

The prepared surfaces shall be wetted to control surface suction and to provide moisture to aid in proper curing of the paint. Cement paint shall be applied with a brush with stiff bristles. The primer coat shall be a thinned coat of cement paint. The quantity of thinner shall be as per manufacturer's instructions. The coats shall be vigorously scrubbed to work the paint into any voids for providing a continuous paint film free from pinholes for effective water- proofing in addition to decoration. Cement paint shall be brushed in uniform thickness and the covering capacity for two coats on plastered surfaces shall be 3 to 4 kg/sq.m. A minimum of 2 coats of the same colour shall be applied unless otherwise specified in the item of work. At least 24 hours shall be left after the first coat to become sufficiently hard before the second coat is applied. The painted surfaces shall be thoroughly

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cured by sprinkling with water using a fog spray at least 2 to 3 times a day. Curing shall commence after about 12 hours when the paint hardens. Curing shall be continued for at least 2 days after the application of final coat. The operations for brushing each coat shall be as detailed in 3.3.1.

IV. OIL BOUND DISTEMPER:-

The prepared surfaces shall be dry and provided with one coat of alkali resistant primer by brushing. The surface shall be finished uniformly without leaving any brush marks and allowed to dry for at least 48 hours. A minimum of two coats of oil bound distemper shall be applied unless otherwise specified in the item of work. The first coat shall be of a lighter tint. At least 24 hours shall be left after the first coat to become completely dry before the application of the second coat. Broad, stiff, double bristled distemper brushes shall be used for the work. The operations for brushing each coat shall be as detailed in 3.3.1.

❖ SYNTHETIC ENAMEL PAINT (OIL PAINT)

I. PLASTERED SURFACE:-

The prepared surface shall be dry and provided with one coat of primer which shall be a thinned coat of enamel paint. The quantity of thinner shall be as per manufacturer's instructions. The paint shall be laid an evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in a direction at right angles. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off constitutes one coat. The next coat shall be applied only after the first coat has dried and sufficiently become hard which normally takes about 2 to 3 hours. A minimum of 2 finishing coats of the same colour shall be applied unless otherwise specified in the item of work. Paint may also be applied using rollers. The surface on finishing shall present a flat velvety smooth finish and uniform in shade without any patches.

II. IRON & STEEL WORK:-

All the rust and scales shall be removed by scrapping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought iron during rolling which becomes loose by rusting shall be removed. A coat of red oxide shall be applied before primer coat. The Primer and other coats shall be applied as per item description.

❖ PLASTIC EMULSION PAINT:-

The prepared surface shall be dry and provided with one coat of primer which shall be a thinned coat of emulsion paint. The other procedure of the painting shall be same as specified in Synthetic enamel paint.

❖ ACRYLIC EMULSION PAINT:-

Acrylic emulsion paint shall be applied in the same way as for plastic emulsion paint. The minimum of 2 finishing coats over one coat of primer shall be provided unless otherwise specified in the item of work.

❖ **ACID, ALKALI RESISTING PAINT:-**

A minimum of 2 coats of acid/alkali resisting paint shall be applied over the prepared dry surfaces by brushing. Primer coat shall be as per manufacturer's instructions.

MEASUREMENT:-

Measurement shall be in sq. m or running meters correct to two places of decimal as specified in the item description. Measurement shall be for the areas as executed duly deducting the opening as per I.S. 1200 for the openings etc. In measuring painting, the modified payable areas shall be as per table 1. The coefficients shall be applied measured flat and not girthed in all cases. Rate quoted shall take into account the provision of necessary enabling works such as scaffolding, painter's cradle etc and post painting cleaning work.

❖ **WHITE WASH WITH LIME**

I. SCAFFOLDING:-

Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being white washed. For all exposed brick work or tile work, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

Note : In case of special type of brick work, scaffolding shall be got approved from Engineer-in-Charge in advance.

Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

For white washing the ceiling, proper stage scaffolding shall be erected.

II. PREPARATION OF SURFACE:-

Before new work is white washed, the surface shall be thoroughly brushed free from mortar droppings and foreign matter. In case of old work, all loose particles and scales shall be scrapped off and holes in plaster as well as patches of less than 50 cm area shall be filled up with mortar of the same mix. Where so specifically ordered by the Engineer-in-Charge, the entire surface of old white wash shall be thoroughly removed by scrapping and this shall be paid for separately. Where efflorescence is observed the deposits may be brushed clean and washed. The surface shall then be allowed to dry for at least 48 hours before white washing is done.

III. PREPARATION OF LIME WASHES:-

The lime wash shall be prepared from fresh stone white lime (Narnaul or Dehradun quality). The lime shall be thoroughly slaked on the spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 40 gm of gum dissolved in hot water, shall be added to each 10 cubic decimeter of the cream. The approximate quantity of water to be added in making the cream will be 5 liters of water to one kg of lime.

Indigo (Neel) up to 3 gm per kg of lime dissolved in water shall then be added and stirred well.

Water shall then be added at the rate of about 5 liters per kg. of lime to produce a milky solution.

IV. APPLICATION:-

The white wash shall be applied with moonj brushes to the specified number of coats. The operation for each coat shall consist of a stroke of the brush given from the top downwards, another from the bottom upwards over the first stroke, and similarly one stroke horizontally from the right and another from the left before it dries.

Each coat shall be allowed to dry before the next one is applied. Further each coat shall be inspected and approved by the Engineer-in-Charge before the subsequent coat is applied. No portion of the surface shall be left out initially to be patched up later on.

For new work, three or more coats shall be applied till the surface presents a smooth and uniform finish through which the plaster does not show. The finished dry surface shall not show any signs of cracking and peeling nor shall it come off readily on the hand when rubbed.

For old work, after the surface has been prepared, a coat of white wash shall be applied over the patches and repairs. Then a single coat or two or more coats of white wash as stipulated in the description of the item shall be applied over the entire surface. The white washed surface should present a uniform finish through which the plaster patches do not appear. The washing on ceiling should be done prior to that on walls.

Note : In case of Hessian ceiling, on no account, lime shall be used as it rots cloth and hessian.

V. PROTECTIVE MEASURES:-

Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be white washed, shall be protected from being splashed upon. Splashings and droppings, if any shall be removed by the contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings and fixtures shall be recoverable from the contractor.

❖ DRY DISTEMPER

I. MATERIALS:-

Dry distemper of required colour (IS 427) and of approved brand and manufacture shall be used. The shade shall be got approved from the Engineer-in-Charge before application of the distemper. The dry distemper colour as required shall be stirred slowly in clean water using 6 deciliters (0.6 liter) of water per kg of distemper or as specified by the makers. Warm water shall preferably be used. It shall be allowed to stand for at least 30 minutes (or if practicable over night) before use. The mixture shall be well stirred before and during use to maintain an even consistency.

Distemper shall not be mixed in larger quantity than is actually required for one day's work.

II. PREPARATION OF SURFACE:-

Before new work is distempered, the surface shall be thoroughly brushed free from mortardroppings and other foreign matter and sand papered smooth.

New plastered surfaces shall be allowed to dry for at least two months, before applying distemper.

In the case of old work, all those pieces and scales shall be removed by sand papering. The surface shall be cleaned of all grease, dirt, etc.

Pitting in plaster shall be made good with plaster of paris mixed with the colour to be used. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of the distemper shall be applied over the patches. The patched surface shall be allowed to dry thoroughly before the regular coat of distemper is applied.

III. PRIMING COAT:-

A priming coat of whitening shall be applied over the prepared surface in case of new work, if so stipulated in the description of the item. No white washing coat shall be used as a priming coat for distemper.

The treated surface be allowed to dry before distemper coat is given.

IV. APPLICATION:-

In the case of new work, the treatment shall consist of a priming coat of whitening followed by the application of two or more coats of distemper till the surface shows an even colour.

Before new work is distempered, the surface shall be thoroughly brushed free from mortar droppings and other foreign matter and sand papered smooth.

New plastered surfaces shall be allowed to dry completely before applying distemper.

In the case of old work, all loose pieces and scales shall be removed by sand papering. The surface shall be cleaned of all grease, dirt, etc.

Pitting in plaster shall be made good with plaster of paris mixed with the colour to be used. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of the distemper shall be applied over the patches. The patched surface shall be allowed to dry thoroughly before the regular coat of distemper is applied.

The application of each coat shall be as follows:

The entire surface shall be coated with the mixture uniformly, with proper distemper brushes (ordinary white wash brushed shall not be allowed) in

horizontal strokes followed immediately by vertical ones which together shall constitute one coat.

The subsequent coats shall be applied only after the previous coat has dried. The finished surface shall be even and uniform and shall show no brush marks. Enough distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room, which cannot be completed the same day. After each day's work, the brushes shall be washed in hot water and hung down to dry. Old brushes which are dirty or caked with distemper shall not be used.

The specifications in respect of scaffolding, protective measures, measurements and rate shall be as described in Plastering Chapter.

❖ PAINTING WITH ANTI-CORROSIVE BITUMASTIC PAINT

Ready mixed paint (conforming to IS 158) shall be of approved brand and manufacture. It shall be black, lead free, acid-alkali-heat-water resistant.

Preparation of surface and application shall be as specified in SP-BLD-PN-07 for painting on new or old surfaces as the case may be.

The drying time between consecutive coats, however, shall be not less than 3 hours. Other details shall be as specified in SP-BLD-PN-07 as far as applicable.

❖ CONCRETE WORKS

I. SCOPE:

This specification covers the general requirements for concrete using on-site production facilities including requirements in regard to the quality, handling, storage of ingredients, proportioning, batching, mixing, transporting, placing, curing, protecting, repairing, finishing and testing of concrete; formwork; requirements in regard to the quality, storage, bending and fixing of reinforcement; as well as mode of measurement and payment for completed works. It shall be very clearly understood that the specifications given herein are brief and do not cover minute details. However, all works shall have to be carried out in accordance with IS: 456 and other relevant standards and codes of practices or in their absence in accordance with the best accepted current engineering practices or as directed by ENGINEER from time to time. The decision of ENGINEER as regards the specification to be adopted and their interpretation and the mode of execution of work shall be final and binding on CONTRACTOR and no claim whatsoever will be entertained on this account.

II. APPLICABLE CODES AND SPECIFICATIONS:-

The following specifications, standards and codes, including all official amendments/revisions and other specifications & codes referred to therein, should be considered a part of this specification. In all cases the latest issue/edition/revision shall apply. In case of discrepancy between this specification and those referred to herein below or other specifications forming a part of this bid document, this specification shall govern.

III. MATERIALS:-

IS:383 Specification for coarse and fine aggregates from natural sources for concrete. IS:455 Specification for portland slag cement.
IS:1489 Specification for portland pozzolona cement.
IS:1566 Specification for Hard drawn Steel wire fabric for concrete reinforcement.
IS:1786 Specification for high strength deformed steel bars and wires for concrete reinforcement.
IS:2062 Hot Rolled Low, Medium & High Tensile Structural Steel. IS:2645 Specification for integral cement water- proofing compounds. IS:4990 Specification for plywood for concrete shuttering work.
IS: 8112 Specification for 43 grade ordinary portland cement. IS:9103 Specification for admixtures for concrete.
IS: 12269 Specification for 53 grade ordinary portland cement.

IV. MATERIAL TESTING:-

IS:4031 (Parts 1 to 15) Methods of physical tests for hydraulic cement. IS:4032 Method chemical analysis of hydraulic cement.
IS:650 Specification for standard sand for testing of cement. IS:2430 Methods for sampling of aggregates for concrete.
IS.2386 (Parts 1 to 8) Methods of test for aggregates for concrete.
IS:3025 Methods of sampling and test (physical and chemical) water used in industry. IS:6925 Methods of test for determination of water soluble chlorides in concrete admixtures.

V. MATERIAL STORAGE:-

IS:4082 Recommendations on stacking and storing of construction materials at site.

VI. CONCRETE MIX DESIGN:-

IS:10262 Recommended guidelines for concrete mix design.SP:23 (S&T) Handbook on Concrete Mixes.

IS:4926 Ready Mixed Concrete-Code of Practice.

VII. CONCRETE TESTING:-

IS:516 Method of test for strength of concrete. IS.1199 Method of sampling and analysis of concrete.

IS:2770 Methods of testing bond in reinforced concrete.

IS:8142 Method of test for determining setting time of concrete by penetration resistance

IS:9013 Method of making, curing and determining compressive strength of accelerated cured concrete test specimens.

IS:9284 Method of test for abrasion resistance of concrete.

VIII. EQUIPMENT:-

IS:1791 Specification for batch type concrete mixers.

IS:2505 General Requirements for concrete vibrators: Immersion type. IS:2506 General Requirements for screed board concrete vibrators.

IS:2722 Specification for portable swing weigh batchers for concrete (single and double bucket type).

IS:2750 Specification for steel scaffoldings

IS:4925 Specification for concrete batching and mixing plant. IS:5892 Specification for concrete transit mixers and agitator. IS:7242 Specification for concrete spreaders.

IX. CODES OF PRACTICE:-

IS:456 Code of practice for plain and reinforced concrete.

IS:2502 Code of practice for bending and fixing of bars for concrete reinforcement. IS:2571 Code of practice for laying insitu cement concrete flooring.

IS:2751 Code of practice for welding of mild steel plain and deformed bars used for reinforced concrete construction.

IS:3370 (Parts 1 to 4) Code of practice for concrete structures for storage of liquids. IS:3414 Code of practice for design and installation of joints in buildings.

IS:3558 Code of practice for use of immersion vibrators for consolidating concrete. IS:4014 (Parts 1 & 2) Code of practice for steel tubular, scaffolding.

IS:4326 Code of practice for earthquake resistant design and construction of building. IS:5525 Recommendation for detailing of reinforcement in reinforced concrete works. IS:7861 Code of practice for extreme weather concreting.

Part 1 Recommended practice for hot weather concreting. Part 2 Recommended practice for cold weather concreting

IS:9417 Specification for welding cold worked bars for reinforced concrete construction.

WZO**X. CONSTRUCTION SAFETY:-**

IS.3696 (Parts 1& 2) Safety code for scaffolds and ladders. IS:7969 Safety code for handling and storage of building materials. IS:8989 Safety code for erection of concrete framed structures.

XI. MEASUREMENT:-

IS:1200 – Method of measurement of building and engineering works.

❖ GENERAL ENGINEER:-

shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and ENGINEER's approval obtained, prior to starting of concrete work. This shall, however, not relieve CONTRACTOR of any of his responsibilities. All materials, which do not conform to this specification, shall be rejected.

MATERIALS:-

should be selected so that they can satisfy the design requirements of strength, serviceability, safety, durability and finish with due regards to the functional requirements and the environmental conditions to which the structure will be subjected. Materials complying with codes/standards shall generally be used. Other materials may be used after approval of the ENGINEER and after establishing their performance suitability based on previous data, experience or tests

❖ MATERIALS**I. CEMENT:-**

Cement shall be 43 grade / 53 grade ordinary portland cement conforming to IS:8112/ IS:12269 or portland slag cement conforming to IS:455 or Portland pozzolona cement conforming to IS:1489. Type of cement to be used for specific work is covered in item description in section „C2“ of the document.

Only one type of cement shall be used in any one mix. The source of supply type or brand of cement within the same structure or portion thereof shall not be changed without approval from ENGINEER.

Cement, which is not used within 90 days from its date of manufacture, shall be tested at a laboratory approved by ENGINEER and until the results of such tests are found satisfactory, it shall not be used in any work.

II. AGGREGATES:-

Aggregates shall consist of naturally occurring stones (crushed or uncrushed), gravel and sand. They shall be chemically inert, strong, hard, clean, durable against weathering, of limited porosity, free from dust/silt/ organic impurities/deleterious materials and conform to IS:383. Aggregates such as slag, crushed over burnt bricks, bloated clay ash, sintered fly ash and tiles shall not be used.

Aggregates shall be washed and screened before use where necessary or if directed by the ENGINEER.

❖ **COARSE AGGREGATE:-**

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

I. SCREENING AND WASHING:-

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

II. GRADING:-

Coarse aggregate shall be either in single size or graded. In both cases, the grading shall be within the limits. The pieces shall be conical in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale, if present, shall be only in such quantities that will not, in the opinion of the Engineer, affect adversely the strength and/or durability of concrete. The maximum size of coarse aggregate shall be 40 mm for M15 to M30 concrete and 20 mm for M35 and M40 concrete, or as directed by the Engineer or specified otherwise. The maximum size of coarse aggregate shall be the maximum size specified above, but in no case greater than 1/4 of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. Plums above 160 mm and up to

any reasonable size can be used in plain mass concrete work of large dimensions up to a maximum limit of 20% by volume of concrete when specifically approved by the Engineer. For heavily reinforced concrete members, the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5 mm less than the minimum cover to the reinforcement whichever is smaller. The amount of fine particles occurring in the free state or as loose adherent shall not exceed 1% when determined by laboratory sedimentation tests as per IS 2386. After 24 hours' immersion in water, a previously dried sample shall not have gained more than 10% of its oven dry weight in air, as determined by IS 2386.

III. FOREIGN MATERIAL LIMITATIONS:-

The percentage of deleterious substances in the aggregate delivered to the mixer shall not exceed the following

Table 1

Sr. No.	Foreign Materials	Percent by weight	
		Uncrushed	crushed
i)	Material finer than 75 micron IS sieve	3.00	3.00
ii)	Coal and lignite	1.00	1.00
iii)	Clay lumps	1.00	1.00
iv)	Soft Fragments	3.00	-
v)	Total of all above substances	5.00	5.00

The fineness modulus of sand shall neither be less than 2.2 nor more than

3.2.s

IV. FINE AGGREGATE:-

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

V. MACHINE-MADE SAND:-

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

VI. SCREENING AND WASHING:-

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

VII. GRADING:-

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

Table 1 – B

PERCENTAGE PASSING FOR				
IS Sieve	Grading	Grading	Grading	Grading
Designation	Zone I	Zone II	Zone III	Zone IV
10mm	100	100	100	100
4.75mm	90-100	90-100	90-100	95-100
2.36mm	60-95	75-100	85-100	95-100
1.18mm	30-70	55-90	75-100	90-100
600	15-34	35-59	60-79	80-100
microns				
300 microns	5-20	5-20	12-40	15-50

Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 micron IS sieve, by total amount not exceeding 5 percent, it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600 micron IS sieve or to percentage passing any other sieve size on the coarser limit of Grading Zone I or the finer limit of Grading Zone IV. Fine aggregates conforming to Grading Zone IV shall be used unless mix designs and preliminary tests have shown its unsuitability for producing concrete of specified strength and workability.

VIII. FINENESS MODULUS:-

The sand shall have a fineness modulus of not less than 2.2 or more than 4.2. The fineness modulus is determined by adding the cumulative



❖ **WATER:-**

REINFORCEMENT:-

ADMIXTURES:-

❖ **SAMPLES AND TESTS:-**

EMPLOYER

Water to be used shall be tested to comply with requirements of IS:456. CONTRACTOR shall furnish manufacturer's test certificates and technical literature for the admixture proposed to be used. If directed by Engineer, the admixture shall be got tested at an approved laboratory at no extra cost.

❖ STORAGE OF MATERIALS:-

All material shall be stored in a manner so as to prevent its deterioration and contamination, which would preclude its use in the works. Requirements of IS:4082 shall be complied with. CONTRACTOR will have to make his own arrangements for the storage of adequate quantity of cement. If such cement is not stored properly and has deteriorated, the material shall be rejected. Cement bags shall be stored in dry weatherproof shed with a raised floor, well away from the outer walls and insulated from the floor to avoid moisture from ground. Not more than 15 bags shall be stacked in any tier. Storage under tarpaulins shall not be permitted. Each consignment of cement shall be stored separately and consumed in its order of receipt.

Each size of coarse and fine aggregates shall be stacked separately and shall be protected from leaves and contamination with foreign material. The stacks shall be on hard, clean, free draining bases, draining away from the concrete mixing area. CONTRACTOR shall make his own arrangements for storing water at site in tanks to prevent contamination.

The reinforcement shall be stacked on top of timber sleepers to avoid contact with ground/water. Each type and size shall be stacked separately.

❖ CONCRETE GENERAL

Concrete grade shall be as designated on drawings. In concrete grade M20, M25 etc. the number represents the specified characteristics compressive strength of 150 mm cube at 28 days, expressed in N/sq.mm as per IS:456. Concrete in the works shall be "DESIGN MIX CONCRETE" or "NOMINAL MIX CONCRETE". All concrete works of grade M7.5, M10, M15 and M20 shall be NOMINAL MIX CONCRETE and M10, M15 and above, shall be DESIGN MIX CONCRETE.

• DESIGN MIX CONCRETE Mix Design & Testing:-

For Design Mix Concrete, the mix shall be designed according to IS:10262 and SP:23 to provide the grade of concrete having the required workability and characteristic strength not less than appropriate values given in IS:456. The design mix shall in addition to such that it is cohesive and does not segregate and should result in a dense and durable concrete and also capable of giving the finish as specified. For liquid retaining structures, the mix shall also result in water tight concrete. The CONTRACTOR shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

The minimum cement content and maximum free water-cement ratio for Design Mix Concrete shall be as per table – 5 of IS 456 for "Severe" category of exposure, unless noted otherwise in the specification document.

The minimum cement content stipulated in IS 456 shall be adopted irrespective of whether the CONTRACTOR achieves the desired strength with

less quantity of cement. The CONTRACTOR's quoted rates for concrete shall provide for the above eventuality and nothing extra shall become payable to the CONTRACTOR on this account. Even in the case where the quantity of cement required is higher than that specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the CONTRACTOR.

It shall be CONTRACTOR's sole responsibility to carry out the mix designs at his own cost. He shall furnish to ENGINEER at least 30 days before concreting operations, a statement of proportions proposed to be used for the various concrete mixes and the strength results obtained. The strength requirements of the concrete mixes ascertained on 150 mm cubes as per IS:516 shall comply with the requirements of IS:456. The mix design shall be approved by the Engineer before starting the concrete work.

Range of slumps which shall generally be used for various types of constructions shall be as per clause 7.1 of IS:456 unless instructed otherwise by ENGINEER.

Batching & Mixing of Concrete.

Proportions of aggregates and cement, as decided by the concrete mix design, shall be by weight. These proportions shall be maintained during subsequent concrete batching by means of weigh batchers capable of controlling the weights within one percent of the desired value. Amount of water added shall be such as to produce dense concrete of required consistency, specified strength and satisfactory workability and shall be so adjusted to account formoisture content in the aggregates. Water- cement

ratio specified for use by ENGINEER shall be maintained. Each time the work stops, the mixer shall be cleaned out, and while recommencing, the first batch shall have 10% additional cement to allow for sticking in the drum.

Arrangement should be made by CONTRACTOR to have the cubes tested in an approved laboratory or in field at his own expense, with prior consent of ENGINEER. Sampling and testing of strength and workability of concrete shall be as per IS:1199, IS:516 and IS:456.

Batching Plant where used shall conform to IS 4925.

Ready-Mixed Concrete

Ready-mixed concrete to be used, subject to approval. It shall be produced at an approved plant. The concrete shall conform with IS:4926 and with this specification.

All the constituents for each mix shall be added at the manufacturer's plant. No extra water or other material shall be added after the concrete has left the plant.

All delivery notes shall be retained by the CONTRACTOR and made available for inspection throughout the duration of the contract.

Samples of concrete shall be taken in accordance with the requirements of the specification at the point and time of delivery. The sampled concrete shall be tested in accordance with the specification. The test results shall be certified by Owner/Engineer.

If at any time the ENGINEER is not satisfied that the ready-mixed concrete complies with the specification, ENGINEER may alter the frequency of the sampling.

• REINFORCEMENT WORKMANSHIP:-

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Reinforcing bars supplied bent or in coils shall be straightened cold without damage at no extra cost. No bending shall be done when ambient temperature is below 5 Deg.C.

All bars shall be accurately bent gradually and according to the sizes and shapes shown on the drawings/ schedules or as directed by ENGINEER. Re-bending or straightening incorrectly bent bars shall not be done without approval of ENGINEER.

Reinforcement shall be accurately fixed and maintained firmly in the correct position by the use of blocks, spacers, chairs, binding wire etc. to prevent displacement during placing and compaction of concrete. The tied in place reinforcement shall be approved by ENGINEER prior to concrete placement. Spacers shall be of such materials and designs as will be durable, not lead to corrosion of the reinforcement and not cause spilling of the concrete cover. Binding wire shall be 16 gauge soft annealed wire. Ends of the binding wire shall be bent away from the concrete surface and in no case encroach into the concrete cover.

Substitution of reinforcement, laps/splices not shown on drawing shall be subject to ENGINEER's approval.

Tolerances on placing of reinforcement and Tolerance for cover shall be as per IS456.

- **TOLERANCES:-**

Tolerance for formed and concrete dimensions shall be as per IS:456 unless specified otherwise. Tolerances specified for horizontal or vertical building lines or footings shall not be construed to permit encroachment beyond the legal boundaries.

- **REPARATION PRIOR TO CONCRETE PLACEMENT:-**

Before concrete is actually placed in position, the inside of the formwork shall be cleaned and mould oil applied, necessary inserts/embedments/pipe sleeves and reinforcement shall be correctly positioned and securely held, necessary openings, pockets, etc. provided. All arrangements-formwork, equipment and proposed procedure, shall be approved by ENGINEER. CONTRACTOR shall maintain separate Pour Card for each pour as per the format enclosed.

- **MASS CONCRETE WORKS:-**

Sequence of pouring for mass concrete works shall be as approved by ENGINEER. CONTRACTOR shall exercise great care to prevent shrinkage cracks and shall monitor the temperature of the placed concrete.

- **CURING:-**

Curing shall start immediately after the compaction of the concrete to protect it from

- a) Premature drying out, particularly by solar radiation and wind;
- b) leaching out by rain and flowing water;
- c) rapid cooling during the first few days after placing;
- d) high internal thermal gradients;
- e) low temperature or frost;
- f) vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement.

All concrete, unless directed otherwise by ENGINEER, shall be cured by use of continuous sprays or ponded water or continuously saturated coverings of

sacking, canvas, hessain or other absorbent material for the period of complete hydration with a minimum of 7 days. The quality of curing water shall be the same as that used for mixing.

Where a curing membrane is directed to be used by the ENGINEER, the same shall be of a non-wax base and shall not impair the concrete finish in any manner. Curing shall be carried out generally as per ACI:307. Curing compound shall comply with ASTM C 309. The curing compound to be used shall be got approved from the ENGINEER before use and shall be applied with spraying equipment capable of a smooth, even textured coat, generally in conformity with recommendations of the manufacturer.

Curing may also be done by covering the surface with an impermeable material such as polyethylene, which shall be well sealed and fastened. Extra precautions shall be exercised in curing concrete during cold and hot weather.

• TESTING CONCRETE STRUCTURES FOR LEAKAGE:-

Hydro-static test for water tightness shall be done at full storage level or soffit of cover slabs, as may be directed by ENGINEER, as describe below.

In case of structures whose external faces are exposed, such as elevated tanks, the requirements of the test shall be deemed to be satisfied if the external faces show no sign of leakage or sweating and remain completely dry during the period of observation of seven days after allowing a seven day period for absorption after filling with water.

In the case of structures whose external faces are submerged and are not accessible for inspection, such as underground tanks, the structures shall be filled with water and after the expiry of seven days after the filling, the level of surface of water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24 hrs. Over a period of seven days. Backfilling shall be withheld till the tanks are tested. The total drop in surface level over a period of seven days shall be taken as an indication of the water tightness of the structure. The engineer shall decide on the actual permissible nature of this drop in the surface level, taking into account whether the structures are open or closed and the corresponding effect it has on evaporation losses. Unless specified otherwise, a structure whose top is covered shall be deemed to be watertight if the total drop in the surface level over a period of seven days does not exceed 40mm

Each compartment/segment of the structure shall be tested individually and then together.

For structures such as pipes, tunnels etc. The hydrostatic test shall be carried out by filling with water after curing as specified and subjecting to the specified test pressure for specified period. If during this period the loss of water does not exceed the equivalent of the specified rate, the structure shall be considered to have successfully passed the test.

❖ WATERPROOFING WORKS

• SCOPE:-

This specification covers the general requirements for Waterproofing works comprising water- proofing of roofs with bitumen felt, roofs with lime concrete, admixtures, waterproofing compounds, membranes, block bat and such other related works forming a part of this job, which may be required to be carried out though not specifically mentioned above. The work under this

specification shall consist of furnishing of all tools, plants, labour, materials, and everything necessary for carrying out the work.

• **WATER-PROOFING ADMIXTURE:-**

Water-proofing admixture shall conform to the requirements of IS:2645 and shall be of approved manufacture. The admixture shall not contain calcium chloride. The quantity of the admixture to be used for the works and method of mixing etc. shall be as per manufacturer's instructions and as directed by the Engineer. Payment shall be made for the actual quantity of such admixture used unless it is already covered in the rate for the relevant item of work.

WATERPROOFING WORK

Work shall include design, supply, install and test waterproofing systems to underground structure, terraces, toilet sunk slabs, UG and Overhead water tanks, water bodies, landscape areas etc. This shall be guaranteed for 10 years on Rs.100/- stamp paper in proforma to be approved by the Engineer in-charge.

A) Water proofing of basement including sealing of services junctions, drain points, sumps shall be as per membrane treatment.

B) Water proofing of terrace with insulation inclusive of grouting, sealing rainwater down takes outlets, other services outlets, junctions of walls, slab, beam, columns, parapet wall etc., where required expansion joints all as per approved terrace treatment.

Work shall include design, supply, install and test systems for basement, terrace, toilets, water retaining structures as approved by the Engineer in-charge. This shall be guaranteed for 10 years on Rs.100/- Stamp paper in proforma to be approved by the Engineer in-charge. Work shall conform to minimum standards specified. Systems detailed hereunder are to clarify type of water proofing system expected. Contractor is at liberty to suggest and submit equivalent system with products meeting / exceeding standards.

• **GENERAL:-**

Quality Assurance (The sentences are incomplete, Please complete the sentences such that bidder should not interpret otherwise. For example refer first clause below. This is applicable till 3.1.3)

Manufacturer's Qualification

A) Bidder should have at least five years experience in manufacturing of membrane roofing.

1. Obtain primary materials from single manufacturer. Manufacturer's name shall appear on containers and accessories.

2. Provide secondary materials as required by manufacturer of primary materials. Applicators Qualification

A) Approved by manufacturer prior to execution of this Contract, with experience on at least five projects.

B) Foreman of Field Crew: Minimum five years experience with system of waterproofing being installed.

Certifications

Manufacturer's certifications on manufacturer's letterhead:

1. Certify system design; penetration, transition, and perimeter details; and system specifications are appropriate and satisfactory for this particular project.

2. Certify products proposed for use comply with standards.
3. Certify materials ordered and supplied are compatible with each other, suited for local and purpose intended and shipped in sufficient quantity to ensure proper timely installation.
4. Certify materials have express warranty of merchantability and fitness for particular purposes of this Project.
5. Certify manufacturer has reviewed Project and will issue warranty upon successful completion of installation.
6. Certify materials shipped to site meet membrane manufacturer's published performance standards and requirements of this Specification.
7. Membrane manufacturer's approval of insulation type and method of installation.
8. Manufacturer's approval of installer.

Sub Contractor / Specialist shall be from the approved list and same shall be approved by the Engineer in-charge in writing before being employed by the Contractor.

I. SUBMITTALS:-

The Contractor shall submit

Statement giving detailed brief of work he proposes to carry out.

A) Name of agency with his experience certificate and quantum of work carried out. List of technical persons with their details

B) Technical Specifications

C) Product data sheets of material to be used

D) Shop drawing detailing

Sections co-ordinated with typical installation details Vertical termination and sealing Laps needed if any

Typical expansion, construction and control jointing details with minimum requirement Horizontal fixing and laying details

Typical finishing arrangement Flashings if required

E) Protective measures to be taken.

F) Installation guidance

G) Samples of each product in duplicate fixed over plywood boards or similar to enable proper cross sections.

H) Manufacturer's certificate that product and material to be used is correct and shall give intended results when applied through authorized agency.

II. WARRANTY:-

Warranty with attachments for full replacement value of completed installation signed by manufacturer, applicator and Contractor warranting against water infiltration and defects of materials and workmanship for period of ten years.

Provide warranty that covers labour and workmanship, including labour for access to waterproofing, for watertight warranty.

A. Warrant penetrations, terminations, changes of direction, and membrane.

B. Warranty shall include removing and reinstalling superimposed work covering waterproofing.

• MATERIALS

I. CEMENT:-

Cement shall be ordinary Portland Cement conforming to IS and shall be of grade 43 or 33.

It shall be received in bags of 50 kg and each batch shall be accompanied with a test certificate of the factory. Also it shall be tested before use to ascertain its strength, setting time, etc. In case cement has been stored for over 6 months or for any reasons the stored cement shows signs of deterioration or contamination, it shall be tested as per the direction of the Engineer in charge prior to use in the works.

Cement shall be stored in such locations so as to prevent deterioration due to moisture dampness. A dry and water proof shed shall be provided. Bags shall be stacked on rigid water-proof platforms about 15 to 20 cm clear above the floors and 25 to 35 cm clear or away from the surrounding walls. A maximum high stack of 12 bags is permitted. Stacks shall be so arranged that the first batches are used first (FIFO), and that they permit easy access for inspection and handling.

II. SAND:-

Natural sand deposited by stream or glacial agencies as a result of disintegration of rock is the best form of sand and shall be used.

Sometimes it is obtained from crushed stone screenings but often contains a high percentage of dust and clay. It tends to be flaky and angular. This type produces harsh concrete and should be avoided.

Sand shall be hard, durable, clean and free from adherent coatings and

organic matter and shall not contain any appreciable amount of clay. Sand shall not contain harmful impurities such as iron, pyrites, coal particles, lignite, mica shale or similar laminated material, alkali, and organic impurities in such form or quantities as to affect the strength or durability of concrete or mortar.

When tested as per IS 2386 Part I and Part II, sand shall not exceed permissible quantities of deleterious materials as given in table 1 of IS 383.

Grading of sand shall conform to IS and shall fall within limits.

Sand shall be stored in such a way that it does not get mixed with mud, grass, vegetables and other foreign matter. The best way is to have a hard surface platform made out of concrete, bricks or planks. It should be to the approval of the Engineer in-charge.

III. WATER:-

Water used for mixing and curing shall be clean, reasonably clear and free from objectionable quantities of silt, oils, alkalies, acids, salts so as not to weaken mortar, or concrete or cause efflorescence or attack the steel in RCC while curing. It shall be free of elements, which significantly affects the hydration reaction. Potable water is generally satisfactory but it shall be tested prior to use in the works.

Water tested shall be in accordance with IS 3025. Maximum permissible limits of deleterious materials in water should be as given in IS 456.

Water storage tanks shall be such as to prevent any deleterious materials getting mixed with it.

Water shall be tested and approved in writing by the Engineer in-charge prior to use in the works.

• ACCESSORIES:-

Primers, bonding agents, water stops or plugs etc. As per recommendations of the manufacturer.

I. MIXES:-

- A) Mix materials in accordance with manufacturer's instructions
- B) Mix in clear containers
- C) Do not re-temper mix after initial set.

II. MEMBRANE:-

APP Modified Membrane

It is a polymeric water proofing membrane manufactured to high standards. It is five layered APP modified polymeric membrane with centre core as 20 micron HMHDPE/100 micron HMHDPE High Molecular High Density Polyethylene Film, is the heart of the membrane and protects against water and moisture. The centre core is sandwiched on both sides by high quality polymeric mix with properties of high softening point, high heat resistance and cold resistively to make it ideal for all water proofing treatment. The polymeric mix is protected on both sides with 20 micron HMHDPE film. The membrane is available in variable thickness and weights. Usual width is 1.0 m.

PVC Membrane

The PVC membrane system shall conform to the following specifications.

1. Minimum Thickness: 2.0 mm (UNI EN 1849
2. Elongation at Break : >300% (UNI EN ISO 527 -
3. Puncture resistance : > 1100mm (DIN 16726-5.12)
4. Water impermeability: no penetration @ 5 bar
- Tensile Strength: >17Mpa (UNI EN ISO 527 -
5. Tear resistance: > 50 N/mm

III. WATERPROOFING COMPOUNDS:-

Waterproofing compounds shall be cementitious (cement based) non-shrinking, self curing mixtures. These shall be

- ❖ Free from sodium and chlorides
- ❖ Free from material detrimental to concrete and reinforcement.
- ❖ Able to create a membrane in one or multiple coats as per manufacturer's instruction.
- ❖ Membrane capable to prevent infiltration when applied to interior faces and ponded.
- ❖ Permeability, shear bond strength, compressive strength, volume changes meets minimum requirements of codes.

• ACCESSORIES:-

All other accessories materials such as primers, bonding agents, polymers etc. Shall be as recommended by waterproofing manufacturer.

DELIVERY / STORAGE:-

All materials shall be delivered and stored at site conforming to following minimum requirements.

- Material received is approved by Engineer in-charge.
- Material is in unopened container and labeled with manufacturer's name, brand name and instructions for use.
- Material received shall be along with manufacturer's certificate for quality and period of manufacture.

- **WZO** Material shall be stored in dry, well ventilated and covered storage if so desired by manufacturer.
- Primers, adhesives etc. Shall be as recommended by the membrane manufacturer.

• WORKMANSHIP

I. PREPARATION OF SURFACES:-

A) The surfaces to receive the treatment shall be thoroughly cleaned of Laitance, scales, loose material on surface.

Grease, oil or other contaminants by etching with 10-15% of solution of muriatic acid using commercial grade alkaline cleaner, flushing with clean water drying and vacuuming.

B) Surfaces shall be examined and well-defined cracks grouted by making „V” groove / notches with cement slurry, shall be cured and dried well before treatment.

C) Any honeycombs shall be carefully cut and plugged, and cured well before treatment.

D) Examination of surface shall account for the fact that Surfaces are cured for 14 days and no condensation has taken place. Horizontal and vertical surfaces have smooth finish, free from defects.

Surfaces are dry, clean, free of grease, oil, dirt, rust, corrosion, other coatings and contaminants which could affect bond of water proofing system.

II. TESTING:-

On completion of installation and prior to next operation or as directed by Engineer in-charge work shall be tested by the Contractor. Required water shall be arranged and disposed of by the contractor at his cost.

A) All openings, drains etc. Shall be plugged.

B) Water shall be flooded about 200 mm over the Sunk portion. Water shall be kept for 72 hours.

C) Surfaces shall be observed critically and in case any leakage is observed areas shall be treated again and tests to be carried out again to the satisfaction of the Engineer in-charge. Approval of water test does not relieve the contractor of his obligation of providing installed water proofing guaranteed for 10 years as per contract.

All arrangement of material, labour etc. Required including preserving and maintaining areas flooded shall be carried out by the Contractor at his cost.

III. GUARANTEE:-

All waterproofing systems described above are to be referred as guide-lines only. The contractor shall propose the system before starting waterproofing work giving full description for approval of Engineer in-charge.

The system shall be guaranteed for 10 years against all defects and liabilities thereof from the date of completion of project. The guarantee shall be on Stamp Paper of Rs.100/- in proforma to be approved by Engineer in-charge.

(The contractor shall submit proforma for approval of Engineer in-charge before being written on Stamp Paper.) The cost of Stamp Paper shall be to the contractor's account. Work shall be carried through approved specialist agency as per method of working approved in writing by the Engineer in-charge.

• WATERPROOFING WORKS

I. GENERAL:-

It is the intent of this specification to secure a completely water tight basement, toilets and terraces etc. Guaranteed for at least 10 (Ten) years from the date of final completion. The guarantee shall be executed & extended by the Contractor & not by the water proofing agency. The contractor shall provide all materials, labour, plant, equipment, incidentals and everything necessary for securing a fully waterproof job as called for above.

All water proofing work shall be carried out by specialists as approved by the Engineer-In Charge. Installation and materials shall be as per best practices for obtaining water proof work and as recommended by the manufacturer.

Water proofing work shall be commenced only after the surface is prepared, smooth rendered, cleaned free of dirt, dust and foreign matters, inspected and approved. Compressed air shall be used for effective cleaning of all surfaces. The vents and other projections through the roof shall be made absolutely secure before flashing.

II. WORKMANSHIP:-

Horizontal Surface: After the excavation and PCC levelling course, water proofing course shall be laid consisting of cement mortar 1:3 (1 cement:3 sand) and mixed with Acrylic water proofing chemicals and embedding aggregate by hand pack at random in two layers each of 25mm thick thus the total water proofing course shall be about 50mm thick. After the necessary curing, and fixing raft reinforce cement in partition provide 20 mm pipe sleeves at 1.2 m c/c on both ways by tying it with reinforcement in such a manners to ensure that the bottom end of the pipe remain free from getting choked and the length of the pipes shall be that of total thickness of the raft plus 25 mm above to protrude from the surface of the raft.

After concreting the raft, grouting Acrylic based waterproofing chemical mixed with neat cement slurry through the pipe sleeves shall be carried and for the required period. The projected pipe ends shall be cut after grouting the mouths. The same procedure shall be adopted for all joints around the column wall joints.

Vertical Surfaces: The vertical surfaces shall be treated by making holes on the surface at 1.20 m centre to centre on both ways and also at 0.75 m along construction joints, corners and fixing nozzles of 20 mm dia pipe and inject Acrylic based chemicals mixed with neat cement slurry as explained above. After grouting the pipe, nozzles shall be removed and the packets shall be made good. The external surface of the walls shall be neatly plastered with cement mortar (1:3) admixed with Acrylic Chemicals of 12 to 15 mm thick.

III. TESTING:-

As directed by Engineer-In-Charge.

IV. MEASUREMENT:-

Measurement shall be done in Sqm.

V. RATE:-

Rate Shall be include all operation mentioned in bill

❖ MASONRY WORKSCOPE

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This specification covers the general requirements for masonry works comprising brick, random rubble masonry, uncoursed rubble masonry, block masonry, and such other related works forming a part of this job, which may be required to be carried out though not specifically mentioned above. The work under this specification shall consist of furnishing of all tools, plants, labour, materials, and everything necessary for carrying out the work.

• BRICKWORK

I. MATERIALS:-

Bricks used in the works shall conform to the requirements laid down in IS:1077. The class of the bricks shall be as specifically indicated in the respective items of work.

The nominal size of the modular brick shall be 200mm x 100mm x 100mm with the permissible tolerances over the actual size of 190mm x 90mm x

90mm as per IS: 1077. The nominal thickness of one brick and half brick walls using modular bricks shall be considered as 200 mm and 100 mm respectively. In the event of use of traditional bricks of nominal size 230mm x 115mm x 75mm with tolerance up to +3 mm in each dimension, one brick and half brick walls shall be considered as 230 mm and 115 mm respectively.

II. CLASSIFICATION:-

Bricks/Brick tiles shall be classified on the basis of their minimum compressive strength as given below :

Class designation	Average compressive strength not less than	Average compressive strength less than
12.5	12.5	15
10	10	12.5
7	7	10
5	5	7
3.5	3.5	5

The bricks shall have smooth rectangular faces with sharp corner and shall be uniform in colour and emit clear ringing sound when struck.

Bricks/Brick tiles shall be classified on the basis of material used and size as given below :

III. COMMON BURNT CLAY BRICKS:

Common Burnt Clay Bricks shall conform to IS:1077 and shall be hand moulded or machine moulded. They shall be free from nodules of free lime, visible cracks, flaws warpage and organic matter, have a frog 100 mm in length 40 mm in width and 10 mm to 20 mm deep on one of its flat sides. Bricks made by extrusion process and brick tiles may not be provided with frogs. Each brick shall be marked (in the frog where provided) with the manufacturer's identification mark or initials.

• **BURNT CLAY PERFORATED BUILDING BRICKS** **GENERAL QUALITY:-**

The bricks shall be made of suitable clay and shall be thoroughly burnt at the maturing temperature of clay. They shall be free from cracks, flaws and nodules of free lime. They shall have rectangular face with sharp straight edge at right angle. They shall be of uniform colour and texture. These bricks generally should conform to IS 2222.

PERFORATIONS:-

The area of perforation shall be between 30% and 45% of the total area of the corresponding face of the bricks.

The perforation shall be uniformly distributed over the surface. In the case of rectangular perforations, the **larger** dimension shall be parallel to the longer side of the brick. The shorterside of the perforation shall be less than 20 mm incase of rectangular perforations and less than 25 mm diameter in case of circular perforations.

The area of **each** perforation shall not exceed 500 mm².

The thickness of any shell shall not be less then 15 mm and that of any web not less than 10 mm.

COMPRESSIVE STRENGTH:-

The bricks when tested in accordance with the procedure laid down in IS 3495 (Parts 1 to 4) shall have a minimum average compressive strength of 7 N/ mm² on net area.

The compressive strength of any individual brick tested shall not fall below the minimum compressive **strength** specified for the corresponding class of bricks. The lot shall then be checked for next lower class of brick.

WATER ABSORPTION:-

The bricks when tested in accordance with the procedure laid down in IS 3495 (parts 1 to 4): after immersion in cold water for 24 hours water absorption shall not be more than 20 percentby weight.

EFFLORESCENCE:-

The bricks when tested in accordance with the procedure laid down in IS 3495 (Parts 1 to 4) shall have a rating of efflorescence not more than "slight".

WARPAGE:-

The bricks when tested in accordance with the procedure laid down in IS 3495 (parts1 to 4) the average warpage shall not exceed 3%.

BRICK BATS:-

Brick bats shall be obtained from well burnt bricks.

• **REPAIR WORKS**

• **POLYMER MODIFIED CEMENT**

MORTAR **GENERAL:-**

The cement based polymer modified mortar shall be prepared at the site by

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adding blended cement, polymer and aggregate or using ready to use components supplied by manufacturer's in pre-packed containers/ bags subject to approval of Engineer. The Polymer must be brought at the site in sealed packed containers directly from the manufacturer/source as specified and directed by the consultants.

QUALITY ASSURANCE

LABELING:-

Contractor shall clearly mark all containers with following information

- Name of manufacturer
- Manufacturer's product identification
- Manufacturer's instruction for mixing
- Warning for handling and toxicity

APPLICATION CONTROL:-

The contractor shall submit mixing application procedure for approval prior to use.

DELIVERY OF MATERIAL:-

Contractor shall deliver all materials in sealed containers with labels legible and intact.

STORAGE OF MATERIAL:-

Contractor shall arrange to store all materials at the temperature recommended by the manufacturer and as directed by the consultants.

MATERIALS:-

The CEMENT used shall be blended cement conforming to IS:8112. IT must be free from any lumps and must be from fresh stock. The sand shall be sharp washed, well graded and free from excessive fines. Quartz sand 1630 mesh size shall be used for all polymer modified work.

Water used for cementitious polymer modified mortar shall conform to the requirement of IS:456.

Polymer used shall be Acrylic base.

EXECUTION

PREPARATION OF CONCRETE SURFACE:-

A good base or foundation shall be prepared for successful application of polymer concrete. Proper support must be provided to members under repair before exposing the same for repair. It is mandatory for the contractor to seek consultant's approval for the support system. The ultimate responsibility of the support system lies with the contractor. The gist of the point being the paramount importance of the safety of the building under repair.

The props must be tight against any jerks or jolts. The system should ensure that all loads of slab, beams and overhangs are properly redistributed by bypassing the column to be repaired. Necessary length of the wall, if required can be dismantled. All unsound/ weak concrete material shall be first removed up to the required depth including undercut up to 6 mm behind the reinforcement bars, wherever required as directed by the Engineer. Chipping shall continue until there are no offsets in the cavity will cause an abrupt change in the thickness of the repaired surface.

While removal of cover, care is to be taken that the sound core of the column is not disturbed. Exposed corroded steel is to be cleaned thoroughly



EMPLOYER

Each completed work shall be systematically sounded with a hammer to check for drummy areas after hardening. In suspected areas or whenever directed by Engineer, contractor shall drill the cores from the finished work after 7 days and 28 days of mortar application. The cores shall be examined for evidence of poor workmanship by the engineer and if he feels that either bonding work or the subsequent layer of mortar are not required workmanship, the contractor at the instruction of the engineer shall dismantle such areas of work as required by the Engineer and redo the same after re-preparing the surface by chipping of mortar work and abrading the bonding slurry interface. Fogging to be carried out for at least 4-5 days.

JACKETING

PREPARATION OF SURFACE:-

A good base or foundation shall be prepared for successful application of jacketing. Proper support must be provided to members under repair before exposing the same for repair. It is mandatory for the contractor to seek consultant's approval for the support system. The ultimate responsibility of the support system lies with the contractor. The gist of the point being the paramount importance of the safety of the building under repair.

The props must be tight against any jerks and jolts. The system should ensure that all load of slab, beams and overhangs are properly redistributed by bypassing the column to be jacketed. Necessary length of wall etc. can be dismantled.

All sound/ weak concrete material shall first be removed up to the required depth as directed by Engineer. Chipping shall continue until there are no offsets in the cavity, which will cause an abrupt change in thickness of repaired surface.

Exposed corroded steel is to be cleaned thoroughly by chipping hammer and wire brush. The steel surface is to be evenly coated twice by any rust converter in 4 hours interval and must be cleaned with running water for 12 hours. Subsequently, two coats of Rust Passivator or Polymer: Cement should be applied on cleaned reinforcement in 4 hours interval.

After it has been insured that the surface to which jacket concrete is to be bonded is sound, holes of required depth and diameter shall be drilled using heavy duty "BOSCH" hammer drill as per the spacing stated. The drilled holes shall be thoroughly cleaned off loose particles by oil free air blast. The treated steel bars of required length, shape and diameter shall then be driven inside the hole, packed with polymer mortar.

A polymer dash coat must be applied at least one day prior to casting of Jacket, impregnating 20 mm down metal pieces.

REPAIRS TO PLASTER:-

The work includes cutting the patch and preparing the wall surface. Patches of 2.50 square meters and less in area shall be measured under item of "Repairs to Plaster" under this sub-head.

Plastering in patches over 2.5 square meters in area shall be paid for at the rate as applicable to new work under sub head Finishing".

SCAFFOLDING:-

Scaffolding as required for the proper execution of the work shall be erected. If work can be done safely with the ladder or jhoola these will be permitted in place of scaffolding.

CUTTING:-

The mortar of the patch, where the existing plaster has cracked, crumbled or sounds hollow when gently tapped on the surface, shall be removed. The patch shall be cut out to a square or rectangular shape at position marked on the wall as directed by the Engineer-in-Charge or his authorized representative. The edges shall be slightly under cut to provide a neat joint.

PREPARATION OF SURFACE:-

The masonry joints which become exposed after removal of old plaster shall be raked out to a minimum depth of 10 mm in the case of brick work and 20 mm in the case of stone work. The raking shall be carried out uniformly with a raking tool and not with a basuli, and loose mortar dusted off. The surface shall then be thoroughly washed with water, and kept wet till plastering is commenced.

In case of concrete surfaces, the same shall be thoroughly scrubbed with wire brushes after the plaster had been cut out .

The joints shall be raked out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scrapping. The surface shall then be thoroughly washed with water, cleaned and kept wet before plastering is commenced.

In case of concrete surface if a chemical retarder has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retarders is left on the surface.

APPLICATION OF PLASTER:-

Mortar of specified mix with the specified sand shall be used. The method of application shall be as described for single coat plaster work of the specified mix and under SP-CS-PL-05. The surface shall be finished even and flush and matching with the old surrounding plaster. All roundings necessary at junctions of walls, ceilings etc. shall be carried out in a tidy manner as specified in sub-head SP-CS-PL-05.

All dismantled mortar & rubbish etc. shall be disposed off within 24 hours from its dismantling promptly as directed by the Engineer-in-Charge.

PROTECTIVE MEASURE:-

Doors, windows, floors, articles of furniture etc. and such other parts of the building shall be protected from being splashed upon. Splashing and droppings, if any, shall be removed by the contractor at his own cost and the surface cleaned. Damages, if any, to furniture or fittings and fixtures shall be recoverable from the contractor.

CURING:-

Curing shall be done as per plaster work with special reference to the particular type of plaster mix as described under sub-head finishing".

FINISHING:-

After the plaster is thoroughly cured and dried the surface shall be white washed or colour washed to suit the existing finishing as required unless specified.

MEASUREMENTS:-

Length and breadth shall be measured correct to a cm. The area shall be calculated in square metre correct to two places of decimal. Patches below 0.05 square metre in area shall not be measured for payment. Pre-measurements of the patches to be plastered shall be recorded after the old plaster has been cut and wall surface prepared.

RATE:-

The rate includes the cost of all the materials and labour involved in all the operations described above including lead as described in the item for disposal of old dismantled plaster /material.

• **MICRO CONCRETE**

Supports: The RC members should be properly supported before chipping the spalled / loose concrete. The props provided shall be adequate to provide sufficient structural support to the load carrying members.

SURFACE PREPARATION OF CONCRETE:-

All the spalled cracked concrete or any other pre-applied mortar shall be removed by chipping to expose the reinforcing bars. The concrete shall be chipped to a minimum depth of 10mm behind the reinforcing bars. The areas to be repaired shall be profiled to get rectangular or square shape with an inward tapering

SURFACE PREPARATION OF REINFORCEMENT:-

The exposed reinforcing bars should be cleaned thoroughly to remove all traces of rust, scales, etc., by using wire brush, emery paper etc. The lateral ties/stirrups shall also be cleaned in the same way. After removal of corroded portion, the diameter of the reinforcement shall be checked and compared with the drawings, edge

PROVISION OF ADDITIONAL REINFORCEMENT:-

As the diameter of reinforcing bars is reduced substantially (say >20%) additional bars shall be provided as per the design. This additional reinforcement shall be properly anchored to the existing concrete by providing adequate shear connectors. Weld mesh may also be provided if found necessary.

PROVISION OF SHEAR CONNECTORS:-

Shear connectors of 8mm diameter shall be provided in holes of 14mm diameter and 75 mm deep. These shall be provided at every 500mm c/c on all the faces of the beams in staggered form. The holes shall be cleaned with compressed air or water jet to remove all the dust etc. and then the shear connectors shall be fixed in the holes using polyester resin anchor grout

PRIMING OF REINFORCEMENT BARS:-

The exposed and cleaned reinforcing bar shall be provided with a coat of Epoxy Zinc Primer such that the coated film will have a dry film thickness of 40 microns. The film shall be continuous especially in the regions where pitting, imperfections etc., are present on the surface of the bars. It is important that the rear portion of the bars should not be left without coating. A second coat if needed may be provided to achieve a uniform and continuous film. The additional reinforcement provided and also the shear

connectors shall be coated with Epoxy Zinc Primer. The weld mesh if provided shall also be coated with Epoxy Zinc Primer.

PROVISION OF EPOXY BASED BONDING AGENT:-

The base and hardener component of epoxy resin based bonding agent must be mixed well to get a uniform grey coloured mix. Apply the material to properly cleaned and dry concrete substrate using stiff nylon brush by scrubbing it well into the substrate. The coat should be uniform and well spread on the entire surface area of the repair patch. The mixed material must be applied before the elapse of its pot life and the new repair mortar must be applied before the elapse of overlay time. As a fully dried epoxy resin coat acts as debonding layer, the repair material should be applied whilst the bonding coat is tacky. In case the applied epoxy bond coat gets dry, an extra coat should be applied before application of repair mortar.

FORMWORK AND SHUTTERING:-

Slurry tight and strong form work shall be provided. The shuttering for encasement shall be kept ready such that the formwork shall be placed in position and fixed such that the micro concrete can be poured into the formwork within the overlay time of the bonding agent (5 hours). Adequate supports shall be provided for the formwork. Care should be taken to ensure leak proof shuttering. Under no circumstance the slurry should flow out of the shuttering during pouring of micro concrete.

MIXING OF MICRO CONCRETE:-

It should be mixed using the appropriate water powder ratio as mentioned in the product data sheet. The mixing shall be done mechanically and under no circumstance hand mixing shall be done. Mixing shall be carried out for 3 to 5 minutes to ensure that homogeneous mix is obtained without any bleeding or segregation. In hot climate ice cooled water shall be used to maintain the temperature of mixed material. If the encasing thickness is more than 100 mm, add stone aggregates up to 50 % by weight of micro concrete to the mixed micro concrete directly into the mixer hopper. The stone aggregates must be 12 mm and down and shall be clean, washed and dried. The mixing should be done for 3 minutes in mixer and then pre-weighed stone aggregates into the mixer. Mix further for 2 minutes till lump free mix is obtained.

DESHUTTERING:-

The shuttering from the sides of the RC members shall be removed after a period of 24 hours. However, the formwork of the soffit shall be retained and removed after 3 days.

POURING OF MICRO CONCRETE:-

The mixer should be poured into the formwork using a suitable funnel or through a hose pipe. It must be poured from one end only. A suitable hopper / funnel arrangement shall be made at site to facilitate the pouring operations. The pouring operation shall be continuous, and it shall not be stopped unless the job is completed. To achieve this sufficient mixers / drilling machines and work force shall be arranged at site.

CURING:-

All the repaired and encased area shall be fully cured as per standard

WZO concrete practices. Curing compound shall be used for effective curing of sides and soffits of beams. If a curing compound is applied, care shall be taken to ensure that proper surface preparation is carried out so as to remove any traces of curing compound on the surface. If this is not done, it may lead to debonding of any protective coating applied on top.

- **GROUTING**

The apparatus for mixing and placing grout shall be capable of mixing effectively and stirring the grout and forcing it into holes or grout connections in a continuous, uninterrupted flow at specified pressures. The arrangement of the grouting equipment shall be such as to provide a supply line and return line from the grout pump to the grout hole. Provision shall be made to permit continuous circulation and accurate control of grouting pressures and grout flows into the grout holes.

If, during the grouting of any hole, grout is found to flow from adjacent grout holes, those holes shall also be grouted as specified before the grout has set. Any leakage points through the concrete shall be plugged/sealed and grouting continued when the seal has set.

Grouting shall start with a cement grout with water cement ratio (by volume) of 20:1 at a pressure not exceeding 0.5 kg/cm². If grout is found to be readily flowing, the grout proportions can be made stiffer in steps of 5:1 up to 5:1 and finally 1:1 by volume.

Grout shall be prepared with clean potable water in a grout mixer. Cement shall conform to IS: 269. The mixing shall be continued for at least 15 minutes so that no lumps of cement are left in the mix and the whole slurry is colloidal. Only small quantities of slurry shall be mixed at a time. Preferably each batch shall contain not more than 5 kg of cement.

The grout nipples shall then be removed. The grout holes shall be properly sealed by 1:1 (Cement: sand) stiff mortar, by trodding it into the hole and then plastering the top 12 mm of the hole flush with the interior surface of the wall.

All the holes shall be so drilled and grouted so that it is possible to ascertain the intake of grout from each hole. Depending on the results of the grout intake, the Engineer-in-Charge shall decide the additional extent of drilling and grouting which shall be final and binding on the Contractor.

The grouting and sealing of the grout holes shall be taken three circular rows at a time starting from the lower elevation to the top.

All equipment required to mix and pump the grout shall be provided by the Contractor. A standby grout pump shall be kept ready at Site. Contractor shall ensure that sufficient quantity of cement is always available during the execution of the works. Grouting once started shall be done quickly and continuously.

No extra claim shall be entertained due to change in number, position and/or dimensions of the holes.

All arrangements for continued access to grout hole locations, ventilation, cleaning of Reservoir walls and other parts and safety during all operations shall be the responsibility of the Contractor. The Contractor will not be paid extra for all these works and his quoted percentage should include them.

DEFINING THE DAMAGE AREA FOR THE REPAIR:-

Type of repair as mentioned in the para 1.1 shall be carried out as per the visual inspection and/ or as directed by the ENGINEER-IN-CHARGE.

The doubtful area shall be tapped with a light hammer. Any loose plaster or coating shall be removed to expose the concrete surface to be treated. In case the exposed concrete surface is found to be sound, but there is separation of plaster due to lack of bond then, the area shall be demarcated for re plastering only.

In case the concrete is found damaged, the area around also shall be hammer tested and the total damaged area shall be demarcated.

REPAIR FOR CRACKS IN THE STRUCTURE:-

The following procedure shall be adopted for repairing cracks in the structures: Open the crack into „V” groove of size 20x20 mm, cleanse and moisten.

Apply priming cum bonding coat of EPIBOND of approved make with brush to the groove surface.

Immediately, fill the groove with the non shrink grout or approved equivalent. On the exterior of the groove epoxy sealant of approved make will be applied. Cure the mortar for 7 days.

• SPECIFICATION FOR CEMENTICIOUS GROUT

MATERIALS

CEMENT:- 43 grade Portland Cement conforming to 1S:8112.

WATER:- Water used for grout shall conform to the requirements of 1S:456.

ADDITIVE:- CONBEX-100 manufactured by FOSROC or equivalent.

PREPARATIONS:-

Suitable holes shall be drilled in concrete surfaces and 12mm dia. grouting nipples shall be inserted at 100mm c/c and 30 to 40mm deep. In case of cracks, the nipples shall be inserted along crack lines, after making “V” grooves by means of suitable chisels. The grooves shall be made dust free by thorough washing and drying. The distance between injection nipples along crack lines shall be sealed with epoxy putty. The grout holes shall be flushed with water prior to application of grout to pre-wet the structure. However, the substrate so wetted shall just be moist and there shall not be standing or free water present.

MIXING OF GROUT & INJECTING:-

The grout shall be mixed in following proportions.

Cement 50 kg.

CONBEX 100 225 gms.

Conbex-100 additive shall be premixed with dry cement which shall be then gradually added to the water and mixed for 3-5 minutes until thorough dispersion is achieved. After mixing all grout shall be passed through a 5mm sieve to remove lumps. The grout shall be pumped using 2-3 kg/cm² pressure, in a continuous fashion. All nipples shall be cut flush and sealed after the grout has hardened.

PRECAUTIONS:-

All eye contaminations shall be avoided. In case of eye contaminations, the eyes shall be thoroughly washed immediately with plenty of water and medical advice shall be sought.

• SPECIFICATION FOR WATERPROOFING WITH

POLYMERMODIFIED CEMENT SLURRY

GENERAL:-

The polymer modified cement slurry shall be prepared at site adding 43 grade cement and polymer latex.

QUALITY ASSURANCE:-

Labeling - Contractor shall clearly mark all containers with following information:-

a) Name of Manufacturer

b) Manufacturer's Product identification

Application Control - Contractor shall submit mixing application procedures for approval prior to use.

PRODUCT DELIVERY STORAGE AND HANDLING

DELIVERY OF MATERIALS:- Contractor shall deliver all materials in containers with labels legible and intact.

STORAGE OF MATERIALS:- Contractor shall arrange to store all materials at temperatures recommended by manufacturer.

HANDLING OF MATERIALS:- All materials shall be handled in a safe manner and in a way to avoid breaking containers.

PROJECT CONDITIONS

ENVIRONMENTAL REQUIREMENTS:- Contractor shall comply with manufacturer's recommendations as to environmental conditions under which the polymer latex compound may be applied.

PRODUCTS

CEMENT:- The cement used shall be 43 grade portland cement conforming to IS:8112.

POLYMER LATEX:- Polymer modified cement slurry shall be prepared using approved brand (Polyalk WP) of Polymer Latex.

EXECUTION

PREPARATION:- All substrate shall be clean and free of dust, plaster, oil, paint, grease, corrosion deposits and any other deleterious substances. All surfaces so treated shall be thoroughly washed with clean water. Cracks other than hair line ones shall be widened, freed from loose particles and then filled with polymer mortar as directed.

The surface shall be moistened about half an hour before application of slurry. Slurry consisting of one part by weight of approved polymer emulsion and 1.5 parts by weight of cement shall be prepared to a lump free consistency. The slurry shall be brush applied to the damp surface taking care to prepare as much slurry as can be utilized within 30 minutes. After

the first coat has dried, a second coat shall be applied at right angles to first one. After allowing for 24 hours, the top coat shall be wet cured for 3 days. In case of 3 coats, the third coat shall be applied after 2nd coat has dried. The third coat shall be wet cured after 24 hours of application for 3 days.

CLEANING

All tools shall be washed with clean water immediately after use.

Recommended PolymerLatex Products

i)Polyalk WP by Sunanda Speciality Coatings Pvt. Ltd.

EXTERNAL LEAKAGE TREATMENT

CRACK FILLING AND APPLICATION OF ELASTOMERIC WATER PROOFPAIN:-

1. Erect the Double scaffolding around the periphery of building. Care should be taken while erecting the scaffolding those walls should not be damaged for placement of bamboos. Or Erect M. S. framed scaffolding.
2. Clean the external surface with wire brush, and wash the surface with water pressure.
3. Now open all the seen cracks with mechanical grinder in "V" groove pattern.
4. Clean the cracks and fill up the „Crack filling" material of approved brand.
5. Finish the surfaces.
6. Carry-Out 7 days curing.
7. Apply one coat of approved External Priming coat as per manufacturer's specifications onthe Entire surface of external walls.
8. Apply first coat of approved waterproofing paint.
9. Apply second coat of waterproofing paint if required add Polymer based waterproofingChemical (W.P) in 1:10 proportion.

MATERIAL SPECIFICATION FOR EXTERNAL LEAKAGE TREATMENT: -

Crack filling Material: - Pidilite, Sunanda

External Elastomeric Waterproofing paint: - Sunanda

Pidilite,Silicon Sealant: - Any approved brand

TREATMENT TO TERRACE PARAPET WALL

1. Clean the roof surface and wash it properly with water so that all dirt and dust should beremoved.
2. Identify the cracks and seal them with using 1:1 proportion of Cement and PolymerChemical (Poly Alk WP/Latx Polymer S.B.R).
- 3.Repair all the damaged portions of RCC, Plaster, Drip moulds, and joints between copings.Gaps between water pipes and walls etc. with appropriate methods of repairing. Coping stones should be removed and refix properly and joints should be sealed with sealing material.

INJECTION GROUTING:-

1. Identify the hollow parts of RCC elements by tapping with hammer and fix the locations of points to be grouted. Drill the points and insert PVD / aluminum nozzles of 8mm die and 3" depth. Prepare Cement Grout; add Polymer based Waterproofing Chemical in 1:10 ratio (1 part chemical and 10 part of cement). Then injects the material into the holes by means of pressure grouting pumps.

2. Seal the holes with PMM.

EPOXY CHEMICAL APPLICATION:-

1. Prepare the application material as per manufactures specifications. Apply First coat of approved Water Proofing Epoxy chemical over the surface.
2. Apply second coat of same material after 4 hrs. Drying period.
3. Cure the surface for seven days by sprinkling water 3 times a day.
4. Care walls, parapet walls, coping should be cover with coating.

• DISMANTLING AND DEMOLISHING WORKS

- 1 **Dismantling:** The term „Dismantling“ implies carefully separating the parts without damage and removing. This may consist of dismantling one or more parts of the building as specified or shown on the drawings.
- 2 **Demolition:** The term „Demolition“ implies breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on the drawings. This chapter refers to buildings only.

SAFETY AND PRECAUTIONS:-

All materials obtained from dismantling or demolition shall be the property of the Government unless otherwise specified and shall be kept in safe custody until they are handed over to the Engineer in-Charge/ authorized representative. The demolition shall always be well planned before hand and shall generally be done in reverse order of the one in which the structure was constructed. The operations shall be got approved from the Engineer-in-Charge before starting the work. Due care shall be taken to maintain the safety measures prescribed in IS 4130.

Necessary propping, shoring and or under pinning shall be provided to ensure the safety of the adjoining work or property before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining work or property. Wherever specified, temporary enclosures or partitions and necessary scaffolding with suitable double scaffolding and proper cloth covering shall also be provided, as directed by the Engineer-in Charge.

Necessary precautions shall be taken to keep noise and dust nuisance to the minimum. All work needs to be done under the direction of Engineer-in-Charge. Helmets, goggle, safety belts etc should be used whenever required and as directed by the Engineer-in-Charge. The demolition work shall be proceeded with in such a way that it causes the least damage and nuisance to the adjoining building and the public.

Dismantling shall be done in a systematic manner. All materials which are likely to be damaged by dropping from a height or by demolishing roofs, masonry etc. shall be carefully removed first. Chisels and cutters may be used carefully as directed. The dismantled articles shall be removed manually or otherwise, lowered to the ground (and not thrown) and then properly stacked as directed by the Engineer-in-Charge.

Any serviceable material, obtained during dismantling or demolition, shall be separated out and stacked properly as directed by the Engineer-in-Charge within a lead of 50 meters. All unserviceable materials, rubbish etc. shall be disposed off as directed by the Engineer-in- Charge.

The contractor shall maintain/disconnect existing services, whether

temporary or permanent, where required by the Engineer-in-Charge.
No demolition work should be carried out at night especially when the building or structure to be demolished is in an inhabited area.
Screens shall be placed where necessary to prevent injuries due to falling pieces. Water may be used to reduce dust while tearing down plaster from brick work.
Safety belts shall be used by labourers while working at higher level to prevent falling from the structure.
First-aid equipment shall be got available at all demolition works of any magnitude.

CEILING:-

The stripping of ceilings shall be measured in square meters.
Dismantling of supporting joists, beams, etc. shall be measured in cubic meters or in quintals as specified in 15.3.6(vi). Height above floor level, if it exceeds 3.5 m shall be paid for separately.

Annexure to BOQ

Following shall be noted before arriving adoption/implementation of any of the specifications mentioned herein BOQ.

- 1.The items of BOQ are worked out on the basis of the visual inspection, Visual damaged level observed and engineering judgments.
2. The final quantities can be worked out only after exposing the entire concrete elements by removing all the finishes, including the removal of loose disintegrated plaster and loose concrete if any by Repair PMC consultant.
- 3.Execution of particular item of work at a given section/portion of structural element need to be approved by the Engineer In-Charge and the decision of the Engineer In-Charge shall be final.
4. Any addition in the items mentioned in the BOQ shall be approved by the Engineer In-Charge.
5. Material to be used shall be tested as and when required from the accredited laboratories or Government institutions like V.J.T.I, Sardar Patel College of Engineering and IIT. For all the repair materials, the test shall be carried out in accordance with the product data sheet supplied.
6. The Estimate includes only Strengthening / Structural Repair items. After tabulating the analytical data of Visual Inspection & by virtue of our experience and expertise in the field of Retrofitting / Structural Repairs the quantity are calculated in Bill of quantity items. It may vary after actual Plaster/ Concrete chipping.
- 7.The construction chemical/ Fibers to be used shall be of approved brand. List of Few chemical manufacturer is as below

1. Krishna Conchem Products Ltd.
2. Sika
3. Chembond
4. Hilti
5. RAWLPLUG
6. BASF
7. Dr. Fixit
8. FOSROC
9. ROFF
10. Sunanda Speciality Coatings Pvt Ltd.
11. CICO
12. STP Limited.
13. PERMA

Any material of other brand not mentioned in report shall be used after getting written approval from the Engineer In-Charge.



WZO

CONTRACTOR

13

EMPLOYER