

TECHNICAL SPECIFICATIONS

PART A - HERITAGE RESTORATION WORKS

PART B - CIVIL WORKS

PART C - CARPENTRY WORKS

PART D - MECHANICAL, ELECTRICAL, AND PLUMBING WORKS

PART A - HERITAGE RESTORATION WORKS

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I. GENERAL:

1. The detailed specifications given hereafter are for the items of works Described in the schedule of quantities attached herein and shall be guidance for proper execution of work to the required standards.
2. It may also be noted that the specification is generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings.
3. The Consulting Architect shall be the sole deciding authority as to the meaning, interpretations and implication for various provisions of the specifications and his decision in writing shall be final and binding on all concerned.
4. In case any difference or discrepancy between the specifications and the Description in the schedule of quantities, the schedule of quantities shall take precedence.
5. In case any difference or discrepancy between the specifications and the drawing, the specification shall take precedence.
6. Unless specifically otherwise mentioned, all the applicable latest codes and standards published by the Bureau of Indian Standards and all other standards, shall govern in all respects of design, workmanship, quality, properties of materials, method of testing and method of measurements.
7. The technical specifications shall be refer to cpwd and corresponding Bureau of Indian standard codes of all parts.

II. DISMANTLING AND DEMOLISHING:

General Guidelines for the Demolition of Selected Masonry Materials:

PART 1---PRODUCTS

1.01 MATERIALS

Provide all materials necessary to perform demolition work as specified.

PART 2---EXECUTION

2.01 EXAMINATION

Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file photographs with Owner's Representative prior to starting work.

2.02 PREPARATION

- I. Safety:** Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
- 1.** Cease operations and notify Owner's Representative immediately if safety of structure appears to be endangered.
- 2.** Take precautions to support structure until determination is made for continuing operations.
- 3.** Cover and protect furniture, equipment, and fixtures from dirt or damage when demolition work is performed in areas where such items have not been removed.
- 4.** Erect and maintain dust-proof partitions and closures as required to prevent the spread of dust or fumes to occupied portions of the building.
 - a) Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 4-inch studs, 5/8-inch drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side.
 - b) Provide weatherproof closures for exterior openings resulting from demolition work.
- 5.** Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

- I. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building.
- II. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

6. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from damage due to selective demolition work.

- a) Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to occupied portions of building.
- b) Erect temporary covered passageways as required by authorities having jurisdiction.
- c) Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
- d) Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
- e) Protect floors with suitable coverings when necessary.
- f) Construct temporary insulated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
- g) Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
- h) Remove protections at completion of work.
 - i. If damage or settlement occurs to portions of the building to remain, immediately provide shoring to prevent further damage or settlement and prepare a plan for repair.
 - ii. The plan for repair shall be approved by the Contracting Officer before repair work begins.

7. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

8. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

- a. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction.
- b. Provide alternative routes around closed or obstructed traffic ways if required by governing regulations.

9. Flame Cutting:

- a. Do not use cutting torches for removal until work area is cleared of flammable materials.
 - b. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations.
 - c. Maintain portable fire suppression devices during flame-cutting operations.
 - d. Follow procedures in "Fire Prevention Precautions for Hot Work".
- 10. Explosives:** Use of explosives will not be permitted.
- 11. Utility Services:** Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
- a. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction.
 - b. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
 - c. Maintain fire protection services during selective demolition operations.
- 12. Environmental Controls:** Use water sprinkling, temporary enclosures and other methods to limit dust and dirt migration.
- a. Comply with governing regulations pertaining to environmental protection.
 - b. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition operations, as directed by the City or governing authorities.
 - c. Return adjacent areas to conditions existing prior to start of work.
 - d. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
 - e. Noise: Comply with rules and regulations of governing agencies for the use of air hammers and other noisy equipment during normal work hours.

PART 3--- ERECTION, INSTALLATION AND APPLICATION

3.01 General: Perform selective demolition work in a systematic manner.

- 1. Use such methods as required to complete work indicated in accordance with demolition schedule and governing regulations.
- 2. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-drawn impact tools.
- 3. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
- 4. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
- 5. For foundation walls, demolish to a depth of not less than 12" below existing ground surface.

6. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs.
7. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saws where possible.
8. For sidewalks and curbs, use removal methods that will not crack or structurally disturb adjacent walls, or curbs. Use power saws where possible.
9. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter.
10. Do not cut structural steel except as specifically detailed.
11. Refer to the structural drawings for demolition work requiring detailed sequenced procedure to protect remaining construction.

B. Salvaged Materials:

1. Salvaged Items: Where indicated to be salvaged and delivered to Owner, carefully remove indicated items, clean, store, and turn over to Owner and obtain receipt.
2. Reused Items: Where indicated to be removed for reuse, carefully remove, clean, store and reinstall at locations indicated.
3. Historic artifacts, including their contents, commemorative plaques and tablets, antiques, revolving doors and other articles of historic significance, remain property of Owner. Notify Owner's Representative if such items are encountered and obtain acceptance regarding method of removal and salvage for Owner.

C. Disposition of Material:

1. Title to all materials and equivalent to be demolished, excepting reserved items, is vested in the Contractor upon receipt of Notice to Proceed.
2. The Government will not be responsible for the condition, loss or damage to such property after Notice to Proceed.

D. Reserved Items: Remove items indicated as reserved property of the Government in a manner to prevent damage.

1. Pack or crate in a manner to protect the items from damage in handling, temporary or permanent storage or shipment.
2. Securely attach embossed metal tags to identify items prior to storage, in a manner not damaging to items.
3. Deliver to the designated storage areas on the site or off the site as directed by the Government and place in permanent storage or reinstall in the work as required.
4. Repair items damaged during removal, reinstallation handling or storage, or replace with new to match existing as acceptable.
5. When directed, turn over items, damaged during removal, reinstallation, handling or storage, including broken pieces to the Government.

6. The Government reserves the right to repair items and to withhold the cost of such repair from any payments due or becoming due to the Contractor.

3.02 ADJUSTING/CLEANING

- A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose of off-site.
 - 1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws and ordinances concerning removal, and handling, and protection against exposure or environmental pollution.
 - 2. Burning of removed materials is not permitted on project site.
- B. Remove tools, equipment and protection, leaving interior areas broom clean.
- C. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

REFER CPWD SPECIFICATIONS VOL2 - **CLAUSE 15.1**

REFER CPWD SPECIFICATIONS VOL2 - **CLAUSE 15.2.4**

General Guidelines for the Dismantling of doors, windows, clerestory windows, ventilators:

- A.** Dismantling of doors, windows, clerestory windows, ventilators etc. (wood or metal) whether done separately or along with removal of wall by making recess in the wall shall be enumerated. Those exceeding 3 sqm each in area shall be measured separately. The item shall include removal of chowkhats architraves, holdfasts and other attachments.
- B.** If only shutters are to be taken out it shall be measured separately.

RECOMMENDATIONS FOR DEMOLITION OF CERTAIN SPECIAL TYPES AND ELEMENTS OF STRUCTURES

1. Jack Arches

Where tie rods are present between main supporting beams, these should not be cut until after the arch or series of arches in the floor have been removed. Particular care should be exercised and full examination of this type of structure undertaken before demolition is commenced (see Fig. 15.1). The floor should be demolished in strips parallel to the span of the arch. rings (at right angles to the main floor beams).

DEMOLITION OF JACK ARCHES

Sub Head : Dismantling and Demolition Clause : 15.2.

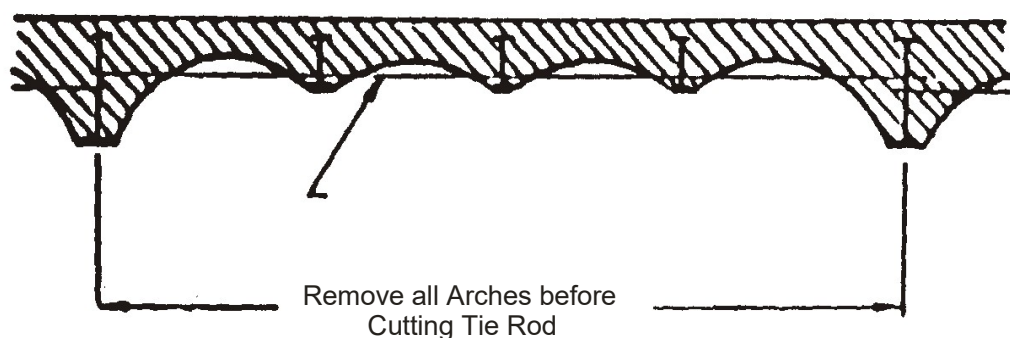


Fig : Demolition of Jack Arches

2. Madras Terrace Roof

Where Madras terrace roofing is present, particular care should be taken during demolition, as the roof consists of layers of brick courses laid over timber or other supporting members. The supporting members should not be removed or disturbed until the overlying terrace courses have been dismantled. A full examination of the roof structure and its supporting walls should be undertaken before demolition is commenced.

The Madras terrace roof should be demolished systematically in small sections, working from the ridge or highest point towards the supporting walls, wherever applicable. The roofing materials should be removed course by course and in strips, avoiding the accumulation of demolished materials on

the remaining roof. Care should be taken to prevent overloading, vibration, or sudden collapse of the supporting members.

III. PLASTER WORK - REPAIRS, REPLASTERING AND POINTING

a) LIME PLASTER WORK – REPAIRS, REPLASTERING AND DEPLASTERING

PART 1---PRODUCTS

1.01 MATERIALS

1. **Lime mortar** – Refer to Specification Section 04100-03-S for requirements relating to lime, aggregate, preparation, slaking, maturation and mixing of lime mortar.
2. Clean, potable water.
3. Approved compatible fine for the respective plaster coats.
4. Approved brick dust, stone dust, coarse sand or other compatible mineral aggregate, where required to match the existing historic plaster and as approved by the Conservation Architect.
5. Approved natural fibers or other traditional additives, only where identified through investigation of the existing plaster or specifically directed by the Conservation Architect.

1.02 EQUIPMENT

1. Trowels – appropriate sizes for plaster application and finishing.
2. Wooden floats.
3. Steel floats, only where specifically approved.
4. Plastering hawks.
5. Wooden straightedges and screeds.
6. Plasterer's darbies.
7. Small chisels and hand tools for localized removal of defective plaster.
8. Light hammers and wooden mallets.
9. Natural-bristle and stiff-bristle brushes.
10. Soft brushes for cleaning historic surfaces.
11. Spray bottles and low-pressure water spray equipment.
12. Fine misting equipment for curing.
13. Buckets, mortar boards and mixing equipment.
14. Hessian, jute cloth, shade cloth and other breathable protective coverings.

15. Scaffolding and access equipment appropriate to the heritage structure.

NOTE: Mechanical breakers, rotary hammers, grinders and other high-impact or high-vibration equipment shall not be used for removal of historic plaster unless specifically approved.

1.03 MIXES

Refer to Specification Section 04100-03-S for approved lime mortar materials and mixing procedures.

PART 2---EXECUTION

2.01 EXAMINATION

1. Before commencing work, examine all existing plaster surfaces and identify:
 - i. Sound and firmly bonded historic plaster.
 - ii. Loose, hollow, detached or drummy plaster.
 - iii. Cracked or failed plaster.
 - iv. Areas affected by dampness or salts.
 - v. Previous cement or incompatible repairs.
 - vi. Different historic plaster layers and finishes.
 - vii. Decorative plaster, mouldings, cornices, bands, inscriptions or other significant features.
 - viii. Areas where the plaster has detached from the masonry substrate.
2. Sound historic plaster shall be retained wherever reasonably possible.
3. DE plastering shall not be undertaken merely to provide a uniform new surface.
4. Where historic plaster survives and is substantially sound, repairs shall be undertaken locally rather than removing the entire plaster finish.
5. Where the cause of failure appears to be dampness, structural movement, salt contamination or incompatible previous repairs, the cause shall be investigated and reported before replastering.
6. Any unexpected historic finish, painted layer, decorative feature, inscription or other significant fabric exposed during the work shall be immediately protected and reported to the Conservation Architect.

2.02 PREPARATION

A. Protection of Historic Fabric

1. Protect all retained historic plaster, masonry, stonework, brickwork, timber, flooring, doors, windows, decorative elements and building contents.
2. Provide dust screens, temporary coverings and other protection necessary to prevent damage during DE plastering and plaster application.
3. Do not drill, chase, cut or fix into historic masonry without approval.

B. DE plastering

1. Remove defective, loose, detached or non-original plaster only where indicated or directed.
2. DE plastering shall generally be carried out manually using small chisels, scrapers, wooden mallets and other low-impact hand tools.
3. Start removal from already detached areas and work progressively towards sound plaster.
4. Avoid impact directly on the masonry substrate.
5. Do not unnecessarily remove or damage historic lime mortar joints.
6. Do not widen existing masonry joints during plaster removal.
7. Where sound historic plaster is encountered, terminate removal neatly at the boundary and retain the surviving plaster.
8. Removed plaster shall be collected and removed without dragging debris across historic floors or surfaces.
9. Representative samples of original plaster shall be retained where directed for documentation or laboratory analysis.

C. Cleaning of Substrate

1. After removal of defective plaster, gently clean the exposed masonry using natural-bristle or approved stiff-bristle brushes.
2. Remove loose dust, friable material, salts and other contaminants without damaging the masonry.
3. Do not use wire brushes.
4. Do not use acids, alkalis, detergents or aggressive chemical cleaners.
5. Existing sound lime mortar joints shall not be unnecessarily disturbed.
6. Defective or loose masonry joints shall be repaired separately with approved compatible lime mortar where directed.

D. Dampening

1. Before applying lime plaster, thoroughly dampen the masonry substrate with clean water.

2. The substrate shall be uniformly damp but shall contain **no standing or free water**.
3. Dampening shall be repeated as necessary to prevent excessive suction and premature drying of the plaster.

PART 3--- APPLICATION

3.01 LIME PLASTER APPLICATION

1. Lime plaster shall be applied only to properly prepared, clean and suitably dampened surfaces.
2. Plaster shall be applied by hand using traditional techniques appropriate to the existing historic fabric.
3. The mortar shall be firmly pressed and compacted onto the substrate.
4. Each coat shall be applied to the approved thickness and shall be properly keyed to receive the succeeding coat.
5. The number and thickness of coats shall be based on the existing historic plaster and approved sample rather than applying a standard modern plaster thickness.

Typical Coat Arrangement

Where applicable, the following system may be adopted:

Base/Scratch Coat

- Coarse lime mortar with appropriately graded aggregate.
- Firmly applied and compacted to the substrate.
- Surface lightly keyed to receive the next coat.
- Excessive smoothing shall be avoided.

Intermediate Coat

- Lime mortar with suitably graded aggregate.
- Applied after the base coat has adequately stiffened.
- Surface shall be levelled without excessive trowelling.

Finishing Coat

- Fine lime mortar with appropriate fine aggregate.
- Applied to the approved thickness and finish.
- Texture shall match the approved sample and surviving historic plaster.

6. Each succeeding coat shall be applied only after the preceding coat has adequately stiffened and is capable of receiving the next coat without deformation.
7. The plaster shall not be allowed to dry excessively between coats.
8. Excessive working, polishing or steel-trowelling of lime plaster shall not be permitted unless required to reproduce the historic finish.
9. The surface shall not be artificially sealed.

3.02 REPAIRS TO EXISTING LIME PLASTER

1. Small cracks and local failures shall be repaired using compatible lime mortar.
2. Loose edges of retained plaster shall be carefully cut back only as necessary to form a sound and stable edge.
3. The repair mortar shall be pressed firmly behind and against the retained plaster.
4. The repaired area shall be finished to match the surrounding historic plaster in texture, colour and profile.
5. Repairs shall not be feathered excessively over unstable or dusty material.
6. Large detached areas shall be treated by an approved conservation repair method rather than simply covering them with new plaster.

3.03 JUNCTIONS BETWEEN OLD AND NEW PLASTER

1. Junctions between retained historic plaster and new plaster shall be carefully formed to avoid visible stepped edges.
2. The new plaster shall not be forced over or mechanically fixed to sound historic plaster.
3. The junction shall follow the existing construction and historic detailing.
4. The finished repair shall visually integrate with the retained plaster while remaining compatible with the historic fabric.

3.04 ARCHITECTURAL FEATURES AND MOULDINGS

1. Existing cornices, mouldings, arches, bands, niches, reveals and other decorative plaster features shall be retained and repaired wherever possible.
2. Removal of original decorative plaster shall not be undertaken without specific approval.
3. Missing sections shall only be reconstructed where sufficient evidence exists to establish the original profile.
4. Profiles shall be taken from surviving sections and approved before reconstruction.
5. Templates, gauges and moulding tools shall be prepared where necessary.

6. New work shall reproduce the approved historic profile, texture and finish.

3.05 FINISHING

1. The final finish shall match the approved sample and surviving original plaster as closely as practicable.
2. The finish may be:
 - Float finished;
 - Sponge finished;
 - Brushed/textured;
 - Fine smooth lime finish;
 - Traditional roughcast;
 - Other historic finish identified during investigation.
3. The final surface shall not be excessively smooth unless such finish is demonstrably characteristic of the original work.
4. Aggregate shall remain suitably visible where this corresponds to the historic finish.
5. No modern decorative texture shall be introduced without approval.

3.06 CURING AND PROTECTION

1. Lime plaster shall be protected during the initial curing period from:
 - Direct sunlight;
 - Strong wind;
 - Rapid drying;
 - Heavy rainfall;
 - Excessive heat;
 - Physical impact and vibration.
2. Fresh plaster shall be lightly misted/sprayed with clean water as required to prevent premature drying.
3. In hot or dry windy weather, the work shall be protected using damp hessian and breathable shade coverings.
4. The curing regime shall generally be maintained for a minimum of **7 days**, and longer where required by weather conditions and the approved lime mortar system.
5. For exposed external work, the Contractor shall maintain appropriate damp curing for the period specified by the Conservation Architect.
6. The Contractor shall provide adequate protection during non-working hours, weekends and holidays.
7. Heavy rain shall be prevented from directly washing newly applied lime plaster.
8. Impermeable plastic sheeting shall not be placed directly against fresh lime plaster.

3.07 CLEANING

1. Keep adjacent historic surfaces clean during plastering.
2. Remove accidental mortar splashes before they harden.
3. Clean using soft or natural-bristle brushes and clean water.
4. Do not use metal scrapers or wire brushes.
5. Acid, alkali, cement-removing chemicals, detergents and other aggressive cleaning agents shall not be used.
6. Do not scour the surface of historic masonry during cleaning.
7. Final cleaning shall be carried out only after the plaster has adequately cured and the masonry can be cleaned without damage.

3.08 QUALITY CONTROL AND APPROVAL

1. A representative **sample/trial panel** shall be prepared before commencing full-scale work.
2. The trial panel shall demonstrate:
 - Lime type;
 - Aggregate type and grading;
 - Mix proportion;
 - Number and thickness of coats;
 - Application method;
 - Surface texture;
 - Colour;
 - Final finish;
 - Curing method.
3. The sample shall be reviewed and approved by the Conservation Architect before proceeding with the main work.
4. No change in lime source, aggregate source, mix or finish shall be made without written approval.
5. Completed plaster shall be inspected for:
 - Hollow or detached areas;
 - Excessive cracking;
 - Poor bonding;
 - Uneven thickness;
 - Incompatible texture;
 - Poor junctions;
 - Improper curing;
 - Colour or finish variation.
6. Defective work shall be carefully removed and reinstated using approved materials and methods at no additional cost.

3.09 CONSERVATION REQUIREMENTS

1. The work shall follow the principles of:
 - Minimum intervention;
 - Retention of original fabric;
 - Material compatibility;
 - Breathability and vapour permeability;
 - Reversibility where practicable;
 - Visual compatibility.
2. The Contractor shall not remove historic fabric merely for convenience of construction.
3. Cement plaster shall not be used as a substitute for lime plaster.
4. Waterproof coatings, acrylic paints, polymer-modified renders and other impermeable treatments shall not be applied over lime plaster unless specifically approved.
5. Any condition not covered by this specification shall be referred to the Conservation Architect before proceeding.

3.10 MEASUREMENT

1. Deplastering and lime plastering shall be measured in square metres (m²) of completed and accepted work unless otherwise stated in the BOQ.
2. Where the BOQ item includes both deplastering and replastering, the rate shall include careful removal of existing defective plaster, preparation of the substrate, disposal of debris and application of new lime plaster.
3. Where historic plaster is retained and only localised repairs are undertaken, measurement shall be based on the actual repaired area as specified in the BOQ.
4. Decorative mouldings, cornices, profiles and special features shall be measured separately where specifically identified.

3.11 ACCEPTANCE

The completed work shall be accepted only when:

- The approved lime mortar has been used.
- Sound historic fabric has been retained.
- The new plaster is properly bonded and cured.
- No unacceptable hollow areas or detachment are present.
- The texture, colour and finish conform to the approved sample.
- Junctions with retained historic plaster are properly executed.
- Historic architectural features have not been damaged.
- The work conforms to the approved conservation methodology.

The objective of the work is conservation of the historic building and not merely replacement of an existing plaster finish.

b) Repointing Masonry Using Lime Mortar

PART 1---PRODUCTS

1.01 MATERIALS

1. Lime mortar (See 04100-03-S for materials and procedures in preparing lime mortar)
2. Clean, potable water

1.02 EQUIPMENT

1. Trowels: range in length from 10-12 inches
2. Chisels:
 1. Joint chisels or a standard mason's chisel with a 1-1/2 in. blade and a long narrow handle
 2. Floor chisels
3. Hammers:
 1. 5# stone dressing hammer
 2. 2# striking hammer
 3. "No-Bounce" hammer
 4. Full size and one half size brick hammers
4. Joint Tools: (see 2.01 MANUFACTURERS above)
 1. 3/8"-1/4" raised beaded tool
 2. 3/8"-1/4" beaded striking tool
 3. 1/2" raised beaded tool with offset handle
 4. 1/2" flat joint iron
 5. Pointing tool should be about 1/16" narrower than the joint being filled to achieve good compaction
5. Hawks: Plywood or steel hawk (mortar board)
6. Brushes:
 1. Natural bristle brushes
 2. Stiff bristle brushes (no wire)
7. Spray bottle

1.03 MIXES

1. Refer to Specification Section 04100-03-S for approved lime mortar materials and mixing procedures.

PART 2---EXECUTION

2.01 EXAMINATION

1. Examine all existing exterior mortar joints. If the answer to any of the following questions is yes, then the building's joints are deteriorated and need repointing:

- a) Are mortar joints eroded back more than 1/4" from the masonry face?
 - b) Are there cracks running vertically or horizontally through the mortar?
 - c) Are mortar bonds broken or pulled away from the masonry?
 - d) Has mortar fallen out of joints?
 - e) Is mortar excessively soft, powdery or crumbling?
 - f) Is pointing badly-stained?
2. Typical exterior damage due to mortar deterioration includes open joints, efflorescence, spalling and loosened masonry units.
3. Typical interior damage due to mortar deterioration includes failing plaster and stained wall paper.
4. A professional pointer experienced in old masonry is required for any of the following areas or conditions:
- a) Chimneys need repointing
 - b) Window lintels must be rebuilt.
 - c) Masonry is loose or missing.
 - d) Work must be done from scaffolds or extension ladders.
 - e) The original mortar joints were "beaded"-tooled with a raised, round-profiled joint that projects out from the wall.

2.02 PREPARATION

1. Preparing the Joints:

- 1. Clean area of loose dirt and debris using a stiff bristle brush and remove all extraneous fastenings and devices.
- 2. Install necessary protection of adjacent building materials, property and persons from joint cleaning work and dirt.
- 3. Control dust and dirt from raking work; dampen area being worked; and use curtains to limit spread of dust from joint raking and cutting operations.

2. Joint Cutting and Raking:

1. Cut and rake old mortar from existing joints by hand using a hammer and chisel. NOTE: POWER CHISELS AND POWER SAWS SHOULD NOT BE USED.
2. Place the chisel in the center of the joint and pound it with a striking hammer or "No-Bounce" hammer until the mortar disintegrates.
3. Rake out the loose material to a depth of about 1 inch and never to a depth less than their width. Leave a clean, square face at the back of the joint to provide optimum contact with the new mortar.
CAUTION: AVOID OVERCUTTING ENDS OF VERTICAL JOINTS, WIDENING JOINTS OR CUTTING INTO BEDDING FACES OF MASONRY UNITS.
4. While raking out joints, remove all metal fittings such as nails, brackets and clips on both horizontal and vertical surfaces.
5. Carefully clean out the prepared face with a soft or stiff bristle brush, or blow the joints clean with low-pressure compressed air (40-60 psi).
6. Thoroughly flush out joint with clean, clear water.

2.03 ERECTION, INSTALLATION, APPLICATION

1. Filling Joints:

1. Dampen masonry surfaces and joints to control suction and evaporation before placing repointing mortars.
NOTE: THERE SHOULD BE NO FREE WATER PRESENT WHICH MAY CAUSE VOIDS IN THE MORTAR.
2. Using a pointing tool, push the mortar into the joint from a board and iron with the maximum possible pressure; The mortar should be applied in layers, each to a maximum thickness of 3/8".
NOTE: THE POINTING TOOL SHOULD BE ABOUT 1/16" NARROWER THAN THE JOINT BEING FILLED TO ACHIEVE GOOD COMPACTION. IN SOME CASES, THE JOINTS WILL BE SO THIN THAT A STANDARD POINTING TOOL WILL NEED TO BE GROUND DOWN TO FIT THE JOINT.
3. Thoroughly compact each layer of mortar and allow to set until thumb-print hard before applying the next layer of mortar.
4. Fill the joints so that they are slightly recessed from the masonry face. Avoid leaving a joint which is visually wider than the actual historical appearance.
5. Continuously keep all excess and spilled mortar brushed off the faces of masonry units, ledges and other surfaces before it sets or stains the work.

2. Joint Finishing:

1. Begin when mortar attains "thumb print" hardness.
2. Tool the joint to match the old mortar.
NOTE: IT IS IMPORTANT TO TOOL THE JOINT AT THE RIGHT STAGE; IF THE JOINT IS TOO SOFT, THE COLOR WILL BE LIGHTER THAN EXPECTED AND HAIRLINE SHRINKAGE CRACKS ARE LIKELY TO OCCUR;

IF THE JOINT IS TOO HARD WHEN TOOLED, DARK STREAKS MAY APPEAR (TOOL BURNING) AND GOOD CLOSURE OF THE MORTAR AGAINST THE MASONRY WILL NOT BE ACHIEVED. EXCESSIVE TOOLING MAY BRING LIME AND FINE AGGREGATES TO THE SURFACE, CREATING A VISUAL CHANGE IN THE TEXTURE AND A SURFACE SUBJECT TO EARLY DETERIORATION.

3. To produce a roughened texture, lightly spray the mortar with water after the initial set, stipple the mortar with a stiff bristle brush or dab the mortar with coarse sacking.
4. Protect finished work from direct sun and rain until the face has dried and hardened.

2.03 ADJUSTING/CLEANING

1. Cleaning Up:

1. Use masking and drop cloths to prevent mortar stains on adjacent work and ledges.
2. Keep work areas clean and free from mortar drips, spills and residue of waste mortars or wash-off.
3. Clean off excess mortar as work proceeds using masonry brushes before mortar sets.
4. Wash completed repointing work when finished mortar joints are set with clean water and masonry brushes, scrubbing only as required to clean mortar stains off masonry without scouring the units and joint faces.
5. Do not use acid or detergent cleaning agent to aid mortar removal and clean-up without written approval from RHPO.

2. Curing:

1. Schedule work only when moderate weather is forecast.
2. Protect completed work from adverse weather, heavy rainfall, freezing, and drying by direct sunlight and winds until cured.
3. Sprinkle or mist repointed work as required to achieve cure in mortar joints for a minimum of 72 hours after completion.
4. Lime Mortar: Cures by drying and crystallization, not by hydration; and can be washed out of joints if not protected before it cures.

3. Final Cleaning:

1. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter using stiff nylon or bristle brushes and clean water spray applied at low pressure. NOTE: USE OF METAL SCRAPERS OR BRUSHES IS NOT PERMITTED. USE OF ACID OR ALKALI CLEANING AGENTS IS NOT PERMITTED.
2. Some efflorescence, called new construction "bloom," occasionally appears on the surface within the first few months following a

repointing project. These deposits normally are harmless and are removed by the natural washing of the rain. If not removed by natural weathering, they can be removed with dry brushing with a bristle brush. The use of chemical cleaners to remove this type of efflorescence normally is not necessary. AVOID USING ACIDS, PARTICULARLY MURIATIC ACID.

3. Lime mortar only, unless otherwise specified, is to be used for pointing, and it is essential that in repointing old buildings the instructions given below should be carefully followed in order that the best results may be obtained. In the case of new masonry, provided that it is laid in lime, it is better that the joints should be finished off at once.
4. The joints of the walls should be deeply raked out, to get rid of all loose dirt or old mortar, and to destroy the roots of weeds, grasses, or jungle which may be growing in them.
5. Old mortar, though apparently sound, often has a number of small voids behind the outer surface. When this is the case, these should be thoroughly exposed and the surface mortar cut out.
6. After cutting out (and before pointing) the joints should be very thoroughly blown out by an air-pump, or by using the pressure from the grouting machine, if it is on the building. They should then be washed out thoroughly with clean water, by means of a garden syringe or spraying machine, or by a hose-pipe when the latter is possible, or by using the grouting machine under pressure. The bricks or stones should be quite wet when the pointing is commenced. Care should be taken that no bulk of water remains lying in old hollows and fractures in the walls.
7. Where the raking out exceeds 3 inches in depth, the joints are, before pointing, to be tamped with cement mortar well pressed home with special tools (see Plate VII, fig. 3). The cement mortar is to be kept back a minimum of 2 inches from the face of the wall, or is to be raked out to that minimum depth. In either case it is to be left rough as a key for the lime pointing. Only so much of the masonry (about a super-yard) is to be tamped at one time as will permit of the pointing being done while the cement is still green.
8. Unless otherwise specified, the new mortar used for pointing should be made to harmonize with the old work adjacent both in colour and texture, fine gravel, bajri, pounded brick or other ingredients being used for the purpose, according to the instructions of the Archaeological Officer. The mortar is to be rammed tightly home by means of wood or iron punches and modelling tools. Each joint should be finished off at once, and successive layers of the mortar should be avoided.

9. Where grouting is required at the back of the pointing, the depth of the pointing should be at least 3 inches, and, where possible 5 to 6 inches in depth, including the tamped cement mortar.
10. The surface finish of the pointing will be decided by the Architect. In all cases it will be expected that the grit in the mortar shall show on the surface. This may be attained either by dashing clean water from a brush on to the pointing, or by pouring clean water from a tin on to it after it has begun to set, stubbing the pointing with a hog's hair brush and cleaning off with more water poured over it from the tin. Where it is imperative not to stain the masonry or brickwork on account of its colour, the surface of the pointing must be stubbed with a hog's hair brush; while a damp Cloth is held along the lower edge of the joint. In cases like the latter very little water can be used.
11. During hot, or dry windy weather, the green Pointing should be kept permanently damp for a period Of two weeks, by covering the walls with damp Cloths, and an awning, or by spraying with water From a spraying machine* as many times daily as may be necessary. In very wet weather the new mortar must be protected by tarpaulins or other efficient covering. The overseer is to see that the contractor arranges for the adequate protection or spraying of green Pointing during holidays.
12. Pointing must not in any circumstances be carried out during frosty weather, and, in cold districts, all work must be stopped one month before the period of the usual frosts of the district. Any work which is unavoidably carried out in seasons liable to frosts must be covered up at night boards, sacking or other approved non-conducting materials.
13. In pointing the face of a wall, the masons should start at the top and work downwards.
14. No pointing of any kind is to be keyed or Struck with the but a perfectly flat face should be obtained for the joint between each stone and a rounded or lumpy surface must be avoided. It is not desired, however, that the surface should be so smooth that the grains of sand or Sukhi are flush with the lime, but the grains should be made to stand out slightly beyond the lime face. A small sample of pointing will be supplied upon application to the Archaeological Superintendent.
15. Where the masonry is uneven and the edge of one stone is recessed some distance back from an adjoining stone, the pointing, nevertheless, must still retain a flat face.
16. In India, "pointing" is frequently understood to mean the smearing of mortar flush over the surfaces on either side of a joint, and the subsequent marking of the line of the joint by an incised line. Such "pointing " must never be permitted on an ancient monument. It is an anachronism which cannot be too strongly guarded against.

IV. Cleaning, Painting and Polishing:

PART 1--- CLEANING

1.01. REMOVAL OF OLD PAINT

PAINT REMOVER:

4.01.1 Patent paint removers shall consist of volatile organic liquids thickened with waxes and other suitable ingredients to retard evaporation and enable a substantial layer of remover to be applied to the surface. The paint remover shall be of a brand and manufacture approved by the Engineer-in-Charge.

4.01.2 The paint remover shall be suitable for use on cast iron, stone and steel surfaces, shall be free from alkaline matter and shall be non-caustic so that it can be handled by workmen without injury. It shall be of non-inflammable quality as far as possible and shall not adversely affect the base material.

1. APPLICATION:

1. Paint remover shall be used for removal of old and deteriorated paint coatings from cast iron, stone and steel rafters where burning off with a blow lamp is not suitable or may cause damage to the surface or surrounding materials.
2. The paint remover shall be applied liberally and uniformly with a suitable brush over the painted surface. It shall be allowed to remain on the surface for a period depending upon the particular brand of remover used and the thickness and number of existing paint coatings.
3. When the paint film softens, lifts or wrinkles under the action of the remover, it shall be carefully stripped using a suitable sharp scraper or other approved hand tool. Care shall be taken not to damage or excessively score the underlying cast iron, stone or steel surface.
4. Where the paint film is not thoroughly removed after the first application, a second coat of remover may be applied over the remaining patches, if necessary, and the softened paint shall then be thoroughly scraped off.
5. In the case of steel rafters, particular attention shall be given to riveted, bolted, jointed and concealed portions, corners, angles and

areas where paint has accumulated or deteriorated. All loose, blistered, flaking and softened paint shall be completely removed.

6. In the case of cast iron surfaces, the remover and scraping operation shall be carried out carefully to avoid damage to the existing surface and to prevent the formation or enlargement of defects.
7. For stone surfaces, the paint remover shall be compatible with the type of stone and shall not cause staining, discolouration, surface deterioration or damage to the stone. Aggressive scraping or methods likely to damage the stone surface shall not be permitted.
8. After the surface has been stripped, it shall be thoroughly cleaned to remove all traces of paint remover, softened paint, wax and other residues. Where the manufacturer's instructions permit, mineral turpentine or other approved cleaning agent shall be used for removal of paraffin wax and residue. The cleaned surface shall thereafter be allowed to dry completely.
9. The cleaned cast iron, stone and steel surfaces shall be suitably prepared for the application of the specified primer, paint or other approved finish. In the case of steel rafters, any exposed steel shall be protected with the specified primer as soon as practicable after cleaning to prevent rust formation.

2. PRECAUTIONS:

1. Where the paint remover used is of the inflammable type, suitable precautions shall be taken against the risk of fire. Smoking, naked flames and other sources of ignition shall not be permitted in the working area.
2. Adequate ventilation shall be maintained during application and removal of the paint remover, particularly in enclosed or poorly ventilated areas.
3. Neighbouring painted, finished or unpainted surfaces which are not to be treated shall be properly protected from contact with the paint remover.
4. The remover shall not be allowed to remain in contact with stone, cast iron or steel surfaces for a period exceeding that recommended by the manufacturer.
5. Suitable personal protective equipment, including gloves, eye protection, protective clothing and respiratory protection where required, shall be used by the workmen.

6. All removed paint, residue, contaminated materials and waste shall be collected and disposed of in accordance with applicable safety and environmental requirements.
7. The entire operation shall be carried out under the direction and to the satisfaction of the Engineer-in-Charge.

1.02 REMOVAL OF VEGETATION & ALGAE, LICHEN

1. REMOVAL OF VEGETATION:

1. In removing weeds, trees or shrubs, etc., from Walls it is essential that the roots should be completely destroyed, and during the process of raking out any tendrils found in the joints should be followed up and Removed. The growth of vegetation in the joints of
2. Ancient brick or stone buildings is one of the principal factors in causing their ruin, and the only sure way of dealing with this evil is constantly to eradicate the plants before they become fully rooted.
3. Joints which have to be raked out in order to destroy the vegetation should, after the earth, etc., has been removed, be immediately repainted (see paras. 202 sqq.).
4. The cutting out of large trees from ancient masonry is an operation that demands especial care. As a rule, large trees should be removed in sections, in order to prevent injury being done to the masonry.
5. When jungle has to be cleared from around an ancient monument, it should be cut for at least 30 yards on all sides, unless special reasons to the contrary exist, and its roots should be completely eradicated so as to prevent them from sprouting again.

2. Plant Growth

1. Just like a human being needs a periodical health check-up and a car needs periodical servicing, a building also needs periodical maintenance – preferably annual – most effective is pre-monsoon. This consists of cleaning the roof of all the accumulated dried-up moss, leaves and the like, (a heap of such mass is a very fertile ground for plant growth.) Plants, as they grow, cause cracks in walls and in the roofs.
2. Then of course one has to pull out all the plants that have already taken root. Plants less than a year old are easily uprooted and rarely ever grow again from the leftover roots. However, plants older than a year need a little more effort. Where roots have gone deep, use of acid is not really a

solution since the acidity does not get carried through to the entire root ends and the plant regrows from these roots. Instead, snip the plant's main stem leaving a stub of about 3 - 5 cm. Make a stiff paste of pure asafoetida (in Tamil perungayam – available in nattu marindu shops). Shape it into a ball roughly the size of the stem and put it on the plant stub like a cap. Cover the ball with a piece of cloth and moisten it every day for about seven days. Care has to be taken to see that one does not start providing sustenance to plant by letting water seep to the roots. Most of the young plants need only one such application but older plants may need the above treatments to be repeated every two to three weeks with fresh asafoetida till the stem dries up.

MASONRY MORTAR:REFER IS - 2250 . 1981

BRICKS:REFER IS - 1077 . 1992

SAND:REFER IS - 2116 – 1980

PART 3--- PAINTING AND POLISHING

2.01 PAINTING:

1. General

1. All surfaces which are to be painted, oiled or otherwise treated shall be dry and thoroughly cleaned to remove all loose scale and loose rust. Surfaces not in contact but inaccessible after shop assembly, shall receive the full specified protective treatment before assembly. This does not apply to the interior of sealed hollow sections. Part to be encased in concrete shall not be painted or oiled. A priming coat of approved steel primer such as Red Oxide/Zinc Chromate primer conforming to IS 2074 shall be applied before any member of steel structure are placed in position or taken out of workshop.

2. SURFACE GROUTING TO WALLS AND CEILINGS

1. Providing surface grouting to existing **heritage wall surfaces and ceilings**, wherever necessary, prior to plastering, painting or application of clear coat to exposed brick surfaces.
2. The surfaces shall first be carefully cleaned using **controlled high-pressure water cleaning**, as approved by the Engineer-in-Charge/Conservation Architect, to remove dirt, loose material and surface deposits and to expose existing micro-cracks and open joints. The surface shall then be inspected and prepared for grouting.

3. Grouting shall be carried out using a **compatible lime-based grout/slurry with pozzolanic additives such as brick powder (Surkhi)**, suitably proportioned to match the existing masonry and approved by the Engineer-in-Charge/Conservation Architect. The grout shall be injected at low pressure through suitable injection points using an approved **Killick Nixon low-pressure grout pump**, ensuring proper filling of micro-cracks, voids and loose portions without causing damage or displacement of the existing heritage fabric.
4. Grouting shall be carried out in stages and at controlled pressure to avoid leakage, cracking, bulging or damage to the existing wall or ceiling. Injection points and openings shall be sealed with compatible lime-based mortar after completion. The treated surfaces shall be suitably cured and made ready for subsequent plastering, painting or clear coating, as specified.
5. The rate shall include the cost of all **materials, labour, Killick Nixon low-pressure grout pump, tools and plant, scaffolding, curing, lifts at all heights, leads, cleaning, injection accessories and all incidental charges**, complete in all respects as directed by the Engineer-in-Charge/Conservation Architect.
6. **Measurement and Payment:**
Payment shall be made on the basis of the **actual area of approved grout injected**, measured in square metres, as verified and approved by the Engineer-in-Charge.

3. APPLICATION OF RED OXIDE ZINC CHROMATE PRIMER

1. Supply and application of **Red Oxide Zinc Chromate Primer** of approved brand such as **Asian Paints / Nippon Paints / Berger**, conforming to relevant IS specifications and applicable standards, on properly prepared **steel and galvanized iron/steel surfaces** as the first protective coat.
2. The surface shall be suitably cleaned and prepared by removing loose paint, rust, scale, dust, grease, oil and other contaminants. The primer shall be thoroughly mixed and applied uniformly by brush, roller or approved spray method in accordance with the manufacturer's recommendations, to achieve a **continuous, uniform and defect-free coating**.
3. The work shall be executed carefully in the existing heritage building, taking all necessary precautions to protect the **existing structure, roof, walls, flooring, wooden members, ventilators, windows, doors, exposed brickwork, stonework and other adjacent surfaces** from

- damage, staining or contamination. Suitable protective coverings, masking and temporary protection shall be provided wherever required.
4. Any damage or defective areas in the primer coating shall be suitably repaired and recoated before application of subsequent coats. The primer shall be allowed to dry/cure for the period recommended by the manufacturer.
 5. The rate shall include the cost of **all materials, labour, surface preparation, tools and plant, scaffolding, protective coverings, curing/drying, lift at all heights, lead of materials and all incidental charges**, complete in all respects to the satisfaction of the Engineer-in-Charge/Conservation Architect.

4. BREATHABLE EMULSION PAINT TO CEILINGS AND WALL

1. Providing and applying **breathable, emulsion-based paint** of approved brand such as **Asian Paints / Nippon Paints / Berger**, in approved shade, to existing and new ceiling / Wall surfaces.
2. The surface shall be thoroughly prepared by **scrubbing, gentle water washing and final cleaning** to remove dust, dirt, loose material, flaking paint and other foreign matter. Any minor cracks, holes or surface defects shall be suitably repaired with compatible material before painting.
3. The prepared surface shall receive **one coat of suitable penetrating primer**, followed by **two coats of approved breathable silk emulsion paint**, or as specified, applied uniformly to achieve a smooth, even and consistent shade and finish. Materials shall be compatible with the existing heritage substrate and shall not adversely affect its breathability.
4. The work shall be carried out neatly and carefully, taking necessary precautions to protect the **existing structure, walls, flooring, doors, windows, wooden members, fixtures, fittings and other adjacent surfaces** from damage, staining or paint splashes. Suitable protective coverings and masking shall be provided wherever required.
5. Measurement shall be made in **square metres (m²)** of the actual ceiling area successfully prepared, primed and painted, as measured and approved by the Engineer-in-Charge/Conservation Architect.
6. The rate shall be **full and inclusive** of all materials, primer and paint, surface preparation, minor making good, labour, tools and plant, scaffolding, protective coverings and masking, curing/drying, lift at all heights, lead and transportation of materials, wastage and all incidental charges necessary to complete the work.

7. No separate payment shall be made for surface preparation, primer coat, scaffolding, masking, protection, minor repairs, wastage or additional work required to achieve the specified finish.

Payment shall be made for the **actual measured and approved area** completed in all respects.

5. GREY PRIMER TO NEW WOODWORK

1. Providing and applying **one coat of ready-mixed Grey Primer** of approved brand and manufacture to **new hard and soft woodwork**, after proper preparation of the surface.
2. The wood surface shall be thoroughly cleaned, rubbed down and sanded to remove dust, dirt, loose fibres, grease and other foreign matter and to obtain a clean, smooth and suitable surface for subsequent painting. Knots, cracks, joints and minor surface defects shall be suitably treated with approved compatible materials wherever necessary.
3. The approved grey primer shall be thoroughly mixed and applied evenly and uniformly by brush or other approved method, ensuring complete coverage of all exposed surfaces, edges and corners.
4. The work shall be carried out neatly and carefully, taking all necessary precautions to protect the **existing heritage structure, walls, flooring, doors, windows, fixtures, fittings and adjacent surfaces** from damage, staining or paint splashes by providing suitable protective coverings and masking.
5. Measurement shall be made in **square metres (m²)** of the actual woodwork surface prepared and coated with one approved coat of grey primer, as measured and accepted by the Engineer-in-Charge/Conservation Architect.
6. The rate shall be **full and inclusive** of all materials, primer, surface preparation, sanding, minor making good, labour, tools and plant, scaffolding, protective coverings and masking, drying/curing, lift at all heights, lead and transportation of materials, wastage and all incidental charges necessary to complete the work.
7. No separate payment shall be made for surface preparation, sanding, scaffolding, masking, protection, wastage or minor making good.
8. Payment shall be made for the **actual measured and approved area** completed in all respects.

6. BREATHABLE EMULSION PAINT TO UNPLASTERED INTERNAL WALL SURFACES

1. Providing and applying **breathable emulsion-based paint** of approved brand such as **Zydex / Novosil / Keim Paints**, in approved shade, to existing and new **unplastered internal wall surfaces**.
2. The wall surface shall be carefully prepared by **gentle scrubbing, controlled water washing and final cleaning** to remove dust, dirt, loose particles, flaking material and other foreign matter. Cracks, holes and minor surface defects shall be suitably repaired using **compatible lime-based or approved breathable materials**, wherever required, without damaging the existing heritage fabric.
3. The prepared surface shall receive **one coat of suitable penetrating primer**, followed by **two coats of approved breathable silk emulsion paint**, applied uniformly to achieve a smooth, even and consistent shade and finish. The primer and paint shall be compatible with the existing substrate and shall allow the wall to breathe without trapping moisture.
4. The work shall be carried out neatly and carefully, protecting the **existing structure, flooring, doors, windows, wooden members, fixtures, fittings and adjacent surfaces** from damage, staining or paint splashes by providing suitable protective coverings and masking.
5. Measurement shall be made in **square metres (m²)** of the actual wall surface successfully prepared, primed and painted, as measured and approved by the Engineer-in-Charge/Conservation Architect.
6. The rate shall be **full and inclusive** of all materials, primer and paint, surface preparation, minor making good, labour, tools and plant, scaffolding, protective coverings and masking, curing/drying, lift at all heights, lead and transportation of materials, wastage and all incidental charges necessary to complete the work.
7. No separate payment shall be made for surface preparation, primer coat, minor repairs, scaffolding, masking, protection or wastage.

7. WATER REPELLENT PROTECTIVE COATING TO EXPOSED BRICKWORK

1. Providing and applying **three coats of approved silicon-based water-repellent protective coating**, transparent/clear in appearance, of approved brand, by brush or low-pressure spray to clean and dry **external exposed brick surfaces**, until complete and uniform saturation is achieved.
2. The coating shall be **breathable and non-film-forming**, allowing moisture vapour to escape while reducing water absorption and preserving the original appearance, texture and character of the heritage brickwork.

3. Surface preparation shall include **gentle scrubbing, controlled water washing wherever necessary and final cleaning** to remove dust, dirt, loose particles, biological growth and other surface contaminants. Existing sound brickwork shall not be damaged or excessively abraded during preparation.
4. Each coat shall be applied only after the previous coat has suitably dried, strictly in accordance with the manufacturer's recommendations. Trial/sample application shall be carried out and approved by the Engineer-in-Charge/Conservation Architect before full-scale application.
5. Suitable protective coverings and masking shall be provided to protect adjoining **stonework, plaster, windows, doors, wooden members, flooring and other surfaces** from staining or overspray.
6. Measurement shall be made in **square metres (m²)** of the actual exposed brick surface successfully prepared and treated with the specified three coats, as measured and approved by the Engineer-in-Charge/Conservation Architect.
7. The rate shall be **full and inclusive** of all materials, three coats of water-repellent coating, surface preparation, labour, scaffolding, tools and plant, protective coverings and masking, access and lift at all heights, lead and transportation, wastage and all incidental charges necessary to complete the work.
8. No separate payment shall be made for surface preparation, scaffolding, masking, protection, trial application or wastage.
9. Payment shall be made for the **actual measured and approved area** completed in all respects.

8. REPAIR AND RESTORATION OF CORNICE

1. Repair and restoration of existing **cornice** using compatible **lime plaster/stucco of the same or compatible specification as the existing work**, matching the original **design, style, dimensions, profiles, proportions, texture and finish**.
2. Loose, cracked, hollow or damaged portions shall be carefully identified and removed manually without disturbing the sound and original fabric. The exposed surface shall be cleaned and suitably prepared, and the damaged portions shall be rebuilt using compatible lime-based materials and approved workmanship.
3. The restored cornice shall be properly finished to match the adjoining original work, including all mouldings, grooves, projections, curves and decorative profiles. No cement-based or incompatible material shall be

used unless specifically approved by the Engineer-in-Charge/Conservation Architect.

4. The work shall include necessary **scaffolding, access, protection of adjacent surfaces, curing and making good**, complete with all materials, labour, tools and plant and incidental charges.
5. Measurement shall be made in **running metres (RM)** of cornice actually repaired and restored, measured along the length of the cornice and approved by the Engineer-in-Charge/Conservation Architect.
6. The rate shall be **full and inclusive** of all materials, lime plaster/stucco, removal of damaged portions, surface preparation, moulding and profiling, finishing, curing, scaffolding, protection, tools and plant, lift at all heights, lead of materials and all incidental charges necessary to complete the work.
7. Payment shall be made for the **actual measured and approved length** of cornice restored, complete in all respects.

9. CLEAR NATURAL MELAMINE POLISH TO WOODWORK

1. Finishing **woodwork, including frames and shutters**, with approved clear natural melamine polish, while retaining the natural character and appearance of the existing heritage timber.
2. **Surface Preparation:** Existing loose, peeling, flaking and deteriorated paint/polish shall be carefully scraped without damaging the original wood. The surface shall be progressively sanded using suitable emery paper from approximately **80/100 grit, 120 grit, 180 grit and finally 220/240 grit**, or as required, to obtain a smooth and uniform surface.
3. The surface shall be thoroughly cleaned to remove dust, dirt, grease and sanding residue. Minor holes, cracks, joints and imperfections shall be filled with approved compatible wood filler and finally sanded with 220/240 grit emery paper.
4. **Melamine Sealer:** One or more coats of approved **melamine sealer**, compatible with the proposed polish, shall be applied by skilled brush or spray application. Adequate drying time shall be provided and light sanding with fine emery paper shall be carried out between coats wherever required.
5. **Melamine Polish:** Two or more coats of approved **clear natural melamine polish** of **Asian Paints / Nippon Paints / Berger**, or equivalent approved brand, shall be applied uniformly by skilled brush or spray application. Each coat shall be allowed to dry adequately and lightly sanded wherever required.

6. The final finish shall be **smooth, uniform and even half-matt/half-gloss (suede)**, free from runs, brush marks, patches, dust inclusions and other defects. The natural grain and character of the heritage wood shall be retained.
7. All materials shall be compatible with the existing timber and shall be applied strictly in accordance with the manufacturer's recommendations and as approved by the Engineer-in-Charge/Conservation Architect.
8. Measurement shall be made in **square metres (m²)** of the actual woodwork surface successfully prepared, sealed and polished, as measured and approved by the Engineer-in-Charge/Conservation Architect.
9. The rate shall be **full and inclusive** of all materials, melamine sealer and polish, scraping, sanding and emery paper, wood filler, labour, tools and plant, scaffolding/access, protective coverings and masking, cleaning and disposal of debris, lift at all heights, lead of materials and all incidental charges necessary to complete the work.
10. No separate payment shall be made for surface preparation, filler, sanding, sealer, additional sanding, scaffolding, protection, wastage or access.
11. Payment shall be made for the **actual measured and approved area** completed in all respects.

V. ROOF AND MASONRY WORKS

PART 1---JACK ARCH ROOF CONSTRUCTION

1. GENERAL

Providing and constructing Jack Arch roof construction to match the existing heritage building, including all materials, equipment, centering, temporary supports, labour and finishing, complete as directed by the Engineer-in-Charge/Conservation Architect.

2. MATERIALS:

1. Well-burnt, sound and approved **bricks/terracotta units**, matching the existing Jack Arch.
2. **Lime-based mortar** compatible with the existing heritage construction, with approved sand and pozzolanic additives such as Surkhi, where required.

3. Steel I-section joists, tie rods and other steel components, wherever required, conforming to approved drawings and specifications.
4. Lime concrete/levelling course and waterproofing materials compatible with the existing roof construction.
5. All materials shall be approved and shall match the existing construction in size, profile, texture and appearance.

3. EQUIPMENT AND TOOLS:

1. The work shall be carried out using suitable and approved **centering, staging, scaffolding, lifting equipment, masonry tools, mortar mixer, hand tools, measuring instruments and other necessary equipment**. Equipment shall be used carefully to avoid vibration or damage to the existing heritage structure.

4. WORKMANSHIP:

1. The span, rise, thickness, profile, joist spacing, bearing and arrangement of the Jack Arch shall exactly match the existing construction at site. Existing details shall take precedence over standard details, subject to structural approval.
2. Proper centering and temporary supports shall be provided during construction. Bricks/terracotta units shall be laid uniformly with compatible lime mortar, maintaining the required arch profile. The levelling course and subsequent roof finish shall be executed as specified.

5. QUALITY CONTROL:

1. All materials shall be inspected and approved before use. The completed Jack Arch shall be checked for **alignment, level, rise, thickness, bearing, workmanship and surface finish**. Any defective or damaged work shall be rectified as directed.
2. The work shall generally conform to **IS 2118:1980**, wherever applicable, along with approved drawings and heritage conservation requirements.

6. PROTECTION:

1. Existing walls, flooring, roof members, ceilings, decorative elements and other adjoining heritage components shall be adequately protected during the work. No drilling, cutting or alteration of original fabric shall be carried out without approval.

7. MEASUREMENT AND PAYMENT:

1. Measurement shall be in square metres (m²) of Jack Arch roof actually constructed and approved, measured in plan area.
2. The rate shall include **all materials, equipment, centering, staging, scaffolding, temporary supports, labour, tools & plant, lifting, transportation, lead, curing, protection and all incidental charges**, complete in all respects.

PART 2--- MADRAS TERRACE ROOF CONSTRUCTION:

Note: The design/construction detail for this item to be matched exactly with the existing component at site. The existing detail shall have precedence over the other standard details provided in the technical specifications unless otherwise as mentioned above.

REFER IS – 2119:1980

LIME MORTAR:

1. For making lime, stone or kankar is burned in kilns as described in M. W. H., para. 3, pages 15 and 16. The former is then slaked and the latter is usually ground dry in a mill passing through a sieve of 64 meshes to the square inch.
2. Stone-lime mortar does not set unless it is mixed with sand, surkhi (pounded bricks) or cinders, in a proportion to be fixed according to the quality of the lime. The usual proportion is 1:2 measured dry. For quality of sand, surkhi and cinders see paras. 6, 7 and 8 of M. W. H., page 16.174. Kankar being composed in part of clay does not, unless it happens to be unusually pure, require other substance to be mixed with it.
3. For the making of lime modular (bichhim) kankar of fair quality dug from the fields is recommended. Hard road metal and washed kankar collected from ravines are not suitable. Kankar containing from 8 to 30 per cent of clay is the best, but all kankar must be thoroughly cleansed and broken to 1 1/2" gauge before laying it in the kiln for burning.
4. For making lime mortar, kankar lime is mixed in a trough according to the requirements of the day, as much water being added as will make it into a stiff paste. Stone lime with its ingredients is first mixed dry on a platform and then with water in a trough.

5. As a rule, the lime is soaked in water in a trough at evening time and is mixed and used on the day following; but if required for immediate use, it should be passed wet through a mortar mill for at least 2 hours before use.
6. Unused mortar should not be allowed to set in the trough or on the ground. Any mortar that has remained in the trough for more than 24 hours is to be thrown away.
7. After removal from the kiln lime should be stored in large heaps in properly covered sheds. Stone lime should be made into mortar and used as soon as possible after it is slaked, but kankar lime can be stored in sheds for a long time after it is ground dry.
8. The mortars above described are suitable for fine joint masonry or 1/2" thick plaster work, but are unsuitable for wide joint brickwork, rubble stone masonry, and thick plaster work. For the latter class of works, which frequently have to be carried out in the conservation of ancient monuments, the best course is to grind the kankar lime wet after its removal from the kiln without any previous dry grinding. The amount of grinding required will vary according to the nature of the work, i.e., the grinding will be longer for fine class work and shorter for coarse work.
9. Lime mortar of which the tensile strength is less than 100 lbs. per square inch is not to be used in conservation works. A practical and quick way of testing lime mortar on the work itself is to take a handful of mortar from the trough and, after a minute or two, to wash it off the hand; if the skin is left rough after washing, the mortar may be considered fit for use.

Specifications of hydrated lime:

<u>Chemical composition:</u>	av. CaO	70 % min
	Silica	0.04% max
	Iron oxide	0.08% max
	Alumina	0.17% max
	Magnesia	0.22% max
	Sulphur trioxide	0.09% max
	Loss on ignition	24.47% max

Fineness: 100% through 300 mesh sieve

Suggested mix for wall plasters:

Pure lime mortar: 1 lime : 2 sand

Composite mortar: 1 cement : 6 lime : 12 sand

Other mixes are also possible.

VI. STONE WORKS AND STONE CLEANING:

REFER CPWD SPECIFICATIONS VOL1 - **CLAUSE 7.8**

REFER CPWD SPECIFICATIONS VOL1 - **CLAUSE 7.9**

New stonework which has to be inserted in NEW-ancient structures, should be matched as nearly as possible with the old masonry adjoining it. It frequently happens that the same quarry yields several varieties of stone, and care should, therefore, be taken when putting in new patches to procure stone of the same texture and colour as was used by the original builders.

In some cases, where the old stonework has weathered to a darker tint, it may be desirable, in order to avoid any violent and unpleasant contrast between the new and old surfaces, to resort to artificial means of staining the former. Such staining, however, should not be attempted in any situation where it will be exposed to heavy and prolonged rains, since no stain has yet been discovered which will successfully withstand them, even for one season.

When dismantling masonry, previous to re- building, it may be necessary to mark or number the old stones, so as the. More readily to replace them in their original positions. In doing this care should be taken not to incise the numbers or to apply to the exposed surface of the stone any oil paint or other pigment or stain which will be difficult to remove again.

PART B - CIVIL WORKS

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I. GENERAL :

- 1.** The detailed specifications given hereafter are for the items of works Described in the schedule of quantities attached herein, and shall be guidance for proper execution of work to the required standards.
- 2.** It may also be noted that the specification are of generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings.
- 3.** The Consulting Architect shall be the sole deciding authority as to the meaning, interpretations and implication for various provisions of the specifications and his decision in writing shall be final and binding on all concerned.
- 4.** In case any difference or discrepancy between the specifications and the Description in the schedule of quantities, the schedule of quantities shall take precedence.
- 5.** In case any difference or discrepancy between the specifications and the drawing, the specification shall take precedence.
- 6.** Unless specifically otherwise mentioned, all the applicable latest codes and standards published by the Bureau of Indian Standards and all other standards, shall govern in all respects of design, workmanship, quality, properties of materials, method of testing and method of measurements.
- 7.** The technical specifications shall be refer to cpwd and corresponding Bureau of Indian standard codes of all parts.

II. DISMANTLING AND DEMOLISHING

1. TERMINOLOGY

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.

2. GENERAL

This chapter relates to buildings only.

2.01 Precautions

1. 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
2. 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
3. Due care shall be taken to maintain the safety measures prescribed in IS 4130.
4. 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.
5. 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.

6. 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.
7. 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.
8. Where existing fixing is done by nails, screws, bolts, rivets, etc., dismantling shall be done by taking out the fixing with proper tools and not by tearing or ripping off.
9. 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 metres. All unserviceable materials, rubbish etc. shall be disposed off as directed by the Engineer-in-Charge.
10. The contractor shall maintain/disconnect existing services, whether temporary or permanent, where required by the Engineer-in-Charge.
11. No demolition work should be carried out at night especially when the building or structure to be demolished is in an inhabited area.
12. Screens shall be placed where necessary to prevent injuries due to falling pieces.
13. Water may be used to reduce dust while tearing down plaster from brick work.
14. Safety belts shall be used by labourers while working at higher level to prevent falling from the structure.
15. First-aid equipment shall be got available at all demolition works of any magnitude.

III. FLOORING

1. BRICK ON EDGE FLOORING

I. Bricks

Bricks of Specified class designations shall be used. These shall conform to the specifications described in Subhead 6.0. Broken bricks shall not be used in flooring except for closing the line. The bricks shall be laid on edge.

II. Mortar

The mortar used shall be as specified (in case of dry bricks flooring fine sand shall be filled in the joints).

III. Base Concrete

1. Flooring shall be laid on base concrete where so provided. The base concrete shall be provided with the slope required for the flooring. Floors in verandah, courtyard kitchens, baths shall have slope ranging from 1 : 36 to 1 : 48 depending upon locations as decided by the Engineer-in-Charge. Floors in water closet portion shall have slope of 1 : 30 or as decided by the Engineer-in-Charge to drain off washing water. exte masonry off-set shall be depressed so as to allow the base concrete to rest on it.
2. If the base is of lean cement concrete, the flooring shall commence within 48 hours of the laying of base, failing which, the surface of base shall be roughened with steel wire brushes without disturbing the concrete. Before laying the flooring the base shall be wetted and smeared with a coat of cement slurry at 2 kg of cement spread over an area of one sqm so as to get a good bond between sub-grade and flooring.
3. Where base concrete is not provided, the earth below shall be properly sloped, watered, rammed and consolidated. Before laying the flooring, it shall be moistened.

IV. Soaking of Bricks

Bricks required for flooring shall be perfectly soaked in stacks before use, by profusely spraying clean water at regular intervals for a period of not less than six hours so as to keep them wet to the satisfaction of the Engineer-in-Charge. (In case the joints are to be filled with sand, the bricks need not be soaked).

V. Laying

1. The bricks shall be laid on the edge, diagonal herring bone bond, or other pattern as specified or directed by the Engineer-in-Charge.
2. Bricks shall be laid on edge on 12 mm thick mortar of specified ratio bed and each brick shall be properly bedded and set home by gentle tapping with trowel handle or wooden mallet. Its inside face shall be buttered with mortar, before the next brick is laid and pressed against it.
3. On completion of a portion of flooring, the vertical joints shall be fully filled from the top with mortar. During laying, the surface of the flooring shall be frequently checked with a straight edge of length at least 2 m, so as to obtain a true plain surface with the required slope.

2. Joints

Bricks shall be so laid that all joints are full of mortar. The thickness of joints shall not exceed 1.0 cm for brick work with bricks of any class designation. All face joints shall be raked to a minimum depth of 15 mm by raking tool during the progress of work when the mortar is still green so as to provide proper key for the plaster or pointing to be done. Where plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying. The face of brick work shall be cleaned on the same day on which brick work is done and all mortar droppings removed promptly.

3. Curing

Brick work shall be protected from rain by suitable covering when the mortar is green. Brick work in cement mortar, shall be kept constantly moist on all faces for a minimum period of seven days. Brick work carried out shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period.

4. Measurements

Length and breadth of the flooring shall be measured correct to a cm and area shall be calculated in square metres correct to two places of decimal. Length and breadth shall be measured before laying skirting, dado or wall plaster. No deduction shall be made nor extra paid for voids not exceeding 0.20 sqm. Deduction for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 sqm.

Brick flooring when laid in diagonal herring bone bond or other pattern as specified or directed by the Engineer-in-Charge shall be measured separately.

5. Rate

The rate shall include the cost of all materials and labour involved in all the operations described above, including application of cement slurry on base concrete or RCC slab and cleaning of base. Base concrete shall be paid for separately.

Dry Brick Flooring

All provisions of para's 11.1.1 to 11.1.8 will be applicable except that bricks need not be soaked. Bricks will be laid on a bed of 12 mm thick mud mortar laid to required slope. The joints shall be as thin as possible and not exceeding 5 mm which will be filled with fine sand. No curing is to be done.

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

2. CEMENT CONCRETE FLOORING

2.01 Cement Concrete

Cement concrete of specified mix grade shall be used and it shall generally conform to the specifications described under sub head 4.0 .

2.02 Base Concrete

I. Flooring shall be laid on base concrete where so provided. The base concrete shall be provided with the slopes required for the flooring. Flooring in verandah, Courtyard, kitchens & baths shall have slope ranging from 1 : 48 to 1 : 60 depending upon location and as decided by the Engineer-in-Charge. Floors in water closet portion shall have slope of 1:30 or as decided by the Engineer-in-Charge to drain off washing water. Further, necessary drop in flooring in bath, WC, kitchen near floor traps ranging from 6 mm to 10 mm will also be provided to avoid spread of water. Necessary margin to accommodate this drop shall be made in base concrete. Plinth masonry off set shall be depressed so as to allow the base concrete to rest on it.

II. The flooring shall be commenced preferably within 48 hours of the laying of base concrete. The surface of the base shall be roughened with steel wire brushes without disturbing the concrete. Immediately before laying the flooring, the base shall be wetted and a coat of cement slurry @ 2 kg of

cement spread over an area of one sqm so as to get a good bond between the base and concrete floor.

III. If the cement concrete flooring is to be laid directly on the RCC slab, the top surface of RCC slab shall be cleaned and the laitance shall be removed and a coat of cement slurry @ 2 kg of cement spread over an area of one sqm so as to get a good bond between the base and concrete floor.

2.03 Thickness

The thickness of floor shall be as specified in the description of the item.

2.04 Laying

I. Panels : Flooring of specified thickness shall be laid in the pattern including the border as given in the drawings or as directed by the Engineer-in-Charge. The border panels shall not exceed 450 mm in width and the joints in the border shall be in line with panel joints. The panels shall be of uniform size and no dimension of a panel shall exceed 2 m and the area of a panel shall not be more than 2 sqm. The joints of borders at corners shall be mitred for provision of strips.

II. Laying of Flooring with Strips : Normally cement concrete flooring shall be laid in one operation using glass/aluminium/PVC/brass strips/stainless steel strips or any other strips as required as per drawing or instructions of the Engineer-in-Charge, at the junction of two panels. This method ensures uniformity in colour of all the panels and straightness at the junction of the panels. 4 mm thick glass strips or 2 mm PVC strips or 2 mm aluminium or brass strips shall be fixed with their tops at proper level, giving required slopes. Use of glass and metallic strips shall be avoided in areas exposed to sun. Cost of providing and fixing strips shall be paid for separately.

III. Concreting : Cement concrete shall be placed in the panels and be levelled with the help of straight edge and trowel and beaten with thapy or mason's trowel. The blows shall be fairly heavy in the beginning but as consolidation takes place, light rapid strokes shall be given. Beating shall cease as soon as the surface is found covered with a thin layer of cream of mortar. The evenness of the surface shall be tested with straight edge. Surface of flooring be true to required slopes. While laying concrete, care shall be taken to see that the strips are not damaged/disturbed by the labourers. The tops of strips shall be visible clearly after finishing with cement slurry.

IV. Laying of Flooring without Strips : Laying of cement concrete flooring in alternate panels may be allowed by the Engineer-in-Charge in case strips are not to be provided.

V. Shuttering : The panels shall be bounded by angle iron or flats. The angle iron/flat shall have the same depth as the concrete flooring. These shall be fixed in position, with their top at proper level giving required slopes. The surface of the angle iron or flats, to come in contact with concrete shall be smeared with soap solution or non-sticking oil (Form oil or raw linseed oil) before concreting. The flooring shall butt against the unplastered masonry wall.

VI. Concreting : The concreting shall be done in the manner described under 11.2.4.2. The angle iron/ flats used for shuttering, shall be removed on the next day of the laying of cement concrete. The ends thus exposed shall be repaired, if damaged with cement mortar 1 : 2 (1 cement : 2 coarse sand) and allowed to set for minimum period of 24 hours. The alternate panels shall then be cleaned of dust, mortar, droppings etc. and concrete laid. While laying concrete, care shall be taken to see that the edges of the previously laid panels are not damaged and fresh mortar is not splashed over them. The joints between the panels should come out as fine straight lines.

VII. Finishing

- The finishing of the surface shall follow immediately after the cessation of beating. The surface shall be left for some time, till moisture disappears from it or surplus water can be mopped up. Use of dry cement or cement and sand mixture stiffening the concrete to absorb excessive moisture shall not be permitted. Excessive trowelling shall be avoided.
- Fresh cement shall be mixed with water to form a thick slurry and spreaded @ 2 kg of cement over an area of one sqm of flooring while the flooring concrete is still green. The cement slurry shall then be properly processed and finished smooth.
- The edges of sunk floors shall be finished and rounded with cement mortar 1:2 (1 cement : 2 coarse sand) and finished with a floating coat of neat cement.
- The junctions of floor with wall plaster, dado or skirting shall be rounded off where so specified.

- The men engaged on finishing operations shall be provided with raised wooden platform to sit on so as to prevent damage to new work.

VIII. Curing

The curing shall be done for a minimum period of ten days. Curing shall not be commenced until the top layer has hardened. Covering with empty gunnies bag shall be avoided as the colour of the flooring is likely to be bleached due to the remnants of cement dust from the bags.

2.05 Precautions

Flooring in lavatories and bath room shall be laid only after fixing of water closet and squatting pans and floor traps. Traps shall be plugged while laying the floors and opened after the floors are cured and cleaned. Any damage done to W.C.'s squatting pans and floor traps during the execution of work shall be made good.

During cold weather, concreting shall not be done when the temperature falls below 4°C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work redone. During hot weather, precautions shall be taken to see that the temperature of wet concrete does not exceed 38° C. No concreting shall be laid within half an hour of the closing time of the day, unless permitted by the Engineer-in-Charge. To facilitate rounding of junction of skirting, dado and floor, the skirting/dado shall be laid along with the border or adjacent panels of floor.

2.06 Measurement

Length and breadth shall be measured before laying skirting, dado or wall plaster. No deduction shall be made nor extra paid for voids not exceeding 0.20 sqm. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 sqm.

The flooring done either with strips (in one operation) or without strips (in alternate panels) shall be treated as same and measured together.

2.07 Rate

The rate shall include the cost of all materials and labour involved in all the operations described above including application of cement slurry on RCC slab or on base concrete including roughening and cleaning the surface but excluding the cost of strips which shall be paid separately under relevant item. Nosing of steps where provided shall be paid for separately in running metre.

Nothing extra shall be paid for laying the floor at different levels in the same room or courtyard and rounding off edges of sunk floors. In case the flooring is laid in alternate panels, nothing extra shall be paid towards the cost of shuttering used for this purpose.

3.1 CEMENT CONCRETE FLOORING WITH METALLIC HARDENER TOPPING

Wherever floors are required to withstand heavy wear and tear, use of floor hardener shall be avoided as far as possible by using richer mixes of concrete, unless the use of a metallic hardener is justified on the basis of cost. Where metallic hardener topping is used, it shall be 12 mm thick.

3.1.1 Metallic Hardening Compound

The compound shall be of approved quality consisting of uniformly graded iron particles, free from non-ferrous metal particles, oil, grease sand, soluble alkaline compounds. Where so directed by the Engineer-in-Charge it shall be tested as described in Appendix A.

3.1.2 Base Concrete

It shall be as specified in 11.2.2.

3.1.3 Under Layer

Cement concrete flooring of specified thickness and mix (mentioned in item for under layer) shall be laid as under layer (11.2.1 and 11.2.4). The top surface shall be roughened with brushes while the concrete is still green and the forms/strips shall be kept projecting up 12 mm over the concrete surface, to receive the metallic hardening compound topping.

3.1.4 Topping

This shall consist of 12 mm thick layer of mix 1:2 (1 cement : 2 stone aggregate 6 mm nominal size) by volume or as otherwise specified with which metallic hardening compound is mixed in the ratio of 1 : 4 (1 metallic concrete hardener : 4 cement) by weight. Metallic hardener shall be dry mixed thoroughly with cement on a clean dry pacca platform. This dry mixture shall be mixed with stone aggregate 6 mm nominal size or as otherwise specified in the ratio of 1 : 2 (1 cement : 2 stone aggregate) and well turned over. Just enough water shall then be added to this dry mix as required for floor concrete.

The mixture so obtained shall be laid in 12 mm thickness, on cement concrete floor within 2 to 4 hours of its laying. The topping shall be laid true to provide a uniform and even surface. It shall be firmly pressed into the bottom concrete so as to have good bond with it. After the initial set has started, the surface shall be finished smooth and true to slope with steel floats.

The junction of floor with wall plaster, dado or skirting and finishing operations shall be dealt with as described in 11.2.5.

The men engaged on finishing operations shall be provided with raised wooden platform to sit on, so as to prevent damage to new work.

The specifications for curing, precautions to be taken, 'Measurements' and 'Rates' shall be as specified in 11.2.

(i) KOTA STONE FLOORING

- **Kota Stone Slabs**

The slabs shall be of selected quality, hard, sound, dense and homogeneous in texture free from cracks, decay, weathering and flaws. They shall be hand or machine cut to the requisite thickness. They shall be of the colour indicated in the drawings or as instructed by the Engineer-in-Charge.

The slabs shall have the top (exposed) face polished before being brought to site, unless otherwise specified. The slabs shall conform to the size required. Before starting the work the contractor shall get the samples of slabs approved by the Engineer-in-Charge.

- **Dressing**

Every slab shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane.

The thickness of the slab after it is dressed shall be 20, 25, 30 or 40 mm as specified in the description of the item. Tolerance of ± 2 mm shall be allowed for the thickness. In respect of length and breadth of slabs Tolerance of ± 5 mm for hand cut slabs and ± 2 mm for machine cut slabs shall be allowed.

- **Preparation of Surface and Laying**

The specification shall be as described in 11.19.3 except that the edges of the slabs to be jointed shall be buttered with grey cement, with admixture of pigment to match the shade of the slab. The thickness of the joints should be minimum as possible. In any location, it shall not exceed 1 mm.

- **Polishing and Finishing**

The specifications shall be as described in 11.19.3 except that (a) first polishing with coarse grade carborundum stone shall not be done, (b) cement slurry with or without pigment shall not be applied on the surface before polishing.

- **Measurements and Rates**

These shall be as described in paras 11.19.5 and 11.19.6.

3.2 KOTA STONE IN RISERS OF STEPS, SKIRTING AND DADO

I. Kota Stone Slabs and Dressing shall be as specified in 11.21.1 and 11.21.2 except that the thickness of the slabs shall be 25 mm or as specified in the description of the item. The slabs may be of uniform size if required.

II. Preparation of surface shall be as specified in 11.20.2.

III. Laying shall be as specified in 11.20.3 except that the joints of the slabs shall be set in grey cement mixed with pigment to match the shade of the slabs.

IV. Curing, Polishing and Finishing shall be as specified in 11.20.4 except that first polishing with coarse grade carborundum stone shall not be done.

3.2.1 Measurements

Length shall be measured along the finished face of riser, skirting or dado correct to a cm. Height shall be measured from the finished level of tread of floor to the top (the underside of tread in the case of steps). This shall be measured correct to a mm in the case of risers of steps and skirting and correct to a cm in the case of dado. The area shall be calculated in square metre correct to two places of decimal.

Lining of pillars etc. shall also be measured under this item.

3.2.2 Rate

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

3.3 CUDDAPAH STONE FLOORING

1. MATERIALS

- **Cuddapah Stone:** Sound, hard, durable and approved Cuddapah stone slabs of specified thickness, free from cracks, cavities, laminations and other defects, with uniform colour and texture matching the approved sample/existing flooring.
- **Cement:** Approved cement conforming to relevant IS standards.
- **Cement Mortar:** Approved cement mortar of specified proportion for bedding and laying.
- **Jointing Material:** Grey cement mixed with suitable pigment to match the colour/shade of the Cuddapah stone.
- **Water:** Clean water suitable for mixing and curing.

2. SURFACE PREPARATION

The base shall be thoroughly cleaned, levelled and prepared to receive the stone flooring. Dust, loose material, laitance, grease and other contaminants shall be removed. Necessary hacking/keying shall be carried out wherever required to ensure proper bonding.

3. LAYING AND WORKMANSHIP

Cuddapah stone slabs shall be accurately cut, dressed and laid to the required **line, level, slope and pattern** over the approved cement mortar bed.

Slabs shall be properly pressed and levelled to ensure full and uniform bedding. Joints shall be straight, uniform and filled with grey cement mixed with pigment matching the stone shade.

The finished flooring shall have proper levels and slopes towards floor drains, where applicable. Edges, thresholds and junctions with adjoining flooring shall be neatly finished.

4. CURING, POLISHING AND FINISHING

The completed flooring shall be adequately cured. The Cuddapah stone shall be **honed/polished to the specified finish**, using suitable grades of abrasive/carborundum as required.

The final surface shall be smooth, even, level and free from stains, cracks, chips, lipping, hollowness and other defects.

5. QUALITY CONTROL

The flooring shall be checked for **stone thickness, colour, texture, level, slope, joint width, alignment, bedding and surface finish**. Any cracked, hollow, chipped or defective slab shall be removed and replaced as directed.

6. HERITAGE PROTECTION

For heritage restoration works, Cuddapah stone shall match the existing flooring in **colour, texture, thickness, finish, size and joint pattern** wherever applicable.

Existing floors, skirting, walls, thresholds and decorative elements shall be protected during execution. No unnecessary cutting or damage to original heritage fabric shall be permitted.

7. MEASUREMENT AND PAYMENT

Measurement shall be in **square metres (m²)** of finished flooring actually laid and approved, measured on the finished surface.

The rate shall include **Cuddapah stone slabs, dressing, cutting, cement mortar, jointing pigment, surface preparation, laying, curing, honing/polishing, finishing, labour, tools & plant, wastage, transportation, lifting and all incidental charges**, complete in all respects.

3.4 GRANITE STONE FLOORING

Providing and fixing **18 mm thick granite stone slabs** for flooring, including dressing, cutting, surface preparation, laying, jointing, curing, polishing and finishing, complete as directed by the Engineer-in-Charge.

1. MATERIALS

- **Granite Stone:** 18 mm thick, sound, hard, durable and approved granite slabs, free from cracks, cavities, stains and other defects, with uniform colour, texture and pattern as per approved sample.
- **Cement:** Approved cement conforming to relevant IS standards.
- **Cement Mortar:** Approved cement mortar of specified proportion for bedding and laying.
- **Jointing Material:** Cement slurry/paste or suitable approved jointing material matching the colour of the granite.
- **Water:** Clean water suitable for mixing and curing.

2. SURFACE PREPARATION

The base shall be thoroughly cleaned, levelled and prepared to receive the granite flooring. Dust, loose material, laitance, grease and other contaminants shall be removed. Necessary hacking/keying shall be carried out wherever required to ensure proper bonding.

3. LAYING AND WORKMANSHIP

- i. 18 mm thick granite slabs shall be accurately **cut, dressed and laid** to the required line, level, slope, pattern and approved layout.
- ii. The slabs shall be properly bedded over the approved cement mortar and pressed/levelled to ensure full contact and uniform bedding. Joints shall be straight, uniform and neatly filled with approved jointing material matching the granite.
- iii. The flooring shall be laid with proper alignment and levels, with suitable slope towards floor drains wherever required. Edges, thresholds and junctions with adjoining finishes shall be neatly finished.

4. CURING, POLISHING AND FINISHING

The completed flooring shall be adequately cured. Granite surfaces shall be **machine polished/honed as specified**, including necessary grinding and polishing operations to achieve a uniform smooth finish.

The finished surface shall be level, even, smooth and free from cracks, chips, stains, lipping, hollowness and other defects.

5. QUALITY CONTROL

The completed flooring shall be checked for **thickness, colour, pattern, alignment, level, slope, joint width, bedding and surface finish**. Any cracked, chipped, hollow or defective slab shall be removed and replaced as directed.

6. PROTECTION

Completed granite flooring shall be protected from damage, staining, scratching and construction traffic until completion of adjoining works. Existing walls, doors, skirting and other finished surfaces shall be adequately protected during execution.

7. MEASUREMENT AND PAYMENT

Measurement shall be in **square metres (m²)** of finished granite flooring actually laid and approved, measured on the finished surface.

IV WATER PROOFING TREATMENT

1. WATER PROOFING TREATMENT ON ROOF SLABS

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

1.01 Preparing Surface

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

1.02 Providing and Laying of Cement Slurry

The procedure to prepare and apply the cement slurry shall be same as detailed in clause 22.5.3 except that over projected pipes etc. slurry shall be applied just upto 100 mm height instead of 150 mm height. The slurry shall be applied upto a height of 300 mm on parapet walls and in the groove where the fibre glass cloth is to be tucked.

1.03 Providing and Laying of Fibre Glass Cloth (2nd Layer)

The fibre glass cloth shall be of approved brand and shall be thin, flexible uniformly bonded mat composed of chemically resistant borosilicate glass

fibre distributed in random open porous structure bonded together with a thermosetting resin.

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

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

1.04 Providing and Laying of Cement Slurry for Third Layer

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

On deciding the correct quantity of water required, the slurry shall be prepared by mixing 1.289 kg/m² of grey cement + 0.67 kg./sqm. of Water Proofing Compound + 1.289 kg./sqm. of coarse sand + x litres of water. Slurry shall be prepared for the area to be covered within ½ an hour of mixing.

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

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

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

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

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

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

1.05 Measurement

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

tucking in a flashing grooves shall not be measured. No deductions shall be made for openings or recess or chimney stack, roof lights or Khurras of area upto

0.40 sqm, nor anything extra shall be paid for forming such openings, recess etc. For area exceeding

0.40 sqm. deduction will be made in the measurement for the full opening and nothing extra shall be paid for making such opening.

1.06 Rate

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

2. INTEGRAL CEMENT BASED WATER PROOFING TREATMENT WITH BRICK BAT COBA (Fig. 22.6)

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

2.1 Preparing the Surface

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

2.2 Providing and Laying of Slurry under Base Coat

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

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

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

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

2.3 Laying Base Coat 20 mm thick

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

2.4 Laying Brick Bat Coba

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

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

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

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

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

2.5 Application of Slurry over Brick Bat Coba

After two days of curing of brick bat coba cement slurry prepared as per clause 22.7.3 shall be applied on the surface of brick bat coba. The application of slurry shall be the same as described in clause 22.5.3 which should cover

the haunches/gola, and the remaining small portion of parapet wall and also inside the groove as shown in the figure.

2.6 Laying Finishing Layer (Protective Coat)

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

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

2.7 Curing and Testing the Treatment

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

2.8 Measurement

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

2.9 Rate

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

2.10 Measurements

The height and breadth shall be measured correct to a cm. The height of the gate shall be measured as the length of the double channels and breadth from outside to outside of the end fixed double channels in open position, of the gate. The area shall be calculated in square metres, correct to two places of decimal.

2.11 Rate

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

V EXTERIOR WORKS

PLINTH PROTECTION

1. MATERIALS

1. Cement: Ordinary Portland Cement/approved equivalent conforming to relevant IS standards.
2. Coarse Sand: Clean, well-graded and approved coarse sand, free from silt and organic impurities.
3. Stone Aggregate: Hard, durable and graded 20 mm nominal size aggregate.
4. Brick Ballast: Sound, hard-burnt brick ballast of 40 mm nominal size, free from dust and deleterious matter.
5. Fine Sand: Clean and approved fine sand for grouting the brick ballast bed.
6. Concrete Mix: 1:3:6 by volume – 1 cement : 3 coarse sand : 6 graded stone aggregate.

2. EQUIPMENT AND TOOLS

Suitable excavation tools, rammers/compactors, concrete mixer, measuring boxes, screed, hand tools, levelling instruments, water equipment and other necessary tools & plant shall be provided.

3. WORKMANSHIP

1. The required area shall be carefully excavated, levelled and dressed without damaging the existing plinth or heritage fabric. A 75 mm thick dry brick ballast bed shall be laid, well rammed and consolidated, and properly grouted with fine sand.
2. Over this prepared bed, 50 mm thick cement concrete in 1:3:6 proportion shall be laid, compacted and finished to the required level and slope. The top surface shall be finished smooth and shall provide proper drainage away from the building.
3. Junctions with existing walls, steps and other elements shall be neatly finished. Any damage to adjoining heritage fabric shall be avoided and rectified at the contractor's cost.

4. QUALITY CONTROL

1. The work shall be checked for thickness, levels, slope, compaction, concrete proportion, surface finish and drainage. Materials shall be approved before use. Concrete shall be properly mixed, placed, compacted and cured.

5. PROTECTION

1. Existing plinth masonry, stonework, walls, doors, steps and other adjoining heritage elements shall be adequately protected during excavation and construction. No cutting, chasing or alteration of original fabric shall be carried out without approval.

6. MEASUREMENT AND PAYMENT

1. Measurement shall be in square metres (m²) of completed and approved plinth protection.
2. The rate shall include excavation, disposal of surplus earth, levelling, dressing, 75 mm brick ballast bed, ramming and consolidation, fine-sand grouting, 50 mm cement concrete 1:3:6, mixing, laying, finishing, curing, labour, tools & plant, transportation, lead, protection and all incidental charges, complete in all respects.

VI RESTORATION OF COURTYARD

PART 1---DEMOLITION OF REINFORCED CEMENT CONCRETE (R.C.C.)

1. MATERIALS

No new construction materials are generally required. **Water and approved consumables** required for controlled demolition, dust suppression and cutting operations shall be provided as necessary.

2. EQUIPMENT AND TOOLS

1. Suitable hand tools, breakers, chipping tools, cutting equipment, welding/gas cutting equipment where approved, scaffolding, staging, lifting and handling equipment, machinery, safety equipment and other necessary tools & plant shall be provided.
2. Mechanical equipment shall be selected and operated to minimize vibration and impact on the existing heritage structure.

3. WORKMANSHIP

3. The RCC member shall be carefully inspected and the demolition sequence shall be approved before commencement.
4. Demolition shall be carried out **from top to bottom and in a controlled sequence**, avoiding sudden impact or overloading of adjoining members.
5. Concrete shall be carefully broken and removed without damaging adjoining structural members, walls, finishes, decorative elements or other heritage fabric.
6. Reinforcement shall be exposed and **cut progressively using suitable cutting equipment**.
7. Serviceable reinforcement bars recovered from demolition shall be carefully removed, straightened where required, stacked separately and protected from damage.
8. Dust, debris and loose materials shall be regularly cleared from the work area.
9. Unserviceable debris shall be loaded, transported and disposed of at an approved location as directed by the Engineer-in-Charge.
10. Where required, temporary **supports, shoring, propping and staging** shall be provided to maintain the stability of the existing structure.

4. HERITAGE PROTECTION / QUALITY CONTROL

Demolition shall be executed with **minimum intervention and minimum vibration**, particularly in areas adjoining historic masonry, arches, ceilings, decorative finishes and other original fabric.

No uncontrolled breaking, heavy-impact demolition or alteration of adjoining heritage elements shall be permitted. Any unforeseen structural condition shall be reported immediately and work shall proceed only as directed.

The Engineer-in-Charge shall inspect the exposed area and confirm that demolition is complete and safe before subsequent work proceeds.

5. SAFETY AND PROTECTION

Adequate **barricading, scaffolding, shoring, propping, dust suppression and safety measures** shall be provided. The work area shall be kept safe and free from loose debris.

Existing walls, floors, roofs, services, doors, windows, decorative elements and other adjoining structures shall be suitably protected throughout the demolition.

6. MEASUREMENT AND PAYMENT

Measurement shall be as specified in the BOQ, based on the **actual quantity of RCC work demolished and approved**.

PART 2--- HIPPED ROOF OVER MS STRUCTURAL STEEL WITH 12 MM MULTI-WALL POLYCARBONATE SHEETING

1. MATERIALS

1. **Polycarbonate Sheets:** 12 mm thick multi-wall translucent polycarbonate roofing sheets of approved make, profile and colour, UV-resistant and suitable for external roofing.
2. **Aluminium Profiles:** Approved aluminium glazing/edge, joining and fixing profiles compatible with the polycarbonate sheets.
3. **Sealant:** Weather-resistant, UV-resistant and polycarbonate-compatible sealant.
4. **MS Structural Sections:** Approved quality MS flats, square/round bars, angles, tees and other sections as per approved structural/shop drawings.

5. **Fasteners:** Approved nuts, bolts, washers, holdfasts, anchor fasteners and other necessary hardware.
6. **Primer:** Approved zinc oxide primer suitable for MS surfaces.
7. **Finish Paint:** Two coats of approved exterior-grade enamel paint over one coat of zinc oxide primer.
8. All materials shall be new, sound, approved and suitable for the intended application.

2. EQUIPMENT AND TOOLS

Suitable **cutting, drilling, welding and fabrication equipment, measuring and levelling instruments, scaffolding, staging, ladders, pulleys, lifting equipment, hand tools and other necessary tools & plant** shall be provided.

3. MS FABRICATION AND WORKMANSHIP

MS members shall be **fabricated and fixed strictly as per approved structural/shop drawings**, including cutting, drilling, welding, grinding, alignment and erection at all heights and locations.

The structural frame shall be properly anchored to existing **walls, floors, RCC slabs or other approved supports** using suitable anchor fasteners, holdfasts, nuts and bolts.

Where cutting/chasing of existing floor or wall is required, it shall be carried out carefully and the disturbed areas shall be **properly repaired and restored to their original condition**.

All MS surfaces shall be cleaned and prepared, followed by **one coat zinc oxide primer and two coats enamel paint**.

4. POLYCARBONATE ROOFING

The 12 mm multi-wall polycarbonate sheets shall be fixed over the completed MS framework with approved **aluminium profiles, fasteners, washers, sealants and accessories**.

Sheets shall be accurately cut, aligned and fixed without cracking, distortion or over-tightening. Adequate allowance shall be provided for thermal movement. Joints, hips, edges, ridges and junctions shall be properly sealed and finished to ensure **weather-tightness and proper drainage**.

The hipped roof shall be provided with the required slope, overhang and detailing as per approved drawings and site conditions.

5. QUALITY CONTROL

The completed work shall be checked for **line, level, slope, structural alignment, anchorage, weld quality, bolt fixing, sheet alignment, joint sealing and water-tightness**.

No damaged, cracked or defective polycarbonate sheets shall be used. All exposed MS surfaces shall have complete and uniform protective coating.

6. HERITAGE PROTECTION

Where the new roof interfaces with the existing heritage building, all fixing and anchoring shall be carried out with **minimum intervention**. Existing masonry, decorative finishes, flooring, cornices and other heritage elements shall be protected.

No cutting, chasing or drilling into historic fabric shall be undertaken without prior approval of the Engineer-in-Charge/Conservation Architect.

7. MEASUREMENT AND PAYMENT

Measurement shall be in **square metres (m²)** of completed and approved polycarbonate roof area measured on the finished roof surface

PART 3---RENEWING FLOATING GLASS PANES WITH PUTTY AND NAILS

1. Removing Broken Glass Panes

Old putty shall be raked out with hack knife. The brad (small nails without head) and pieces of broken glass shall be removed from the rebates of the sash bars. The pieces of glass panes as found useful shall be handed over to the Engineer-in-Charge of the work. No glass shall be inserted in frames until they have been primed and prepared for painting so that the wood may not draw oil out of the putty.

2. Floating Glass Panes

The floating glass panes shall conform to specifications described in IS 14900.

3. Fixing

The floating glass panes shall be so cut that it fits slightly loose in the frame and as specified in A&B of IS 14900. A thin layer of Putty conforming to IS 419 shall be prepared by mixing one part of white lead with three parts of finely powdered chalk and then adding the boiled linseed oil to the mixture to form a stiff paste and adding varnish to the paste @ 1 litre of varnish to 18 kg. of paste. The putty so prepared in the form of a stiff paste shall be drawn along the inner edge of the rebate, for bedding the back of the glass panes. The glass pane shall then be put in position, pressed home against the thin layer of the putty, and secured in rebate by new brads. The brads shall not be spaced more than 7.5 cm from each corner and not more than 15 cm apart. The putty shall then be applied in the rebate uniformly, sloping from the inner edge of the rebate. In doing this care shall be taken to keep the putty a little within the inner edge of the rebate and surplus putty removed so that none of it is seen through the glass from the inside. The putty so filled in the rebates shall be levelled smooth and finished in a straight line. When dried the putty shall be covered with a coat of paint of approved quality and shade to match the existing finish of joinery work.

The floating glass panes shall be cleaned with methylated spirit. All splashings or droppings of washing and paints shall be removed. All rubbish and unserviceable materials shall be disposed off to the dumping ground promptly as per the direction of Engineer-in-Charge.

Thickness and Tolerance of Floating Glass

Thick	Toler
4 mm	+ 0.3 mm
5 mm	+ 0.3 mm
6 mm	+ 0.3 mm

Note : Frosted glass panes should be replaced with frosted glass panes.
These shall be fixed with frosted face on the inside.

4. Measurements

Length and breadth of glass panes shall be measured correct to a cm.
The area of the glass panes as fixed shall be calculated in square metre correct to two places of decimal.

APPENDIX A

ABRASION TEST FOR CONCRETE HARDENING COMPOUNDS (Clause 11.3.1)

3.1 Preparation of Sample

25 mm cylinder shall be prepared in ratio 1:2 mix (1 cement: 2 grades stone aggregate 6 mm nominal size by weight) one each with and without the admixture of concrete hardening compound. The concrete hardening compound shall be used in the proportion by weight of cement as recommended by the firm. The cylinder shall be placed inside a damp box for 24 hours and then cured in water for 27 days. After that, they shall be subject to abrasion test on 'Dorry Type Avery Abrasion Testing Machine, using Emery powder No 80 as the abrading medium under the condition given in para A-2 below:

3.2 Conditions of Test

(a) Area of rubbing surface shall be same in both the cylinders.

(b) Age of cylinder 28 days

(c) Duration of Test 60 minutes

(d) Total distance traverse

 During rubbing About 2.4 km

(e) Pressure on rubbing

 0.04 kg/cm² surface

**TEST REQUIREMENTS AND PROCEDURE FOR TESTING “PRE-CAST
CEMENT CONCRETE/ TERRAZO TILES”
(Clause 11.10.1 & 11.11.1)**

3.1 Sampling

The tiles required of carrying out test described below shall be taken by 'random sampling'. Each tile sample shall be marked to identify the consignment from which it was selected.

Minimum quantity of tiles for carrying out the test and frequency of test shall be as specified in the list of Mandatory Test. The number of tiles selected for each mandatory test shall be as follows”

3.1.2	For conformity to requirements on shape and dimensions, wearing layer, and general quality	- 12 tiles
3.1.3	For wet transverse strength test	- 6 tiles
3.1.4	For resistance to wear test	- 6 tiles
3.1.5	For water absorption test	- 6 tiles

Note: (1) The tests on the tiles shall not be carried out earlier than 28 days from the date of manufacture.

(2) The tiles selected for (a) may as well after verification of requirements, be used for (b).

3.2 Flatness of the Tiles Surface

The tiles when tested according to procedure laid down in IS 1237 edition 2.3, the amount of concavity and convexity shall not exceed 1 mm.

3.3 Perpendicularity

When tested in accordance with the procedure laid down in IS 1237 edition 2.3, the longest gap between the arm of the square and edge of the tile shall not exceed 2 per cent of the length of edge.

3.4 Straightness

When tested as per IS 1237 edition 2.3, the gap between the thread and the plane of tile shall not exceed 1 percent of the length of edge.

not exceed 4 mm, for general purpose tiles. And 2 mm and 2.5 mm of average wear on any individual specimen, respectively for heavy duty floor tiles.

priming coat of approved steel primer conforming to IS 2074 before fixing them in position.

3.5 Measurements

The height and breadth shall be measured correct to a cm. The height of the gate shall be measured as the length of the double channels and breadth from outside to outside of the end fixed double channels in open position, of the gate. The area shall be calculated in square metres, correct to two places of decimal.

3.6 Rate

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

PART C - CARPENTRY WORKS

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I. GENERAL:

1. The detailed specifications given here after are for the items of works Described in the schedule of quantities attached here in, and shall be guidance for proper execution of work to the required standards.
2. It may also be noted that the specification are of generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings.
3. The Consulting Architects shall be the sole deciding authority as to the meaning, interpretations and implication for various provisions of the specifications and his decision in writing shall be final and binding on all concerned.
4. In case any difference or discrepancy between the specifications and the Description in the schedule of quantities, the schedule of quantities shall take precedence.
5. In case any difference or discrepancy between the specifications and the drawing, the specification shall take precedence.

Unless specifically otherwise mentioned, all the applicable latest codes and standards published by the Bureau of Indian Standards and all other standards, shall govern in all respects of design, workmanship, quality, properties of materials, method of testing and method of measurements.

II CARPENTRY

2.01 NEW CARPENTRY WORK

I. FRAMES AND SHUTTER

1. Seasoned Timber:

Timber whose moisture content has been reduced to the specified minimum, under more or less controlled processes of drying.

2. Structural Timber :

Timber used in framing and load bearing structures or timber used or intended for use in buildings where strength is the primary consideration.

3. First Class Wood:

Individual hard and sound knots shall not be more than 25mm in diameter and the aggregate area of all the knots shall not exceed one percent of the area of the piece.

4. Second Class Wood:

Individual hard and sound knot shall not be more than 40 mm in diameter and aggregate of all the knots shall not exceed one and half per cent of the area of the piece. Wood shall be generally free from sapwood, but traces of sapwood may be allowed.

5. Please Refer precaution in CPWD Specification Vol-1 in clause no - 9.1.8

6. Please Refer precaution in CPWD Specification Vol-1 in clause no - 9.3

7. Please Refer precaution in CPWD Specification Vol-1 in clause no - 9.6

For the preservation of teak wood, periodic applications of crude earth oil or boiled linseed oil are efficacious For other kinds of wood "Solignum " is generally preferable.

Woodwork found in wet soil or water should not be exposed to the air, but should be kept in water or wet sand or wet sawdust pending receipt of instructions as to its treatment from the Archaeological Chemist. Before

being laid in wet sand or sawdust, painted, carved or inscribed parts should be protected by a layer of cotton wool. These precautions are necessary to prevent shrinkage and distortion of the wood through too rapid drying.

If woodwork is found to be infected with injurious insects, the pest may be destroyed by means of carbon disulphide or hydrocyanic acid, the wood being afterwards protected against further damage by the application of a suitable preservative.

HARDWARE

Providing, fabricating and fixing second-class seasoned Teak Wood door frame of size 125 × 100 mm and 35 mm thick Teak Wood shutter, accurately fabricated and installed as per approved detailed drawing.

The shutter shall be provided with 5 mm thick fixed glass of approved make, properly cut, fitted and secured. Door shall be complete with 125 × 75 × 75 mm AB Magnum hinges – 5 Nos., 10 × 150 mm anchor fasteners – 12 Nos., 300 mm Crown Handle AB Magnum – 1 No., 200 mm brass aldop – 1 No., 250 mm brass tower bolts – 2 Nos. and brass door stopper – 1 No.

All timber shall be sound, seasoned and free from defects. Frame and shutter shall be fixed true to line, level and plumb, with all hardware securely fitted for smooth operation.

The rate shall include all materials, glass, hardware, fasteners, labour, tools, supports, fixing, adjustments and all incidental works, complete in all respects as per approved drawings and instructions of the Engineer-in-Charge.

II. SHUTTER

Providing, fabricating and fixing rolling shutter made of approved quality galvanized steel/steel laths of suitable gauge and thickness, with interlocked shutter curtains, guide channels, bottom plate, hood, brackets, springs and rolling mechanism, complete as per approved drawing.

The shutter shall be accurately fabricated and installed true to line, level and plumb, with smooth and easy operation. All components shall be securely fixed to the structural opening with necessary fasteners, supports and accessories. Exposed steel surfaces shall be suitably treated and finished with approved primer and paint/coating.

The rate shall include all materials, fabrication, hardware, fixing accessories, labour, tools, supports, transportation, painting/finishing and all

incidental works, complete in all respects as directed by the Engineer-in-Charge.

III. LOUVERS

Providing, fabricating and fixing **louvers** using approved quality seasoned timber/wood, of required section and size as per approved drawing. Louvers shall be properly fabricated with uniform spacing, inclination and alignment, securely fixed to the existing/new frame with suitable supports, screws and fittings.

The work shall include **cutting, dressing, machining, fixing, alignment and finishing** of all louver members. All timber shall be sound, seasoned and free from defects. The completed louvers shall be rigid, properly aligned and provide adequate ventilation while preventing direct rain entry.

The rate shall include **all materials, labour, fasteners, fittings, tools, supports, transportation and incidental works**, complete in all respects as directed by the Engineer-in-Charge.

2. REPAIR OF EXISTING CARPENTRY

Providing, fabricating and fixing **rolling shutter** made of approved quality galvanized steel/steel laths of suitable gauge and thickness, with interlocked shutter curtains, guide channels, bottom plate, hood, brackets, springs and rolling mechanism, complete as per approved drawing.

The shutter shall be accurately fabricated and installed **true to line, level and plumb**, with smooth and easy operation. All components shall be securely fixed to the structural opening with necessary fasteners, supports and accessories. Exposed steel surfaces shall be suitably treated and finished with approved primer and paint/coating.

The rate shall include **all materials, fabrication, hardware, fixing accessories, labour, tools, supports, transportation, painting/finishing and all incidental works**, complete in all respects as directed by the Engineer-in-Charge.

III GLASS WORK

i) CLEAR GLASS

1. MATERIALS

A. Glass:

Provide new clear float glass of approved make, thickness and quality to match the existing glass or as specified in the approved drawings. Glass shall be clear, uniform in thickness and free from cracks, chips, scratches, bubbles, distortion and other visible defects.

B. Glazing Putty/Sealant:

Provide approved quality glazing putty, sealant or glazing compound specifically suitable for fixing clear glass to the existing/new frame.

C. Glazing Beads and Accessories:

Provide new glazing beads, rubber gaskets, clips, supports, screws, fasteners and other accessories to match the existing installation or as approved.

D. Cleaner:

Use manufacturer's standard glass-cleaning solution suitable for cleaning clear glass surfaces without causing damage, stains or scratches.

E. Water for Cleaning:

Use clean, potable water, free from oils, acids, alkalis, salts and organic matter.

F. Cleaning Cloths:

Provide clean, soft and lint-free cloths suitable for cleaning glass surfaces.

2. EQUIPMENT

The following equipment shall be used as required:

- Glass cutting tools.
- Glass suction lifters and handling equipment.
- Soft/stiff bristle brush.
- Vacuum cleaner.
- Suitable hand tools for fixing and installation.
- Ladders, scaffolding and safety equipment as required.

3. EXECUTION**A. Replacement of Broken, Missing or Damaged Glass**

1. Before replacing broken or missing glass, provide temporary supports and protection as required to prevent damage to the frame and surrounding work.

2. Carefully remove glazing beads, putty, sealant, clips or other fixing materials around the glass to be replaced.

3. Remove all broken glass fragments and foreign materials from the frame/rebate. Clean the fixing channel thoroughly before installation.

4. Measure and cut the new glass accurately to the required size, allowing suitable clearance for proper installation.

5. Place the new glass carefully in position using approved glazing blocks, gaskets, putty or sealant, as applicable.

6. Refix the glazing beads, clips or other retaining accessories securely and ensure that the glass is properly aligned and supported.

7. Apply approved sealant neatly wherever required to provide a proper and weather-resistant finish.

8. Ensure that the completed glass is firm, properly aligned and free from excessive stress or movement.

4. CLEANING

1. Clean all accessible clear glass surfaces after completion of installation.

2. Remove loose dirt, dust and construction debris using a soft brush or vacuum cleaner.

3. Wash both sides of the glass using a clean, soft cloth and approved glass-cleaning solution.

4. Rinse both surfaces thoroughly using clean water to remove all cleaning solution and dirt residue. Change rinse water frequently.

5. Repeat the cleaning process as required to obtain a clean and clear appearance.

6. Wipe the surface with a clean, dry, soft cloth to prevent streaks, water marks and residue.

5. PROTECTION AND FINAL CLEANING

1. Protect the completed glasswork from scratches, impact, dust, paint, cement and other construction activities.
2. Provide temporary protective coverings wherever necessary without damaging the glass or frame.
3. At completion of the project, remove all protective coverings and inspect the glass for damage.
4. Re-clean any soiled or contaminated glass surfaces using the approved cleaning materials and procedures.
5. Any glass damaged due to improper handling or construction activity shall be removed and replaced with new glass.
6. The completed clear glass installation shall be handed over in a clean, clear, undamaged and properly finished condition, complete in all respects as directed by the Engineer-in-Charge.

II) STAIN GLASS

1. MATERIALS

A. Glass:

Provide new glass to match the existing glass in terms of **opacity, colour, thickness, texture, pattern and other aesthetic characteristics.**

B. Putty:

Use standard putty manufactured specifically for **lead/stained glass work**, suitable for securely holding the glass within the lead came.

C. Braces and Other Accessories:

Provide new braces, supports and other accessories to **match the existing installation** in material, size, appearance and function.

D. Cleaner:

Use the manufacturer's standard **ammonia-based cleaning solution** specifically designed for cleaning lead/stained glass surfaces.

E. Water for Cleaning:

Use clean, potable water, free from **oil, acids, alkalis, salts and organic matter.**

F. Cleaning Cloths:

Provide clean, soft and lint-free cloths suitable for cleaning glass surfaces without causing scratches or damage.

2. EQUIPMENT

The following equipment shall be used as required:

- Stiff-bristle brush.
- Vacuum cleaner.
- Suitable hand tools for removal and installation of glass.
- Other necessary tools and equipment required for safe execution of the work.

3. EXECUTION

A. Replacement of Broken, Missing or Non-Original Glass

1. Before replacing broken or missing glass, provide **temporary braces and supports** as required to protect the leaded glasswork from deflection, movement or other damage.

2. Carefully pry up the edges of the **lead came** around the location of the glass to be replaced.

3. Remove all fragments of broken glass, putty and other foreign materials from the channel of the lead came that may interfere with installation of the replacement glass.

4. Accurately measure and cut the new replacement glass to match the existing piece. Install the glass in position using suitable **putty within the lead came channels** to hold the new glass securely.

5. Press the lead came back into its proper and flat position and repair any **broken, loose or damaged solder joints** as required.

6. Ensure that the replacement glass matches the existing glass in **colour, pattern, thickness, texture, opacity and overall appearance**.

4. CLEANING

1. Clean all accessible **leaded/stained glass surfaces** after completion of the installation.

2. Remove loose dirt and dust from the glass surface using a **soft brush or vacuum cleaner**.

3. Wash both sides of the glass using a clean, soft cloth and the approved glass-cleaning solution.

4. Thoroughly rinse both surfaces using clean water and a clean cloth to completely remove dirt and cleaning-agent residue. Change the rinse water frequently to avoid redepositing dirt.

5. Repeat the cleaning process as necessary until the required appearance is achieved and matches the approved **mock-up/sample**.

6. Wipe the entire surface with a clean, dry, soft cloth to prevent **streaks, water marks and residue**.

5. PROTECTION AND FINAL CLEANING

1. Protect the completed leaded/stained glasswork from **damage, dust, impact and contamination** during subsequent construction and finishing activities.

2. Provide suitable temporary protective coverings wherever necessary without causing damage to the glass, lead came or supporting members.

3. Upon completion of the project, carefully remove all protective coverings.

4. Re-clean any soiled or contaminated glass surfaces using the **approved cleaning materials and procedures specified above**.

5. The completed stained glass installation shall be handed over in a **clean, undamaged, properly aligned and finished condition**, complete in all respects as directed by the Engineer-in-Charge.

iii) COLOURED GLASS

1. MATERIALS

A. Glass:

Provide new **coloured/decorative glass** of approved make, thickness, colour, shade, texture, pattern and finish to match the existing glass or as specified in the approved drawings. Glass shall be free from cracks, chips, scratches, stains and other visible defects.

B. Glazing Putty/Sealant:

Provide approved quality glazing putty, sealant or glazing compound suitable for fixing coloured glass and compatible with the frame and glass.

C. Glazing Beads and Accessories:

Provide new glazing beads, rubber gaskets, clips, supports, screws, fasteners and other necessary accessories to match the existing installation or as approved.

D. Cleaner:

Use a manufacturer's standard cleaning solution specifically suitable for **coloured/decorative glass surfaces**, without affecting the colour, coating, texture or finish.

E. Water for Cleaning:

Use clean, potable water, free from oils, acids, alkalis, salts and organic matter.

F. Cleaning Cloths:

Provide clean, soft and lint-free cloths suitable for cleaning coloured glass without scratching or damaging the surface.

2. EQUIPMENT

The following equipment shall be used as required:

- Glass cutting and edge-finishing tools.
- Glass suction lifters and handling equipment.
- Soft-bristle brush.
- Vacuum cleaner.
- Suitable hand tools for fixing and installation.
- Ladders, scaffolding and safety equipment as required.

3. EXECUTION

A. Replacement of Broken, Missing or Damaged Glass

1. Before replacing broken or missing coloured glass, provide **temporary supports and protection** as required to prevent deflection or damage to the existing frame and adjacent glass.

2. Carefully remove glazing beads, putty, sealant, clips and other fixing materials around the damaged glass.

3. Remove all fragments of broken glass and other materials from the frame/rebate and clean the fixing channel properly.

4. Provide new coloured glass accurately matching the existing **colour, shade, thickness, texture, pattern and finish**.

5. Cut the replacement glass accurately to the required dimensions with suitable clearance for fixing.

6. Carefully install the new glass using approved glazing blocks, gaskets, putty or sealant, as applicable.

7. Refix glazing beads, clips and other retaining accessories securely and ensure proper alignment.

8. Apply approved sealant neatly wherever required and ensure that the completed glass is securely fixed without excessive stress.

4. CLEANING

1. Clean all accessible coloured glass surfaces after completion of installation.

2. Remove loose dirt and dust using a **soft brush or vacuum cleaner**.

3. Wash both sides of the glass using a clean, soft cloth and approved glass-cleaning solution suitable for the particular glass finish.

4. Rinse the surfaces thoroughly using clean water to completely remove dirt and cleaning-agent residue.

5. Repeat the cleaning process as required to achieve the required appearance and match the approved sample/mock-up.

6. Wipe the surface with a clean, dry, soft cloth to prevent **streaks, water marks and residue**.

5. PROTECTION AND FINAL CLEANING

1. Protect the completed coloured glass from **scratches, impact, dust, paint, cement, chemicals and other construction activities**.

2. Provide suitable temporary protective coverings wherever necessary, ensuring that the covering does not damage or affect the glass finish or colour.

3. At completion of the project, remove all protective coverings and inspect the glass for damage or defects.

4. Re-clean any soiled surfaces using approved cleaning materials and procedures.

5. Any coloured glass damaged due to improper handling or construction activity shall be **removed and replaced with matching glass**.

6. The completed coloured glass installation shall be handed over in a **clean, undamaged, properly aligned and aesthetically uniform condition**, complete in all respects as directed by the Engineer-in-Charge.

A. FIXING DOOR, WINDOW OR CLERESTORY WINDOW CHOWKHATS IN EXISTING OPENING

a) Making Holes

1. In case of door frames without sills, holes 40 mm deep shall be made in the floor for fixing the lower end of verticals of the frames. For doors with sills, the sill plates shall be partly fixed in the floor so that they project above the floor to the height as directed by the Engineer-in-Charge.

2. For embedding hold fasts of doors, windows or clerestory windows, the requisite number of holes at the correct positions shall be cut out in the masonry. The size of the holes shall be such that the chowkhats with the hold-fasts can be conveniently erected in position. Where necessary, masonry shall be chipped uniformly to facilitate easy insertion of the frame in the opening.

3. Special care shall be taken when holes are made in load bearing pillars or wall portions separated by openings to ensure that beams etc. supported by them are properly propped up. In such portions cutting holes shall be done on one side at a time. The sides of the holes shall be truly parallel and perpendicular to the plane of the wall. Due care shall be taken, not to disturb the adjoining masonry and the masonry under the bearings of lintels and arches etc. spanning the opening. The holes shall then be cleaned of all dust, mortar and brick bats or stone pieces and thoroughly wetted.

b) Fixing

The sides of chowkhats of door, window or clerestory window abutting against or to be embedded in masonry shall be painted with two coats of coal tar before being placed in position. The chowkhats shall then be inserted in position with their hold-fasts bolted tight. The chowkhats shall then be adjusted to proper line and plumb and secured in position by temporary bracing which shall not be disturbed or removed until the hold fasts are embedded in the masonry and the concrete block has set. The concrete to be used for embedding hold-fasts shall be cement concrete 1:3:6 mix (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size).

The minimum size of concrete block in which the hold-fasts will be embedded shall be 30 x 10 x 15 cm for 35 cm long holdfasts. The concrete of the block shall completely fill the hole made in the masonry for the purpose. The chase cut in the floor shall be cut square and construction joint shall be provided filled in with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4

graded stone aggregate 20 mm nominal size) and rendered smooth at the top and finished to match the existing type of floor.

c) Finishing

After the surface surrounding the hold-fasts has sufficiently dried it shall be cleaned of dust etc. and wetted. It shall then be plastered with cement mortar 1:4 (1 cement : 4 fine sand) flush and matching with the surrounding plaster work. In case of exposed brick work, stone work, the finishing shall be done to match the surrounding. Any other portion of the wall opening, if damaged, shall be repaired in similar way.

After the cement plaster patches have been thoroughly cured and dried, they shall either be white washed or colour washed as required unless otherwise specified. All malba and debris obtained from cutting etc. shall be disposed off to the nearest dumping ground promptly as directed by Engineer-in-Charge.

d) Measurements

The chowkhats of doors, window and clerestory windows shall be enumerated separately.

e) Rate

The rate shall apply irrespective of the size of the chowkhat upto a maximum area of opening 3.75 square metres for doors, 2.5 square metres for windows and 1.2 square metres for clerestory windows. The rate is inclusive of labour and materials involved in all the operations described above, excluding (a) cost of chowkhats and (b) cost of supplying and fixing the hold-fasts including C.C. block and bolts.

B. FIXING CHOWKHATS IN EXISTING OPENING IN BRICKS / RCC WALL WITH DASH FASTNERS

- i. In case of door frames without sills, holes 40 mm deep shall be made in the floor for fixing the lower end of verticals of the frames. For doors with sills, the sill plates shall be partly fixed in the floor so that they project above the floor to the height as directed by the Engineer-in-Charge.
- ii. For fixing dash fasteners /chemical fasteners of doors, windows or clerestory windows, the requisite number of holes at the correct positions shall be in the masonry/RCC wall. The size of holes shall be such that the fasteners can be conveniently placed in position. Where

necessary, masonry shall be chipped uniformly to facilitate easy insertion of the frame in the opening.

- iii. Special care shall be taken when holes are made in load bearing pillars or wall portions separated by openings to ensure that beams etc. supported by them are properly propped up. In such portions cutting holes shall be done on one side at a time. The sides of the holes shall be truly parallel and perpendicular to the plane of the wall. Due care shall be taken, not to disturb the adjoining masonry and the masonry under the bearings of the lintels and arches etc. spanning the opening. The holes shall then be cleaned of all dust, mortar and brick bats or stone pieces and thoroughly wetted.

a) Fixing

- i. The sides of chowkhats of door, window or clerestory window abutting against or to be embedded in masonry shall be painted with two coats of coal tar before being placed in position. The chowkhats shall then be inserted in position tight. The chowkhats shall then be adjusted to proper line and plumb and secured in position by temporary bracing which shall not be disturbed or removed until the fasteners are embedded in the masonry /RCC wall.

b) Finishing

- i. After the surface surrounding the hold-fasts has sufficiently dried it shall be cleaned of dust etc. and wetted. It shall then be plastered with cement mortar 1:4 (1 cement: 4 fine sand) flush and matching with the surrounding plaster work. In case of exposed brick work, stone work, the finishing shall be done to match the surrounding. Any other portion of the wall opening, if damaged, shall be repaired in similar way.
- ii. After the cement plaster patches have been thoroughly cured and have dried, they shall either be white washed or colour washed as required unless otherwise specified. All malba and debris obtained from cutting etc. shall be disposed off to the nearest dumping ground.

c) Measurements

The chowkhats of doors, window and clerestory windows shall be enumerated separately.

d) Rate

The rate shall apply irrespective of the size of the chowkhat upto a maximum area of opening 3.75 square metres for doors, 2.5 square metres for windows and 1.2 square metres for clerestory windows. The

rate is inclusive of labour and materials involved in all the operations described above, including cost of dash fasteners chemical fasteners but excluding cost of chowkhat.

C.RENEWING FLOATING GLASS PANES WITH WOODEN FILLETS

I. Removing Broken Glass Panes

The specifications shall be the same as in para 14.5.1 except that the wooden fillets including nails shall be taken out carefully.

II. Glazing

- i. The specifications for glass panes and their fixing shall be the same as per IS 14900. The fillet shall either be fixed flush or projected uniformly to match with the existing work by means of nails (brads).
- ii. The new fillet provided shall be painted or finished otherwise to match with the existing finish of the joinery work.
- iii. The glass panes shall be cleaned with methylated spirit of all sorts of splashing and droppings of wash and paints.
- iv. All rubbish and unserviceable materials shall be disposed off in the dumping ground promptly as per the direction of Engineer-in-Charge.

III. Measurements

Length and breadth of glass panes shall be measured correct to a cm. The area of the glass panes as fixed shall be calculated in square metre correct to two places of decimal. The new wooden fillets fixed shall be measured in running metres correct to a cm.

IV. Rate

The rates shall include the cost of labour and material involved in all the operations described above except that the cost of new wooden fillets used in the work and their finishing shall be paid for separately.

D.RENEWING FLOATING GLASS PANES AND REFIXING EXISTING WOODEN FILLETS

The specifications shall be same as described in 14.6 above.

1. PROVIDING NEW WOODEN FILLETS

The fillets shall be of wood, as specified in the item of work, these shall be cut and planed smooth to the required shape and dimensions.

A. Fixing

1. The specifications for glass panes and their fixing shall be the same as given in 9.6.4.6. The fillet shall either be fixed flush or projected uniformly to match the existing work.
2. The fillet shall be painted or finished otherwise to match with the existing finish of the joinery work.
3. The glass panes shall be cleaned with methylated spirit of all sorts of splashing and dropping of wash and paints.

B. Measurements

The fillets shall be measured in running metres. The lengths shall be measured correct to a cm.

C. Rate

The rate shall include the cost of all labour and materials involved in all the operations described above. The rate shall also include the cost of removal of worn out fillets, when these are met with in old work. The rate shall vary according to the class of wood used.

2. RENEWAL OF OLD PUTTY OF GLASS PANES

The old putty shall be removed as specified in 14.5.1 and new putty fixed as specified in 14.5.3.

A. Measurements

The work shall be measured in running metres. The length along the rebate shall be measured correct to a cm.

B. Rate

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

3. REFIXING OLD GLASS PANES WITH PUTTY AND NAILS

Specification same as described in 14.5 above. Except for the glass panes, old glass panes will be used for which nothing extra will be paid.

4. FIXING OLD GLASS PANES WITH WOODEN FILLETS

Specifications same as described in para no. 14.6 above except for the glass panes. Old glass panes will be used for which nothing extra shall be paid.

5. PANELLED GLAZED OR PANELLED AND GLAZED SHUTTERS

i. Pannelled or glazed shutters for doors, windows, ventilators and cupboards shall be constructed in the form of timber frame work of stiles and rails with panel inserts of timber, plywood, block board, veneered particle board, fibre board wire gauze or sheet glass. The shutters may be single or multipanelled, as shown in the drawings or as directed by the Engineer-in-Charge. Timber for frame work, material for panel inserts and thickness of shutters shall be as specified. All members of the shutters shall be straight without any warp or bow and shall have smooth well planed face at right angles to each other.

II. Any warp or bow shall not exceed 1.5 mm. The right angle for the shutter shall be checked by measuring the diagonals and the difference between the two diagonals should not be more than ± 3 mm.

A. Frame Work

Timber for stiles and rails shall be of the same species and shall be sawn in the directions of grains. Sawing shall be truly straight and square. The timber shall be planed smooth and accurate to the required dimensions. The stiles and rails shall be joined to each other by plain or haunched mortise and tenon joints and the rails shall be inserted 25 mm short of the width of the stiles. The bottom rails shall have double tenon joints and for other rails single tenon joints shall be provided. The lock rails of door shutter shall have its centre line at a height of 800 mm from the bottom of the shutters unless otherwise specified. The thickness of each tenon shall be approximately one-third the finished thickness of the members and the width of each tenon shall not exceed three times its thickness.

B. Gluing of Joints

The contact surfaces of tenon and mortise shall be treated, before putting together, with bulk type synthetic resin adhesive conforming to IS 851 suitable for construction in wood or synthetic resin adhesive (Phenolic and aminoplastic) conforming to IS 848 or polyvinyl acetate dispersion based adhesive conforming to IS 4835 and pinned with 10 mm dia hardwood dowels or bamboopins or star shaped metal pins; after the frames are put together and pressed in position by means of press.

Stiles and bottom rail shall be made out of one piece of timber only. Intermediate rail exceeding 200 mm in width may be out of one or more pieces of timber. The width of each piece shall be not less than 75 mm. Where more than one piece of timber is used for rails, they shall be joined with a continuous tongued and grooved joint glued together and reinforced with metal dowels at regular intervals not exceeding 200 mm.

TABLE 14.1

Dimensions of Components of Frame Work

Sl. No.	Description	Width mm	Thickness mm
A. DOOR SHUTTERS			
(i)	Stile, top and freeze rail	100	35 or 40
(ii)	Lock rail	150	35 or 40
(iii)	Bottom rail	200	35 or 40
(iv)	Muntin	100	35 or 40
(v)	Glazing bar	40	35 or 40

Muntin and glazing bars where required shall be stubtenoned to the maximum depth which the size of the member would permit or to a depth of 25 mm whichever is less. Unless otherwise specified the finished dimensions of the components of frame work of shutters shall be as given in Table 14.1. The tolerance on width of styles and rail shall be ± 3 mm. The tolerance in thickness will be ± 1 mm. The thickness of all components of frame work shall be the same as the thickness of the shutter. Tolerance on over all dimensions of the shutter shall be ± 3 mm.

C. Rebating

The shutters shall be single-leaf or double leaved as shown in the drawings or as directed by the Engineer-in-Charge. In case of double leaved shutters, the meeting of the stiles shall be rebated by one-third the thickness of the shutter. The rebating shall be either splayed or square type as shown in Fig. 14.2.

D. Panelling

The panel inserts shall be either framed into the grooves or housed in the rebate of stiles and rails. Timber, plywood, hard board and particle board panels shall be fixed only with grooves. The depth of the groove shall be 12 mm and its width shall accommodate the panel inserts such that the faces are closely fitted to the sides of the groove. Panel inserts shall be framed into the grooves of stiles and rails to the full depth of the groove leaving on space of 1.5 mm. Width and depth of the rebate shall be equal to half the thickness of stiles and rails. Glass panels, asbestos panels wire gauze panels and panel inserts of cupboard shutters shall be housed in the rebates of stiles and rails.

i. Timber Panels

Timber panels shall be preferably made of timber of large width; the minimum width and thickness of the panel shall be 150 mm, and 15 mm respectively. When made from more than one piece, the pieces shall be jointed with a continuous tongued and grooved joint glued together and reinforced with headless nails at regular intervals not exceeding 100 mm. Depth and thickness of such joint shall be equal to one-third of thickness of panel. The panels shall be designed such that no single panel exceeds 0.5 square metre in area. The grains of timber panels shall run along the longer dimensions of the panels. All panels shall be of the same species of timber unless otherwise specified.

ii. Plywood Panels :

Plywood boards used for panelling of shutters shall be BWP type or grade as specified in 9.2.2. Each panels shall be a single piece of thickness, 9 mm for two or more panel construction and 12 mm for single panel construction unless otherwise specified.

iii. Block Board Panels :

Block board used for panelling of shutters shall be Grade I (Exterior Grade) bonded with BWP Type Synthetic resin adhesives as specified in 9.2.2. Each panel shall be a single piece of thickness 12 mm unless otherwise specified.

iv. Veneered Particle Board Panels :

Veneered Particle board used for panelling of shutters shall be Exterior Grade bonded with BWP type synthetic resin adhesive as specified in 9.2.4.2. Each panel shall be a single piece of thickness 12 mm unless otherwise specified.

v. Fibre Board Panels :

Fibre board used for panelling of shutters shall be Exterior Grade bonded with BWP type synthetic resin adhesive as specified in 9.2.8.2. Each fibre board panel shall be a single piece of thickness 10 mm unless otherwise specified.

vi. Wire Gauze Panels :

Wire Gauze used for panelling of shutters shall be woven with 0.63 mm dia galvanised mild steel wire to form average aperture size of 1.40 mm as specified in 9.2.10. Wire gauze shall be securely housed into the rebates of stiles and rails by giving right angles bend turned back and fixed by means of suitable staples at intervals of 75 mm and over this wooden beading shall be fixed. The space between the rebate and the beading shall be fixed with putty to give a neat finish. Each wire gauze panel shall be a single piece, and the panels shall be so designed that no single panels exceeds 0.5 sqm in area. However, care shall be taken to prevent sagging of wire gauge, of panel by providing and fixing 20 x 20 mm square or equivalent beading to the external face in the required patterns as decided by the Engineer-in-Charge.

vii. Glass Panels :

- a)** Glass panelling (Glazing) shall be done with float sheet glass as per IS 14900. Glazing in the shutters of doors, windows and ventilators of bath, WC and Lavatories shall be provided with frosted glass the weight of which shall be not less than 10 kg/sqm. Frosted glass panes shall be fixed with frosted face on

the inside. Glass panels shall be fixed by providing a thin layer of putty conforming to IS 419 applied between glass pane and all along the length of the rebate and also between glass panes and wooden beading.

- b)** Putty can be prepared by mixing one part of white lead with three parts of finely powdered chalk and then adding boiled linseed oil to the mixture to form a stiff paste and adding varnish to the paste at the rate of 1 litre of varnish to 18 kg of paste. Fixing of glass panes without beading shall not be permitted. Glazing shall be done after the shutters have been primed and prepared for painting, so that wood may not draw oil out of putty.

- viii. Finish :** Panels of shutters shall be flat and well sanded to a smooth and level surface.

A. Wooden Beading

Beatings in panelled shutter shall be provided where specified in architectural drawings or directed by the Engineer-in-Charge. Each length of beading shall be single piece. Joints at the corners shall be mitred and exposed edges shall be rounded. Beading shall be fixed with headless nails at 75 mm intervals. For external shutters, the beading shall be fixed on the outside face.

1. Machine/Factory made Shutters

Machine made shutters, where specified, shall be procured from an approved factory. For machine made shutters, operations like sawing, planning, making tongue and tenons, cutting grooves, mortises and rebates, drilling holes and pressing of joints shall be done by suitable machines. Machines made shutters shall be brought to the site fully assembled but without any priming coat. Panel inserts of sheet glass and wire gauze may, however, be fixed at site.

2. Fixing of Shutters

For side hung shutters of height upto 1.2 m, each leaf shall be hung on two hinges at quarter points and for shutter of height more than 1.2 m, each leaf shall be hung on three hinges one at the centre and the other two at 200 mm from the top and bottom of the shutters. Top hung and bottom hung shutters shall be hung on two

hinges fixed at quarter points of top rail or bottom rail. Centre hung shutter shall be suspended on a suitable pivot in the centre of the frame. Size and type of hinges and pivots be as specified. Flap of hinges shall be neatly counter sunk into the recesses cut to the exact dimensions of flap. Screws for fixing the hinges shall be screwed in with screw driver and not hammered in. Unless otherwise specified, shutters of height more than 1.2 m shall be hung on butt hinges of size 100 mm and for all other shutters of lesser height butt hinges of size 75 mm shall be used. For shutter of more than 40 mm thickness butt hinges of size 125 × 90 × 4 mm shall be used. Continuous (piano) hinges shall be used for fixing cup-board shutters where specified.

3. Fittings

Fittings shall be provided as per schedule of fittings decided by Engineer-in-Charge. Appendix H (P-361/SH 9.0) gives for guidance the schedule of fittings and screws usually provided. Cost of providing and fixing shutter shall include cost of hinges and necessary screws for fixing the same. All other fittings shall be paid for separately. The fittings shall conform to specifications laid down in 9.6.8. Where the fittings are stipulated to be supplied by the department free of cost, screws for fixing these fittings shall be provided by contractor and nothing extra shall be paid for the same.

4. Wooden Cleats and Blocks

Wooden cleats and blocks shall be fixed to doors and windows as directed by Engineer-in-Charge, as per size and shape approved by him. These are included in the cost of providing and fixing the shutters.

5. Measurements

Framework and panelling shall be measured separately.

B. Frame Work of Shutters

i. The overall length and width of the framework of the shutters shall be measured nearest to a cm in fixed position (overlaps not to be measured in case of double leaved shutters) and the area calculated in square metres correct to two places of decimeter. No deduction shall be made to form panel openings or louvers. No extra

payments shall be made for shape, joints and labour involved in all operations described above.

ii. For panelling of each type or for glazed panel length and width of opening for panels inserts or glazed panels shall be measured correct to a cm before fixing the beading and the area shall be calculated to the nearest 0.01 sq.m. The portions of the panel inserts or glazed panel inside the grooves or rebates shall not be measured for payment.

C. Rate

Rate includes the cost of materials and labour involved in all the operations described above. The frame work and panelling of each type or glazed panels shall be paid separately. The rate for frame work includes the cost of butt hinges and necessary screws as specified in 9.6.7. However, extra shall be paid for providing moulded beading where specified. Nothing extra shall be paid for plain beading as stated in

9.6.5 when specified in drawing.

a. TRELLIS (JAFFRI) WORK

Specified timber shall be sawn in the direction of the grains. Sawing shall be truly straight and square. The timber shall be planed smooth and accurate to the full dimensions, rebates, roundings, and mouldings as shown in the drawings made, before assembly. Patching or plugging of any kind shall not be permitted except as provided.

b. Plain Trellis (Jaffri)

This shall consist of wooden strips or laths 35 x 10 mm section unless otherwise specified planed and nailed together at every alternate crossing. The strips shall cross each other at right angle and shall be spaced 35 mm apart, so as to form 35 x 35 mm square opening or as shown in the drawing. These shall be fixed with nails to the frame. To cover the ends of strips, 50 x 12 mm beading shall be fixed to the frame with screws. The finished work with a tolerance of ± 1 mm may be accepted.

c. Trellis (Jaffri) Doors and Windows Shutters

Shutter frame of specified timber shall consist of two stiles and top, lock and bottom rails, each of section 75 x 35 mm unless otherwise specified. The stiles and rails shall be properly mortised and tenoned. The tenons shall pass through the stiles for at least

3/4th of the width of the stile. Shutter frame shall be assembled and passed by the Engineer-in-Charge before jointing. The joints shall be pressed and secured by bamboo pins of about 6 mm diameter. To this frame, plain trellis (Jaffri) work as described in 9.11.1 shall be fixed as shown in the drawings or as directed by the Engineer-in-Charge. Fixing, fittings, wooden cleats and blocks shall be provided as specified under 9.6.

Measurements

Width and height of plain trellis work and trellis shutters shall be measured overall correct to a cm. The area shall be calculated in square metres nearest to two places of decimal. In case of shutters, the measurement shall be as specified in 9.11.2.

Rate

It includes the cost of materials and labour required in all the operations described above.

E. FITTINGS

Fitting shall be of mild steel brass, aluminium or as specified. Some mild steel fittings may have components of cast iron. These shall be well made, reasonably smooth, and free from sharp edges and corners, flaws and other defects. Screw holes shall be counter sunk to suit the head of specified wood screws. These shall be of the following types according to the material used.

(i) Mild Steel Fittings

These shall be bright satin finish black stone enamelled or copper oxidised (black finish), nickel chromium plated or as specified.

(ii) Brass Fittings

These shall be finished bright satin finish or nickel chromium plated or copper oxidised or as specified.

(iii) Aluminium Fittings

These shall be anodised to natural matt finish or dyed anodic coating not less than grade AC 10 of IS 1868.

The fittings generally used for different type of doors and windows are indicated in Appendix H (P- 361/SH 9.0) attached. The fittings to be actually provided in a particular work shall, however, be decided by the Engineer-in-Charge.

Screws used for fittings shall be of the same metal, and finish as the fittings. However, chromium plated brass screws or stainless steel screws shall be used for fixing aluminium fittings. These shall be of the size as indicated in respective figures.

Fittings shall be fixed in proper position as shown in the drawings or as directed by the Engineer-in- Charge. These shall be truly vertical or horizontal as the case may be. Screws shall be driven home with screw driver and not hammered in. Recesses shall be cut to the exact size and depth for the counter sinking of hinges.

F. Butt Hinges

Cast brass butt hinges light/ordinary or heavy.

1. **Cast Brass Butt Hinges :** These shall be light/ordinary or heavy as specified. These shall be well made and shall be free from flaws and defects of all kinds. These shall be finished bright or chromium plated or oxidised or as specified. These shall generally conform to IS 205.

2. **Hinge Pin :** Hinge pin shall be made of brass or of phosphor bronze. The hinge pins shall be firmly rivetted and shall be properly finished. The movement of the hinge pin shall be free, easy and square and shall not have any play or shake.

3. **Knuckles :** The number of knuckles in each hinge shall not be less than five. The number of knuckles in case of sizes less than 40 mm shall be three. The sides of the knuckles shall be straight and at right angle to the flap. The movement of the hinge pin shall be free and easy and working shall not have any play or shake.

4. **Screw Holes :** The screw holes shall be clean and counter sunk and of the specified size for different types and size of hinges. The size of the holes shall be such that when it is counter sunk it shall be able to accommodate the full depth of counter sunk head of wood screw specified.

5. **Sampling and Criteria for Conformity :** The number of butt hinges to be selected from a lot shall depend on the size of lot and shall be in accordance with Table 10. Butt hinges for testing shall be taken at random from at least 10 per cent of the package subject to a minimum of three, equal number of hinges being selected from each package. All butt hinges selected from the lot shall be checked for dimensional and tolerance requirements. Defects in manufacture and finish shall also be checked. A lot shall be considered conforming to the requirements of this specification if the number of defective hinges among those tested does not exceed the corresponding number given in Table 14.2.

TABLE 14.2

Lot size	Sample size	Permissible No. of defective hinges
Upto 200	15	0
201 to 300	20	1
301 to 500	30	2
501 to 800	40	2
801 and above	55	3

Note: Any hinge which fails to satisfy the requirements of any one or more of the characteristics shall be considered as defective hinge.

G. Spring Hinges : (Single or double acting)

A. These shall be single acting when the shutter is to open on one side only or double acting when the shutter opens on both sides. These shall be made of M.S. or brass as specified, and shall generally conform to IS 453.

B. Hinges shall work smoothly and shall hold the door shutter truly vertical in closed position. Each double-acting spring hinge shall withstand the following tests which shall be carried out after fixing it to a swing door in the normal manner.

C. When the door is pushed through 90° and released 2000 times on each side in quick succession the hinge shall show no sign of damage or any appreciable deterioration of the components during or on completion of the test.

D. The door shall require a force of 2.0 ± 0.5 kg for 100 mm hinges and 3.0 ± 0.5 kg for 125 mm and 150 mm hinges at a distance of 4.5 cm from the hinge pin to move the door through 90°.

The size of spring hinge shall be taken as the length of the plate.

E. These shall be of the following type :

i. Mild Steel : The cylindrical casing shall be made either from M.S. sheet of 1.60 mm thickness, lap jointed and brazed, welded and

rivetted, or from solid drawn tube of thickness, pressed to from the two casing. It shall be stove enamelled black or copper oxidized or as specified.

- ii. **Cast Brass :** The cylindrical casing shall be made either from brass sheet of 1.60 mm thickness, lap jointed and brazed, or from solid drawn brass tube of not less than 1.60 mm thickness. It shall be satin, bright nickle — plated or copper oxidized or as specified.
- iii. **Sampling :** The number of spring hinges shall be selected from the lot and this number shall depend on the size of the lot and shall be in accordance with Table 14.3.

TABLE 14.3

Lot size	Sample size	Permissible No. of defective spring hinges
1 to 25		
26 to 50		
51 to 100		
101 to 200		
201 to 300		
301 to 500		
501 to 800		
801 and above		

H. Flush Bolts (Fig. 14.3)

These should generally conform to IS 5187. These shall be of cast brass, cast aluminium alloy or extruded aluminium alloy as specified. Only one material shall be used in the manufacture of all the components of flush bolts except spring which shall be of phosphor bronze or steel strip.

When the rod is completely in its maximum bolting position it shall be retained in that position by the spring. The length of the bolt shall be such that, when the bolt is pulled down, the top of the bolt shall be flush with the top of the lip face. The top of the bolt shall be given a taper of 45° to enable easy pull or push.

Brass flush bolts shall be satin or bright polished. Alternatively they may be nickel or chromium plated as specified in IS 4827 or copper oxidised in accordance with IS 1378. Aluminium flush bolts shall be anodised and the quality of the anodised finish shall not be less than grade AC 15 of IS 1868.

Note : The working of flush bolts is found satisfactory only in case of shutters made of high quality timber like teakwood properly seasoned

and when there is no warping due to changes in weather Brass flush bolts which give a more satisfactory performance are costly and uses scarce materials. Hence use of flush bolts is to be discouraged.

I. Floor Door Stopper (Fig. 14.4)

The floor door stopper shall conform to IS 1823. This shall be made of cast brass of overall size as specified and shall have rubber cushion. The shape and pattern of stopper shall be approved by the Engineer-in-Charge. It shall be of brass finished bright, chromium plated or oxidised or as specified. The size of floor stopper shall be determined by the length of its plate. It shall be well made and shall have four counter sunk holes for fixing the door stoppers to the floor by means of wood screws. The body or housing of the door stopper shall be cast in one piece and it shall be fixed to the cover plate by means of brass or mild steel screws and cover plate shall be of casting or of sheet metal. The spring shall be fixed firmly to the pin. Tongue which would be pressed while closing or opening of the door shall be connected to the lower part by means of copper pin. On the extreme end a rubber piece shall be attached to absorb shock. All parts of the door stopper shall be of good workmanship and finish, burrs and sharp edges removed. It shall be free from surface and casting defects. Aluminium stopper shall be anodised and anodic film shall not be less than grade AC-10 of IS 1868.

Sampling and Criteria for Conformity : It shall be same as specified in 9.21.1.4.

TABLE 14.4

Requirements for Rubber

Particulars	Requirement	Testing procedure
Relative density Max	1.3	IS 3400 (Part IX)
Hardness	60	IS 3400 (Part II)
Change in initial for 24 hours at 100° ±	+5	IS 3400 (Part II)

J. Hanging Rubber Door Stopper

These shall be of cast brass, finished bright, chromium plated or as specified. Aluminium stopper shall be anodised and the anodic coating shall not be less than grade AC-10 of IS:1868. The size and pattern of the door stopper shall be approved by the Engineer-in-Charge. The size shall be determined by its length.

Casement Brass Stays (Straight Peg Type) (Fig. 14.5)

These shall be made of mild steel, cast brass, aluminium (extruded section) or plastic (Polypropylene) as specified. Mild steel casement stays shall be a copper oxidised (black finish) or as specified. Cast brass stays shall be finished bright or chromium plated or as specified. Aluminium stays shall be anodised and the anodic coating shall not be less than grade AC-10 of IS 1868. Aluminium and M.S. stays shall be made from channel section. The stays shall not weigh less than that indicated below :

200 mm	0.24 kg each
250 mm	0.28 kg each
300 mm	0.33 kg each

- (i) The shape and pattern of the stays shall be approved by the Engineer-in-Charge. The size of stays shall be determined by its length as shown in the plate. The plastic (Polypropylene) stays shall conform to IS 6318.

PART D - MECHANICAL, ELECTRICAL, AND PLUMBING WORKS

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A.TECHNICAL SPECIFICATION OF FINAL DISTRIBUTION BOARDS:

A1. GENERAL :

Distribution board shall be TP & N or SP & N type for 415 volts 3 phase AC supply of 230V single phase AC supply as required. Distribution boards shall generally conform to and IS 8878 - 1978 for MCB. However the specifications herein after described shall take precedence over the above wherever this specifications call for a higher standard of material or workmanship. The MCB Distribution boards shall be of standard factory made.

A2. CABINET DESIGN :

Distribution boards shall be of totally enclosed with dust and vermin proof construction. The enclosure shall be made of steel sheet of 16G. The sheet steel shall be treated with a rigorous rust inhibition process before fabrication. The distribution boards shall comprise of switch fuse unit or isolator or earth leakage miniature circuit breaker as incoming and required number of miniature circuit breakers or HRC fuses as outgoing whichever is called for. The distribution boards shall be with top and bottom cable/conduit entry boxes. The main and out-going shall rating as specified on the drawings and schedule. The cabinet shall be spray enameled to required colour shade finish. The interior surface shall be finished to an off - white shade. The interior components shall be mounted on separate sheet steel, which is mounted and located on to the studs providing inside the cabinet. Over this, a cover made of hylam sheet or spray enameled 16G sheet steel shall be provided with slots for operating knobs or breakers. The cabinet shall be equipped with a 14G inside hinged front door, having a spring latch and bolt lock or over flanged door. Cabinets shall have detachable gland plates at both top and bottom made out of 14G. The hinged type door shall be with 'U' shape edge to provide square type compressed rubber gasket & for over flanged type doors, it shall be in the MS box.

A3. BUS BARS :

Suitable size bus bars made of high conductivity copper or aluminum strips and mounted on non-hygroscopic supports shall be provided. Neutral and earth bus bar shall be with taped holes and brass screws and spring washers,etc.,

A4. MINIATURE CIRCUIT BREAKERS :

Miniature circuit breakers shall be quick make and break type, and shall conform to Relevant Indian Standards. The housing shall be heat resistant and having a high impact strength. The fault current shall not be less than 9000 amps, at 230V for lighting circuit and 25000A for power circuits. MCB's shall be flush mounted and shall be provided with trip free manual operating lever and 'ON' and 'OFF' indications. The contacts shall be provided with magnetic thermal releases for over current and short circuit protection. The over load or short circuit device shall have a common trip bar in the case of DP and TPN miniature circuit breakers.

A5. TERMINALS :

Distribution boards shall be provided with a terminal block of adequate size to receive mains and outgoing circuits. The location of the terminal block shall be so located such that crowding of wires in the proximity of live parts is avoided.

A6. DIRECTORY;

Distribution boards shall be provided with a directory indicating the areas of loads served by each circuit breaker, the rating of breakers, size of conductors, etc., The directory shall be mounted in metal holder with a clear plastic sheet on inside surface of the front door. The Tin plate with a clear Perspex sheet shall be provided on the front door for over flanged door type DB. Suitable size danger plate indicating voltage grade shall also be fixed to front cover.

A7. INSTALLATION :

Distribution boards shall be wall surface mounted or recess mounted as required and at the locations shown on the drawings. The boards shall be fixed on 30 x 40 x 6mm angle iron frame work and bolts. All cables / conduits shall be properly terminated using glands / grips / checkouts, etc., Wiring shall be terminated properly using crimping lugs / sockets and PVC identification ferrules. No bare conductor shall be provided inside the board.

Distribution boards shall be bonded to the earthing system atleast at two points using brass bolts and lugs.

B. TECHNICAL SPECIFICATIONS OF INTERNAL WIRING:

B1. SYSTEM OF WIRING:

The system of wiring shall consist of PVC Insulated copper conductor wires in, Heavy gauge rigid PVC conduits for connected and metal conduits for surface installations as called for.

B2. GENERAL:

Prior to laying and fixing of conduits, the contractor shall carefully examine the drawings indicating the layout, satisfy himself about the sufficiency of number and size of conduits, location of junction boxes, size and location of switch boxes and other relevant details. Any discrepancy found in the drawings shall be brought to the notice of the Architect/Consultant. Any modifications suggested by the contractor shall be got approved by the architect/Consultant before the actual laying of conduits is commenced.

B3. MATERIALS:

B3.1. CONDUITS:

Generally concealed electrical wiring installation shall be in MS conduits and surface wiring in Rigid steel conduits.

B3.1.a. METAL CONDUITS:

Conduits and accessories shall conform to relevant Indian standards. Solid drawn 16 gauge screwed steel conduits protected by black bituminous enamel shall be used in all situations except where galvanized steel conduits are called for. Buried wiring passing under floor of ground floor shall run in galvanized steel conduit. Joints between conduits and accessories shall be securely made, to ensure earth continuity.

The conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer. The number of 650/1100 volt grade PVC insulated copper/aluminum conductor wires that may be drawn in the conduits of various size are given below and space factor shall not exceed 40%.

B3.3 CONNECTIONS:

All jointing methods shall be subject to the approval of the consultant, separate conduits shall run for lighting, power outlet wiring, telephone, TV public address and fire alarm systems. Conduits shall be screwed metal with white lead and shall be painted with one coat of self-etching zinc chromate primer and two coats of enamel paint.

The threads and sockets shall be free from grease and oil. Connections between screwed conduit and sheet metal boxes shall be by means of a brass hexagon smooth bore bush, fixed inside the box and connected through a coupler to the conduit. The joints in conduits shall be free of the burrs to avoid damage to insulation of conductors while pulling them through the conduits.

B3.4. BENDS IN CONDUIT:

Where necessary, bends or diversions may be achieved by means of bends and/or circular inspection boxes with adequate and suitable inlet and outlet screwed joints. In case of recessed system each junction box shall be provided with a cover properly secured and flush with the finished wall surface. No bends shall have radius less than 2-1/2 times the outside diameter of the conduit.

B3.5 SWITCH OUTLET AND JUNCTION BOXES:

All outlet boxes for switches, sockets and other receptacles shall be rust proof painted and shall be of 6mm thick MS. Boxes shall have smooth external and internal surfaces. All light outlets shall be of deep MS boxes.

All outlets boxes for receiving plug sockets and switches shall be to match the wiring accessories. All boxes shall have adequate number of knock out holes of required diameter and earthing terminal screws. Outlet boxes shall be of a mini-mum depth of 65mm combination type boxes shall be used where there are more than one outlets/accessories located in one box.

B3.6. CEILING FAN OUTLET BOXES:

The boxes for ceiling fan outlets shall be of MS with concealed type of MS hooks. This shall be deep box to accommodate the hook and the wire terminations.

B3.7. INSPECTION BOXES:

50mm dia PVC / MS inspection boxes of 2mm thick having smooth external and internal finish shall be provided to facilitate removal and replacement of wires, where required.

B4. INSTALLATION OF CONDUIT:

B4.1. OPEN / SURFACE CONDUIT SYSTEM:

B4.2a. Wherever specifically called for, surface conduit system shall be made using black enameled sheet pipe conduits shall be run in square and by symmetrical lines/Before the conduits are installed, the exact route shall be marked at the site and approval of the consultant shall be obtained. Conduits shall be fixed by heavy gauge GI saddles, secured by suitable

rowel plugs, at an interval of not more than 1 meter. Wherever, couplers, bends, or similar fittings are used saddles shall be provided at either side at a distance of 300 mm from the centre of such fittings. Conduits shall be joined by means of screwed couplers and screwed accessories only. In long distance straight runs of conduits, inspection type couplers / junction boxes shall be provided. Threading shall be long enough to accommodate pipe to the full threaded portion of the couplers and accessories. But ends of conduits shall have no sharp edges nor any burrs left to avoid damage to insulations of wires.

Bends in conduit runs shall be done by using pipe bending machine. Sharp bends shall be accomplished by introducing solid bends inspection bends or cast iron inspection boxes radius of solid bends shall not be less than 75mm. Not more than 90 degree bend shall be used in a conduit run from outlet to outlet.

B4.2b. All conduit opening shall be properly plugged with PVC stoppers/bushes. Conduits shall be adequately protected against rust by applying two coats of approved synthetic enamel paint after the installation is completed.

B4.2c. Wherever conduits terminate into control boxes, outlet boxes, distribution boards etc., it shall be rigidly connected to the box with check nuts on either side of the entry.

The entire conduit system shall be bonded to the earth.

B4.3. WIRING:

4.3.A. All final branch circuits for lighting and appliances, shall be single conductor cables run inside conduits. Branch circuit conductor sizes shall be as shown in the load analysis of drawing and conforming to the requirements of the I.E.E. Regulations.

Home runs indicated on the drawings for the final branch circuits shall be kept in a separate conduit up to the panel board via switches wherever called for. No other wiring shall be bunched in the same conduit.

For each lot of wires the contractor shall supply a certificate issued by the manufacturer stating its origin, date of manufacture, constitution and standards to which it complies and the test certificates.

Unless otherwise specified, the wiring shall be done in the looping system. Phase and line conductors shall be looped at the switch box and neutral conductor can be looped either from the switch box or from the light. fan or socket outlet. Where joints are unavoidable, they shall be made through approved mechanical connectors.

Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in MS boxes. Chromium plated screws shall be used.

16 Amps power wiring shall be distinctly separate from lighting wiring.

B4.3.b Each circuit phase wire from the distribution boards should be followed with a separate neutral wire of the same size as the circuit wire.

Each and every light, switch boxes, outlet boxes etc., shall be earthed using running a separate PVC insulated copper conductor earth wire in each conduit.

B4.3.c. BUNCHING OF WIRES:

Wires carrying current shall be bunched so that the out going and the return wires are drawn into the same conduit. Wires originating from two different phases shall not run in the same conduit.

B4.3.d. DRAWING CONDUCTORS:

The drawing and jointing of PVC insulated with due regard to the following precautions. While drawing wires through conduits, care shall be taken to avoid scratches and kinks when causes breakage of conductors. There shall be no sharp bends

Insulation shall be shaved off like sharpening of a pencil and it shall not be removed by cutting it square.

PVC insulated copper conductor wire ends shall be soldered (atleast 20mm length).

Strands of wires shall not be cut for connecting terminals. The terminals shall have sufficient cross sectional area to take all strands and shall be soldered. Connecting brass screws shall have flat ends. All looped joints shall be soldered and connected through block/connectors.

The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. Conductors having nominal cross sectional areas exceeding 10 sq.mm shall always be provided with cable sockets. At all bolted terminal, brass flat washer of large area and approved steel spring shall be used. Brass nuts and bolts shall be used for all connections.

Only certified wiremen and cable jointers shall be employed to do jointing work. All wires and cables shall bear the manufacturer's label and shall be brought to site in original packing. For all internal wiring, PVC insulated wires of 650/1100 volts grade shall be used / The sub-circuit wiring for point shall be allowed in the length of the conductors.

If the use of joints connections are unavoidable due to any specific reason, prior permission, in writing, shall be obtained from the Architect. No wire shall be drawn into any conduit, until all work of any nature, that may cause injury to wire, is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of wire. Before the wires are drawn into the conduits, the conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction by forcing compressed air through the conduits. The minimum size of PVC insulated conductor wires for all sub-circuit wiring for light points shall be 2.5 sq.mm.(as specified)

B4.3.JOINTS:

All joints shall be made at main switches, distribution boards. socket outlets, lighting outlets and switch boxes only. No joints shall be made in conduits and in junction boxes. Conductors shall be continuous from outlet to inlet.

B4.4 MAINS AND SUB-MAINS:

Mains and sub-mains cable or wires where called for shall be of the rated capacity and approved make. Every main and sub-main wire shall be drawn into an independent adequate size conduit. An independent earth wire of the proper rating shall be provided for every sub main. The earth wires shall be run inside the conduits. Where mains and sub-main cables are connected to switchgear. Sufficient extra lengths of cable shall be provided to facilitate easy connections and maintenance. The sub main conduit in the ground floor and in electrical ducts shall be run supported on MS angle steel trays or ladders the complete length of pipe trays in the ground floor running surface below the surface of the slab shall be covered with sheet steel enclosure in the bottom & side. The sheet steel cover & supports shall be painted.

B4.5. LOAD BALANCING:

Balancing of circuit in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

B4.6. COLOUR CODE FOR CONDITIONS:

Colour code shall be maintained for the entire wiring installation red, yellow, blue for three phases, black for neutral and green for earthing.

B.5.0. GENERAL REQUIREMENTS OF POINT WIRING:

The point wiring shall include all works necessary to complete wiring using MS conduit and its accessories from distribution board up to

the outlet point through switches, sockets, fans, regulators etc., and includes.

- a. Ceiling rose for light and fan points.
- b. Pendent wires / cables with lamp holder.
- c. Lamp holders for all wall lights.
- d. Switches and switch outlet boxes.
- e. Light / fan outlet boxes.
- f. Fan hook box.
- g. Fan regulator box with Electronic fan regulator.
- h. 6 Amps /16 amps/20A DP switched socket with MS outlet boxes.
- i. Switch and receptacle cover plates.

B.6.0. Internal Wiring (open Fashion) for Small Power / Light Point:

All wiring shall be carried out only with MS conduits.

All light, fan sockets and any other equipment must be earthed.

Wiring shall be carried out with 650V grade PVC insulated single core multi stranded copper conductor wires as per IS : 694.

The method of wiring shall be as recommended in IS : 732 and its several parts.

The physical and electrical continuity of the conduit system shall be maintained throughout.

No wire shall be left exposed at any location, metallic flexible pipe shall be used to cover the same.

Colour coding of wire shall be carried out as detailed below :

PHASES	RED
	YELLOW
	BLUE
NEUTRAL	BLACK
	GREY (for UPS)
EARTH	GREEN

The minimum diameter of the conduits shall be 25mm only.

The following sizes of PVC insulated multi stranded copper conductor wires shall generally be followed throughout :

- a) From the final switch to individual outlets 1.5 sq. mm.
- b) From Distribution Boards to First Switch Board and subsequent switchboards 2.5 sq. mm.
- c) All 16Amps socket 2.5 sq. mm.
- d) All 20Amps socket 4.0 sq. mm.
- e) Earth wire throughout for Lighting 1.5 sq. mm.
- f) Earth wire throughout for Power 2.5 sq. mm.
- g) Adequate protection for other larger size feeders have been provided.

C. TECHNICAL SPECIFICATION OF LIGHT FITTING AND ACCESSORIES:

C.1. LIGHT FITTINGS – GENERAL REQUIREMENTS:

a. Fittings shall be designed for continuous trouble free operation under atmospheric conditions without reduction in lamp life or without deterioration of materials and internal wiring. Outdoor fittings shall be weather – proof and rain proof.

b. Fittings shall be so designed as facilitate easy maintenance including cleaning, replacement of lamps / starters etc.,

c. All fittings shall be supplied complete with lamps. All mercury vapor and sodium vapor lamp fittings shall be complete with accessories like ballasts, power factor improvement capacitors, starters etc., Outdoor type fittings shall be provided with weather proof boxes.

d. **LED 4 ft Day Light fittings** shall be complete with high-efficiency LED module/driver, suitable for 230V, 50Hz AC supply, with integral electronic driver, heat sink, diffuser, and all necessary accessories. The fitting shall provide uniform illumination with minimum flicker and shall have a minimum power factor of 0.90. LED fitting shall be energy efficient, suitable for continuous operation, and shall conform to relevant BIS/IEC standards. **The LED fitting, including LED module and driver, shall be covered by a minimum 12-month**

manufacturer's warranty against manufacturing defects and premature failure.

e. Each fitting shall have a terminal block suitable for loop-out connection by 1100V PVC insulated copper conductor wires upto 4 Sq. mm. The internal wiring should be complete by the manufacturer by means of standard copper wire and terminated on the terminal block.

f. All hardware's used in the fitting shall be suitably plated or anodized and aestivated for use in industrial plants.

g. EARTHING: Each light fitting shall be provided with an earthing terminal. All metal or metal enclosed parts of the housing shall be bonded and connected to the earthing terminal so as to ensure satisfactory earthing continuity throughout the fixture.

h. PAINTING / FINISH: All surfaces of the fittings shall be thoroughly cleaned and decreased and the fittings shall be free from scale, rust, sharp – edges.

i. The housing shall be stove – enameled or anodised as required. The surface shall be scratch resistant and shall show no sign of cracking or flak-ding when bent through 90 deg. Over 12mm dia mandrel.

C.2.A. DECORATIVE TYPE FITTINGS:

Decorative fluorescent fittings shall be provided with mounting / housing channel cum reflectors if CRCA sheet, steel, stove enameller diffusers or louvers shall be translucent white pry styrene.

C.2.1. ACCESSORIES FOR LIGHT FITTINGS REFLECTORS:

The reflectors shall be made of CRCA sheet steel/aluminum/silvered glass/chromium plated sheet copper as required. The thickness of reflectors shall be as per relevant standards. Reflectors made of steel shall have stove enameled/ vitreous enameled/epoxy coating finish. Aluminum used for reflectors shall be as specified. The reflector shall be free from scratches blisters and shall have a smooth and glossy surface having no optimum light reflecting coefficient. Reflectors shall be readily removable from the housing for cleaning and maintenance without use of tools.

C2.2 LAMP / STARTERS HOLDERS:

Lamp holders shall have contact resistance, shall be resistant to wear. They shall hold lamps in position under normal conditions of shock and vibration prevalent in an industrial atmosphere.

C.2.3. BALLASTS:

The ballasts shall be designed for long life and low power loss. They shall be mounted using self – locking, anti – vibration fixtures and shall be easy to remove without demounting the fittings. The enclosures shall be dust tight and non – combustible. Ballast shall be inductive.

Heavy duty type, filled with thermo stating insulation, moisture repellent polyester compound filled under pressure of vacuum. Ballasts shall be provided with taps to set the voltage. The ballast wiring shall be of copper and they shall be free from dust.

Separate ballast shall be provided in case of multiple fittings.

C.2.4. STARTERS:

Starters shall have bi – metal electrodes and high mechanical strength. Starters shall be replaceable without disturbing the reflector of lamps and without use of any tool. Starters shall have brass contacts and radio interference capacitor.

C.2.5. CAPACITORS:

The capacitors shall have a constant value of capacitance and shall be connected across the supply of individual lamp circuits. The capacitor shall have a value of capacitance so as to correct the power factor of its corresponding lamps circuit to 0.95 lag or better capacitor shall be hermetically sealed preferably in a metal en-closure to prevent seepage of imp regnant and ingress of moisture.

C.2.6. LAMPS:

Incandescent lamps shall be clear type unless otherwise specified. Fluorescent lamps shall be “ day – light colour ” type unless otherwise specified and shall be provided features to avoid blackening of lamp ends.

Lamp shall be capable of withstanding vibrations prevalent in an industrial atmosphere and connections at – lend in wires and filament / electrodes shall not break under such circumstances.

D.TECHNICAL SPECIFICATION OF EARTHING:

D.1. EARTHING:

All the non-current carrying metal parts of Electrical Installation shall be earthed as per IS: 3043. All equipment, metal conduits, rising main cable armour, switch gear, Distribution Boards, Meters, all other metal parts forming part of the work shall be bonded together and connected by two separate and distinct conductors to earth electrodes. Earthing shall be in conformity with the provisions of Rules 32, 61, 62, 67 and 68 of IER 1956.

D.2. G.I. PIPE / C.I. PIPE EARTH STATION:

Electrodes shall be made of GI Pipe of Internal Diameter of 50mm dia / cast iron pipe 100 ID, 13mm thick. The pipe electrode shall be as far as practicable embedded below permanent moisture level. The length of the pipe electrode shall not be less than 2.5 mtr. Except where rock is encountered, pipes shall be driven to a depth of at least 2.5 mtr. where rock is encountered at a depth of less than 2.5 mtr the electrode may be buried inclined to the vertical and the inclinations not more than 30 deg. C from the vertical. The pipe electrode shall be made of one piece. Earth leads to the electrode shall be laid in a heavy duty GI pipe and connected to the pipe electrode with brass bolts, nuts and washers. GI Pipe shall be terminated in a wire meshed funnel. The funnel shall be enclosed in a masonry chamber of 450mm x 450mm dimensions. The chamber shall be provided with CI frame and CI Inspection cover. The earth station shall also be provided with a suitable permanent identifications label tag. The earth electrode shall conform to IS: 3043 latest edition. The soil around the earthing electrode shall be treated to reduce the resistivity of the soil by filling the complete depth of electrode with alternative layers of charcoal and salt.(as per general arrangement drawing)

D.3. EARTHING CONDUCTORS:

All earthing conductors shall be of high conductivity GI\Copper flat and shall be protected against mechanical damage and connection. The connection of earth electrodes shall be strong secure and sound and shall be easily accessible. The earth conductors shall be rigidly fixed to the walls, cable trenches, cable tunnel conduits and cables by using suitable clamps.

Main earth bus shall be taken from the main medium voltage panel to the earth electrodes. The number of electrodes required shall be arrived at taking into consideration the anticipated fault on the medium voltage net work. Earthing conductors for equipment shall be run from the exposed metal surface of the Equipment & Connected to a suitable point on the sub main or main earthing bus. All Switch Boards, Distribution Boards and

isolators disconnect switches shall be connected to the earth bus. Earthing conductors shall be terminated at the equipment using suitable lugs, bolts, washers and nuts.

All conducts cable armoring etc., shall be connected to the earth all along their run by earthing conductors of suitable cross sectional area. Two separate earth strip or GI 40 $\times$ 6mm / 25 $\times$ 3mm copper flat shall be run in each Electrical duct as per the requirement of Inspectorate. The Electrical Resistance of earthing conductors shall be low enough to permit the passage of fault current necessary to operate a fuse/protective device a circuit breaker and shall not exceed 2 ohms.

D.4 PRECAUTIONS:

Earthing system shall be mechanically robust and the joints shall be capable of retaining low resistance even after subjections to fault currents.

Joints shall be tinned, soldered and/or double riveted. All the joints shall be mechanically and electrically continuous and effective. Joints shall be protected against corrosion.

D.5. TESTING

On the completion of the entire installation, the following tests shall be conducted.

- i. Earth resistance of electrodes.
- ii. Impedence of earth continuity conductors as per E-3 of IEE regulations.
- iii. Effectiveness of earthing as per E-4 and E-5 of IEE regulations.

All meters, instruments required for the tests shall be provided by the contractor. The tests results shall be submitted in the prescribed tabulated form in triplicate to the \ Consultant for approval.

E. FANS

E1. CEILING FANS:

The Ceiling fans and regulators shall be designed, manufactured and tested as per IS -374. The fans shall have a totally enclosed capacitor start and run motor suitable for operating on 240V single phase, 50Hz AC supply system. The fan shall be of the double ball bearing type, having 3 blades with a sweep of 1200/1400mm complete with suspension rod, canopies and mounting rollers. The regulators shall be of the choke type and suitable for surface /flush mounting on the switch box or inside the switch box as required and shall have 5 running and 1 off position. Wherever required separate down rods made of GI Pipes and suitable to hold the particular fan shall be fabricated

E2. WALL MOUNTING FAN WITH BUILT IN REGULATOR

The wall mounting fan with built in regulator shall be designed, manufacture and tested as per IS.

The fans shall have a totally enclosed capacitor start and run motor suitable for operating on 240V single phase, 50Hz AC supply system the fan shall be of the double ball bearing type, having three blades with a sweep of 400mm complete with supporting rod, mounting bracket removable type chromium plated guards, 2meters 3C x 1.5sqmm flexible cable. The fan shall have a built-in push button type regulator having 3 running and 1 off position, the fan shall be of oscillating type and shall have a operating Knob to actuate the oscillation.

The fan shall be suitable for mounting directly on the wall.

E3. EXHAUST FAN

The exhaust fans shall be of industrial type designed manufactured and tested as per IS - 2312 and operating on 240V single phase 50Hz AC supply system. The exhaust fan shall be of ring mounted type and shall be complete with louvers made of aluminum, built into a steel frame. The louvers shall be designed for opening and closing automatically with air flow velocity.

F. TESTING :

F.GENERAL: 1 At the completion of the work, the entire installation shall be subject to the following tests:

- i. Wiring continuity test.
- ii Insulation resistance test.
- iii. Earth continuity test.
- iv. Earth resistivity test.

Besides the above, any other test specified by the Local Authority shall also be carried out. All tested and calibrated instruments for the testing, labour materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

F2. TESTING OF WIRING:

All wiring systems shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energized.

F3. INSULATION RESISTANCE TESTS:

The insulation resistance shall be measured between earth and the whole system of conductors or any section thereof, with all fuses in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 660 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured as above shall not be less than 50 divided by the number of points provided on the circuit, the whole installation shall have an insulation resistance greater than one mega ohm. The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant standard specification or where there is no such specification, shall not be less than half a mega ohm.

F4. TESTING OF EARTH CONTINUITY PATH:

The earth continuity conductor metallic envelopes of cables shall be tested for electric continuity and the electrical resistance of the same, along with

the earthing lead but excluding any added resistance or earth leakage circuit breaker, measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation.

F5. TESTING OF POLARITY OF NON-LINKED SINGLE POLE SWITCH:

In a two wire installation a test shall be made to verify that all non-lined single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply, in the three or four wire installations a test shall be made to verify that every non linked single pole switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the supply. Architect as well as the Consultant / Owner.

STANDARDS.

1. The equipment and accessories covered by this specification shall be designed, manufactured and tested in accordance with Indian Standards and codes of practice published by the Indian Standards Institution wherever available, in order that specific aspects under Indian Conditions are taken care of.
2. In case where Indian Standards are not available, then equipment and accessories shall conform to the latest publications and codes of practice by any other recognized National Standard Institutions.
3. All Electrical equipment and installations shall conform to the latest publication of Indian standards manuals as listed below:

<u>S. No</u>	<u>ISI Codes</u>	<u>Description</u>
1.	IS 732-1989.	Code of practice for Electrical wiring Installation(system voltage not exceeding 650V)
2.	IS 2274-1963.	Code of practice for Electrical wiring Installation(System voltage exceeding 650V).

3. IS 1646-1961. Code of practice for fire safety of building
(General Electrical installation)

4. IS 694 Wires

5. IS 732 Wiring Installation

6. IS 9537 Part II M.S. Conduit and accessories

<u>S. No</u>	<u>ISI Codes</u>	<u>Description</u>
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7.	IS 2607 & 3837	M.S. Conduit and accessories
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8.	IS 1951	PVC Pipes.
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9.	IS 3646	Lighting (Interior).
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10.	IS 1944	Lighting (in public thoroughfares)
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11.	IS 5077	Light Fittings.
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12.	IS 1913	Light fittings.
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13.	IS 1897/2927	Lugs & Sockets.
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14.	IS 3854	5A & 15A Switches & Sockets.
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15.	IS 1293	5A & 15A Switches & Sockets.
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	IS 5216/1982	Safety in Electrical work (general).
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16.	IS 6538	5A & 15A switch and sockets.
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17.	IS 13032/1991	AC miniature circuit breaker boards for voltages not exceeding 1000V.
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18.	IS 2147/1962	The degree of protection offered by the enclosure to the MCB board.
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19.	IS 374	Ceiling Fan.
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20.	IS 12640/1988	RCCB's
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21.	IS 3427/1969	Metal clad switch gear and control switch gear (1000V to 1100V)
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22.	IS 694	PVC insulated cables for working voltage up to and including 1100V.
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23.	IS 1554	PVC insulated cables for working voltage up to and including 1100V.
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24.	IS 5216/Part II	Life saving techniques.
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25.	IS 8923/1982	Warning symbol for dangerous voltages.
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- 26. IS 3043/1966 Code of practice for earthing.
- 27. IS 3043/1987 Earthing.

SAFETY CODE.

1. The Contractor shall maintain in a readily accessible place first aid appliances including adequate supply of sterilized dressings and cotton wool.
2. An injured person shall be taken to a public hospital without loss of time, incases where the injury necessities hospitalization.
3. Suitable and strong scaffolds should be provided for workmen for all works that cannot safety be done from ground.
4. No portable single ladder shall be over 8 meters in length. The width between the side rails shall not be less than 30cm clear and the distance between two adjacent rungs shall not be more than 30cm. When a ladder is used an extra mazdoor shall be engaged for holding the ladder.
5. The excavated material shall not be placed within 1.5 meters of the edge of the trench or half of the depth of trench whichever is more. All trenches and excavations shall be provided with necessary fencing and lighting.
6. Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be one meter.
7. No floor, roof or other part of the structure shall be over loaded with debris or materials as to render it unsafe.
8. Those engaged in welding works shall be provided with welder's protective eye shields and gloves.
9. Hoisting machine and tackle used in the works, including their attachments, anchorage and supports shall be in perfect condition.
10. The ropes used in hoisting or lowering material or as a means of suspension shall be of durable quality and adequate strength and free from defects.
11. The Consultants / Employer reserves the right to instruct the Contractors to take additional safety precautions if found necessary.