



NIT No. PDX/MM&SC/MUZAFFARPUR/T-05

Sub: Development of infrastructure at Muzaffarpur TPS pertaining to R&M of 2x110 MW, Unit 1 & 2 for KBUNL, KANTI, Bihar.

A : FOR CIVIL WORKS :

1.0 Scope consists of following:

- 1.1 Repair & Renovation of quarters allotted to BHEL for conversion into Transit Hostel and Family Accommodation.
- 1.2 Addition/Alteration and Renovation of allocated building in Power House area or outside for establishment of BHEL site Office.
- 1.3 Work in open store yard such as fencing etc.
- 1.4 Repair work in covered store as required.
- 1.5 Any other work as per requirement.

Further point wise details are as follows for Civil Works –

I. For works under sl. nos. 1.1

A. Plumbing & sanitation

Toilet attached to bedroom

1. Wall mounted Cascade type dual flush set EWC White in colour with seat cover of matching shade with wall mounting arrangement and PVC P-trap Make: Hindware / Parryware or equivalent Angle Stop Cock -01 Nos & PVC Connection-01 Nos..
2. Open wall mixer with bucket point and overhead shower
3. Counter top oval shape washbasin of size 550x450 mm of Hindware /Parryware or equivalent of approved colour with counter of 90cmx60cm made of granite of approved color/shade with basin mixer. & bottle trap CP waste coupling, Angel stop cocks-02 Nos PVC connections (Hot-01 Nos & Cold-01 Nos) and C-PVC waste pipe of 32 mm dia.
4. Two way bibcock with health faucet-01 Nos
5. Towel Ring-01 Nos
6. Towel Racks-01 Nos
7. Coat Hook-01 Nos
8. One of the toilet out of two adjacent toilets should be provided with 25 ltr capacity Geyser of Racold/ Bajaj / Crompton Greaves or equivalent make & connection to each of the two toilets should be provided
9. Glass self-01 Nos
10. Mirror 450mmx600mm of ATUL/MODI GUARD make or equivalent with frame of Aluminium and base of 8 mm thick waterproof and termite proof ply
11. All plumbing C.P. fittings & Accessories shall be of Jaquar make Florentine range or equivalent.
12. All water lines should be concealed C-PVC line with matching fittings of ASTRAL brand from Plumber make or equivalent .
13. All traps and under flow drainage lines should be of KISAN-Classic or equivalent make. Minimum 02 Nos Floor Trap/Nahni Trap should be provided with C.P. Jali.
14. The work shall include dismantling of old fittings if required.
15. For new toilet, if required ,same work as stated above shall be carried out

Rear verandah & servant quarter (as applicable)

Approved by

V.K.Mishra

Date of Issue

24NOV.2010



1. In rear verandah one no. counter top wash hand basin similar to that described under sl.no. 3 above should be provided in rear verandah with proper water supply & drainage arrangement.
2. **Toilet attached to servant quarter** should be provided with 580 mm long Orissa pattern Indian WC (Hindware/Parryware) white in colour with slim line PVC flushing cistern with PVC connection, Angle stop cock and flush pipe. Toilet should be provided with one no. C.P. Bib cock for mug point. All CP plumbing fittings and accessories shall be of Jaquar make – Florentine range or equivalent.

B. Roof Top/ Chhajja Top Cleaning and water proofing treatment

1. Cleaning of roof top & chhajja top including up-rooting of all sorts of vegetations from the surface and removal of old tarfelts.
2. Repairing the damaged portion including cracks with cement concrete 1:2:4 and/or cement sand mortar (1:4) as may be applicable
3. Making C.C. (1:2:4) Gola 75 mmx75 mm at the joint of vertical & horizontal surfaces
4. Providing screed concrete over the roof with C.C. 1:2:4 with water proofing admixture of Fosroc or equivalent with a slope of 1:100 for proper drainage of rain water.
5. Providing PVC Rain water pipe of 4" dia in adequate nos.(to be decided in consultation with BHEL Engineer) including all required fittings. PVC pipes and fitting should be of KISSAN Classic brand or equivalent make.
6. Laying bitumen felt as per CPWD specification.

C. Water Supply & under ground sewerage/drainage System

1. Old M.S Tank/RCC overhead tank should be removed including removal of old connection and in place three nos. 3 layered 1000 liters capacity HDPE Tank of SINTEX make or equivalent to be provided and placed in position over a raised platform of 150mm height made of brick work neatly plastered.
2. Inlet connection to be made with existing line. Supply line to all toilets, Kitchen, courtyard, wash area, wash hand basin in rear verandah and front and backside in the compound wall should be laid using CPVC line of suitable diameter including all fitting as may be required. A float valve should be provided at the inlet to avoid over flow. An over flow line should also be provided for proper drainage of overflow water in case float valve fails.
3. All underground drainage/sewerage system should be revived by resorting to cleaning and repairing of broken inspection/gully trap chambers. In case of broken sewer, the same should be replaced with new line either using stoneware pipe or PVC pipe of suitable diameter, grade and approved make. If revival is not possible, complete replacement should be considered including construction of septic tank and soak pit as per requirement.

D. Wood work, Carpentry & Joinery works

1. All identified door, window & ventilator openings to be closed with brick masonry in cement mortar 1:6 (1cement:6 coarse sand) after removal/dismantling of chowkhats. Hold fast position to be repaired with 1:2:4 Cement concrete. Brick masonry to be plastered with cement mortar 1:4 to match the adjoining plastered surface. Care should be taken for proper joining of new brick masonry with old brick masonry.
2. Wherever chowkhats are damaged these should be repaired to match the existing pattern & design. For repairing wooden members of old dismantled chowkhats can be used.
3. Door shutters to be provided shall be solid core factory made flush door shutter shutter and should be waterproof and termite proof. New shutters should be applied with two coats of wood primer. Shutters should be fixed to the frame with the help of 3 Nos 5" S.S./Brass butt hinges. Each door shutter should be provided with 2 Nos 8" long Aluminium Tower bolt, 01 No cylindrical lock (Godrej make or equivalent), 01 no. door brass stopper. Sample of all these fittings should be got approved from BHEL Engineer before bulk procurement. All bed room door shutters should be provided with one no Cylindrical lock-keyed (Product code 5135 Round Lock-Brass) of Godrej make.
4. All new window shutters shall be paneled as per existing pattern & design made of second class teak wood. All window shutters should be fixed to frame with the help of two nos. 4"



long M.S. butt hinges and shall be provided with two nos. 6" long brass tower bolt, one no 4" long brass handle and one no. brass 6" long peg stay.

5. Masonary rack provided in all the rooms to be converted into covered wardrobe. For this outer framing and two leaf shutters shall be of 19 mm block board (waterproof termite proof) with colour (approved by BHEL) lamination. One number intermediate shelf of 19 mm block board should be provided in the wardrobe which shall be painted with two coats of synthetic enamel paint of approved shade & colour over a coat of wood primer. Ward robe should be provided with magnetic catchers, Handles on both leaves and a suitable lock (Godrej or equivalent make) should be provided.
6. All bedrooms and drawing room should be provided with one no opening with wooden frame for accommodating window AC. Frame should be of 2nd class teak wood painted with synthetic enamel paint over a coat of wood primer. In case of wall mounted AC this work shall not be required
7. Masonary rack provided in Drawing room should be converted into show case with frame of anodized Aluminium with sliding shutters and shelves 3 to 4 in numbers of 5 mm thick float glass. Matching and compatible hardware shall be provided.
8. One rack of store should be covered with anodized aluminium glazed sliding shutters with anodized aluminium frame.

E. Flooring & Floor Finishes

1. Court yard should be provided with 50 mm thick IPS Floor with glass paneling
2. All rooms, Kitchen, store and verandah should be provided with vitrified tile of size 60cmx60cm of approved colour & shade of Marbonite brand of Johnson & Johnson or equivalent make as per relevant IS. The same to be fixed to the existing surface using tile adhesive Balendura/Latcrete. Before fixing of tile wherever floor repairing is required to be done it should be done with P.C.C 1:2:4.
3. Kitchen should be provided with a good quality Granite stone platform of approved colour & shade. From FFL to 2' above the platform, wall should be provided with Kazaria make or equivalent glazed ceramic tile as per relevant IS.
4. Each toilet Floor should be of anti-skid ceramic tile (1'x1') of kajaria or equivalent make as per relevant IS fixed to floor with Balendura / Latcrete after Patch repairing and leveling of Floor with C.C. 1:2:4
5. Each toilet walls should be provided with glazed ceramic tile of Kajaria or equivalent make as per relevant IS fixed to wall with Balendura /Latcrete. Height of tiling should be 7' (up to Lintel soffit) including providing concealed C-PVC pipe line including carrying out necessary repair with cement sand mortar of 1:4(1cement: 4 Sand).
6. All around the building plinth protection in 1500 mm width should be provided.
7. For new toilet under layer of Floor finish shall consists of 150 mm thick boulder soling over a well compacted soil base with 75 mm thick 1:4:8 PCC on top.

F. Roadwork & approaches

1. From front main gate of the compound to garage & porch a WBM road of 3.5 m width shall be provided. WBM road shall consists of a base course of 200 mm thick soling using 90 to 45 mm thick stone metal and a wearing course of 75 mm thick metal soling with 63 mm to 45 mm stone metal. Construction of WBM road shall include all labour, materials tools & tackles etc complete as per CPWD specifications.
2. For drainage of surface water across the road, at some locations under ground RCC Hume pipes of NP2 class would be required to be laid
3. Brick masonry drain along the road shall be made for drainage of surface water.
4. Outside kachcha drain should be channelized by excavating it to the required length, width and depth.

G. Painting & Finishing

1. External wall should be painted with Premium Acrylic Smooth Exterior paint of approved colour and shade. Paint should be APEX brand of ASIAN PAINTS or equivalent. Painting shall include all operations like surface preparation including scrapping of existing surface



- and cleaning of surface including applying a coat of suitable primer including filling of surface cracks and small pitting with Birla white putty.
2. Internal wall and ceiling should be painted with two or more coats of plastic emulsion paint over a coat of 2 mm thick POP PUNNING with under layer coat of suitable primer. Plastic emulsion paint shall be of ASIAN/ICI or equivalent. It includes all operations like surface preparation including scrapping of existing surface finish, cleaning etc complete.
 3. All wooden doors & windows and other wooden articles wherever required should be painted with two or more coat synthetic enamel paint of approved colour & shade of ASIAN make or equivalent. For new works, two coats of wood primer of approved brand and make should be applied before applying synthetic enamel paint.
 4. All grills and structural steel works should be painted with two or more coats of synthetic enamel paint of approved colour & shade of ASIAN make or equivalent. For new steel works, before synthetic enamel paint is applied two coats of steel primer should be applied.

H. Fencing and Fencing Gate

1. All-around barbed wire (9.38 kg/100m) fencing should be provided Boundary should be provided with a M.S Gate of approved design and pattern. Gate design should be submitted by bidder.

II. For work under sl. no. 1.2 - Addition/Alteration and Renovation for BHEL Site Office

A. Toilet modification:

1. Floor Tiling: Antiskid Floor ceramic tiles of Kazaria /Somany /Nitco /Johnson & Johnson or equivalent as per relevant IS
2. Wall tiling: Wall tiling using Glazed ceramic designer pattern using border, motive and base tiles of Kazaria/ Somany/ Nitco/ Johnson & Johnson or equivalent as per relevant IS
3. Construction of partitions as per layout
4. Providing One number wall mounted cascade type EWC and two nos. Half stall Urinals along with necessary fillings as per the requirements.
5. Providing urinal partitions of marble of approved shade & colour
6. Providing Aluminium door in the toilet fixed to chowkhat made of Aluminium section with Aluminium handles of size 6" on both side, Two nos 8" long Al Tower Bolt and one no 300 mm long Sliding bolt.
7. Wall and ceiling should be painted with Plastic emulsion paint of approved colour & shade and it shall be of ASIAN/ICI or equivalent make. The painting shall include all operations including removal/scrapping of old paints, preparation of surface including applying approved distemper primer. MS doors should be painted with two coats of synthetic enamel paint of ASIAN Paints of approved colour and shade.

B. Construction of office cabins

1. Providing anodised aluminum partition of 10' height with lower one third paneling with 12 mm thick both side laminated NOVA PAN Board and upper two third glazing with 5.5 mm thick float glass.
2. Aluminum door should be provided fitted to frame with the help of Aluminum hinges. Door should be provided with one no. hydraulic door closure of Godrej make two nos. disc type handles of and Godrej make mortise lock with Door.
3. False ceiling shall be with tapered edge gypsum board 12.5 mm thick conforming to IS:2095.
4. Floor should be 600mmx600 mm vitrified tile of Johnson & Johnson make or equivalent as per relevant IS.
5. Ceiling and walls should be painted with plastic emulsion paint of approved colour & shade and plastic emulsion paint shall be of ASIAN /ICI or equivalent. The painting should include all operation like preparation of surface including scrapping of old paints including application of approved brand of primer.



6. Main Gate should be of Al partition cum door, which should be lockable. The Gate should be fitted with Godrej make or equivalent mortise lock and hydraulic door closure and a disc type aluminum Handle.

C. Pantry

1. A Granite platform of 600 mm wide and 3.0 m long (as per space availability) should be provided resting of brick pillars
2. Under the platform, suitable racks of 19 mm block board should be provided and these should be provided with open able shutter of 19 mm board with lamination of approved colour and shade. Inside board should be painted with two coats of synthetic enamel paint with under coat of two coats of wood primer of approved make

D. Waterproofing and other applicable works as per 1.1 above.

III. For works under sl. nos. 1.3, 1.4 & 1.5

As per CPWD specification (latest), BHEL's specification and as per instruction of Engineer-In-Charge.

Note:

1. **Abovementioned details are broad description of works which are liable for change by Engineer-In-charge as per site requirement. Apart from above mentioned works there may be some additional works which may not have the specific mention under the scope but may be required to be done. The same shall be carried out by the contractor for which payment shall be made as per the relevant items of the approved price schedule. The quantities mentioned in this scope and specification are only for guidance. Payment will be based on awarded price schedule.**
2. **Following is the brief and general details of technical specification for carrying out civil engineering works. In case of any ambiguity / conflicting provisions in between these specifications and CPWD Specifications for items of work covered in scope of work the CPWD specifications shall prevail.**

2.0 MATERIAL :

2.1 Cement : Approved quality of ordinary Portland cement of Grade 43 confirming to IS code shall be used for all civil construction work. However before using the type of cement, approval is to be obtained from the Engineer In-charge.

2.2 Aggregates : Aggregate means both the coarse aggregate and fine aggregate respectively used in preparation of cement concrete and cement mortar. Aggregate shall consist of natural sand and or crushed stone from a source known to produce satisfactory quality of aggregate and shall confirm to IS 383. Aggregate shall always be free from clay, loam, silt, organic matter, soft clayey, shale or decomposed stone and other impurities and shall be hard and dense.

2.3 Water : Water used for mixing and curing shall be as per clause 5.4 of IS 456. If the water proposed to be used for mixing and curing does not satisfy the stipulations of BIS and or contain acid, alkali, sugar, silt or other deleterious substances, the same shall not be used.

2.4 Reinforcement : Reinforcement bars for RCC shall be HYSD (High Yield Strength Deformed) of grade Fe 415 confirming to IS 1786 (minimum yield strength 415 N/sqmm). MS round bars shall be for grade 1 confirming to IS 432 part I and Welded Wire Fabric shall be confirming to IS 1566.

2.5 Structural Steel : All structural steel shall confirm to Grade A of IS 2062 for rolled steel sections.



2.6 Anchor Bolt : Materials for Anchor Bolts such as MS bars, Washers, nuts, pipe sleeves and plates etc. shall confirm to IS 1363 and IS 1364 of 1962.

2.7 Grout : Water soluble Non-Shrink material of FOSROC or Equivalent make shall be used for all grouting purposes unless specified otherwise.

2.8 Sand : The sand to be used for filling under the floor and grading work shall confirm to IS 383:1999 Zone IV and Zone V.

3.0 SITE PREPARATION : All existing constructions such as but not limited to foundations, paving, trees and shrubs, bushes and other vegetation with dense growth of ground plants shall be completely removed from the site. After the site area is fully cleared the complete area shall be scarified for an average depth of 300 mm and compacted properly with a road roller.

4.0 EXCAVATION, BACKFILLING AND COMPACTION :

4.1 Pits and trenches for foundations of structures and buildings shall be excavated to the level and dimensions shown on the drawings or to such other level and dimensions as directed by the Engineer In-charge. All excavation shall be taken out as nearly as possible to the exact dimensions of the foundations to minimize backfilling.

4.2 Excavated materials from excavations which are suitable and required for backfilling shall be stockpiled clear of the excavation works. The stockpiles shall be shaped and graded to permit proper drainage.

4.3 Excavated materials from excavations which are unsuitable for use as backfilling shall be transported and disposed off to a dumping place as directed.

4.4 Foundation pits and trenches shall be kept free from water during the time that excavation is being carried out and until any concrete therein is sufficiently set and all constructional works therein does not get damaged from flooding, hydrostatic pressure, flotation or other cause. They shall be kept free from water during the period that backfilling is being carried out.

4.5 Backfilling of foundation pits and trenches shall be carried out as soon as the foundations and structural works therein have acquired adequate strength as specified by the Engineer. The timing and rate of placing backfill material around or upon any completed or partially completed structure shall be arranged in such a way that no part of the work is over stressed, weakened or damaged.

4.6 Backfill material shall be placed in layers of uniform thickness and shall be brought up uniformly on all sides of the foundation or structure being backfilled. Each layer shall be so placed as to maintain adequate drainage and to prevent accumulation of water.

4.7 The backfill material shall be compacted in layers not exceeding 150 mm in depth when compacted, to a dry density not less than 95% of the maximum dry density.

5.0 STRUCTURAL CONCRETE :

5.1 Cement concrete shall be prepared by mixing graded stone aggregate as specified with fine aggregate and cement in specified proportions with required quantity of water. The grading and quality of aggregates shall be such as to give minimum compressive strength of 140 kg/sqcm at 7 days and 210 kg/sqcm at 28 days in case of mix 1:2:4. One sample consisting of 6 cubes of 15 x 15 x 15 cm shall be taken for every 10 cum or part thereof as specified for of cement concrete 1:2:4.

5.2 The proportioning shall be done by volume by using boxes of suitable size. The internal dimensions of the boxes shall be generally 35 x 25 x 40 cm deep or as otherwise approved by the Engineer In-charge. The unit of measurement for cement shall be a bag of 50 kg and this shall be taken as 0.0347 cum. While measuring the aggregates, shaking, ramming or heaping shall not be done. The proportioning of sand shall be on the basis of its dry volume and in case of damp sand allowance for bulkage shall be made.



5.3 The concrete mix proportion should be such that the concrete is of adequate workability for the placing conditions of the concrete and can properly be compacted with the means available.

5.4 Concrete shall be produced by concrete mixer machine & hand mix is generally not acceptable. However in certain unavoidable circumstances, hand mix shall be permitted with 10% extra cement content as per the discretion of BHEL engineer.

The entire concrete used in the work shall be laid gently (not thrown) in layers not exceeding 15 cm and shall be thoroughly compacted by means of mechanical vibrator till a dense concrete is obtained. In case of Lean Concrete thorough hand compaction shall be done. The layers of concrete shall be so placed that the bottom layer does not finally set before the top layer is placed.

5.5 When the placing of concrete is suspended, necessary removal of laitance and roughening the surface for jointing future work shall be done before the concrete sets. When the work is resumed the previous work must be thoroughly cleaned, roughened, watered and a grout of neat cement slurry of the proportion 1 kg of cement per 2 liters of water applied uniformly.

5.6 After 24 hours of laying of concrete, the surface shall be cured by flooding with water of minimum 25mm depth or by covering wet absorbent materials. The curing shall be done for a minimum period of 14 days.

5.7 Over the foundation concrete, the masonry work may be started after 48 hours of its laying but curing shall be continued along with the masonry work.

5.8 Reinforced cement concrete work may be cast-in-situ or Precast as may be directed by Engineer-in-charge according to the nature of work. Reinforced cement concrete work shall comprise of the following which may be paid separately or collectively as per the description of the item of work.

(a) Form work (Centring and Shuttering)

(b) Reinforcement

(c) Concreting: 1) Cast-in-situ 2) Precast

5.8a FORM WORK (CENTRING & SHUTTERING)

5.8a.i Form work shall include all temporary or permanent forms or moulds required for forming the concrete which is cast-in-situ, together with all temporary construction required for their support. It shall be strong enough to withstand the dead and live loads and forces caused by ramming and vibrations of concrete and other incidental loads, imposed upon it during and after casting of concrete. It shall be made sufficiently rigid by using adequate number of ties and braces, Screw jacks or hard board wedges where required shall be provided to make up any settlement in the form work either before or during the placing of concrete.

5.8a.ii Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Care shall be taken to see that no piece is keyed into the concrete.

5.8b REINFORCEMENT

5.8b.i Steel Conforming shall be clear and free from loose mill scales, dust, loose rust, coats of paints, oil or other coatings which may destroy or reduce bond It shall be stored in such a way as to avoid distortion and to prevent deterioration and corrosion Prior to assembly of reinforcement on no account any oily substance shall be used for removing the rust.

5.8b.ii Assembly of Reinforcement Bars shall be bent correctly and accurately to the size and shape as shown in the detailed drawing or a directed by Engineer-in-Charge. Preferably bars of full length shall be used. Necessary cutting and straightening is also included. Over lapping of bars, where necessary shall be done as directed by the Engineer-in-Charge the overlapping bars shall not touch each other and these shall be kept apart with concrete between them by 25 mm or 11/4 times the maximum size of the coarse aggregate whichever is greater. But where this is not possible, the overlapping bars shall be bound together at intervals not exceeding twice the dia of such bars with two strands annealed steel wire of 0 90 mm to 1 6



mm twisted tight The overlaps/splices shall be staggered as per directions of the Engineer-in-Charge. But in no case the over lapping shall be provided in more than 50% of cross sectional area at one section.

5.8b.iii Reinforcement bars shall be placed in position as shown in the drawings or as directed by the Engineer-in-Charge The bars crossing one another shall be tied together at every intersection with two strands of annealed steel wire 0 9 to 1 6 mm thickness twisted tight to make the skeleton of the steel work rigid so that the reinforcement does not get displaced during deposition of concrete. Tack welding in crossing bars shall also be permitted in lieu of binding with steel wire if approved by Engineer-in-Charge.

5.8b.iv The bars shall be kept in correct position by the following methods:

(a) In case of beam and slab construction precast cover blocks in cement mortar 1:2 (1 cement : 2 coarse sand) about 4x4 cm section and of thickness equal to the specified cover shall be placed between the bars and shuttering, so as to secure and maintain the requisite cover of concrete over reinforcement.

(b) In case of cantilevered and doubly reinforced beams or slabs, the vertical distance between the horizontal bars shall be maintained by introducing chairs, spacers or support bars of steel at 1.0 metre or at shorter spacing to avoid sagging.

(c) In case of columns and walls, the vertical bars shall be kept in position by means of timber templates with slots accurately cut in them; or with block of cement mortar 1:2 (1 cement :2 coarse sand) of required size suitably tied to the reinforcement to ensure that they are in correct position during concreting.

(d) In case of other R.C.C. structure such as arches, domes, shells, storage tanks etc. a combination of cover blocks, spacers and templates shall be used as directed by Engineer-in-Charge.

5.8b.v Minimum cover in structural members shall be maintained as for moderate exposure. However, in slabs (excluding roof slab, chajjas, fins) mild exposure would be permitted.

5.8c CONCRETING

5.8c.i The concrete shall be prepared as specified above. The concrete which will flow sluggishly into the forms and around the reinforcement without any segregation of coarse aggregate from the mortar, shall be used. The consistency shall depend on whether the concrete is vibrated on or hand tamped. It shall be determined by slump test as per standard practice.

5.8c.ii Concreting shall be commenced only after Engineer-in-charge has inspected the centering, shuttering and reinforcement as placed and passed the same. Shuttering shall be clean and free from all shavings, saw dust, pieces of wood, or other foreign material and surfaces shall be treated as instructed.

5.8c.iii In case of concreting of slabs and beams, wooden plank or cat walks of chequered MS plates or bamboo chalties or any other suitable material supported directly on the centring of wooden blocks or lugs shall be provided to convey the concrete to the place of deposition without disturbing the reinforcement in any way. Labour shall not be allowed to walk over the reinforcement.

5.8c.iv In case of columns and walls, it is desirable to place concrete without construction joints. The progress of concreting in the vertical direction shall be restricted to one metre per hour.

5.8c.v The concrete shall be deposited in its final position in. a manner to preclude segregation of ingredients. In deep trenches and footings concrete shall be placed through chutes or as directed by the Engineer-in-Charge. In case of columns and walls, the shuttering shall be so adjusted that the vertical drop of concrete is not more than 1 .5 metres at a time.



5.8c.vi During cold weather, concreting shall not be done when the temperature falls below 4.5°C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work redone.

5.8c.vii During hot weather precaution shall be taken to see that the temperature of wet concrete does not exceed 38°C. No concrete shall be laid within half an hour of the closing time of the day, unless permitted by the Engineer-in-Charge.

5.8c.viii It is necessary that the time between mixing and placing of concrete shall not exceed 30 minutes so that the initial setting process is not interfered with.

5.8c.ix Concrete shall be compacted into dense mass immediately after placing by means of mechanical vibrators designed for continuous operations. The Engineer-in-Charge may however relax this conditions at his discretion for certain items, depending on the thickness of the members and feasibility of vibrating the same and permit hand compaction instead. Hand compaction shall be done with the help of tamping rods so that concrete is thoroughly compacted and completely worked around the reinforcement, embedded fixtures, and into corners of the form.

5.8c.x Concrete shall be judged to be properly compacted, when the mortar fills the spaces between the coarse aggregate and begins to cream up to form an even surface. When this condition has been attained, the vibrator shall be stopped in case of vibrating tables and external vibrators. Needle vibrators shall be withdrawn slowly so as to prevent formation of loose pockets in case of internal vibrators. In case both internal and external vibrators are being used, the internal vibrator shall be first withdrawn slowly after which the external vibrators shall be stopped so that no loose pocket is left in the body of the concrete. The specific instructions of the makers of the particular type of vibrator used shall be strictly complied with. Shaking of reinforcement for the purpose of compaction should be avoided. Compaction shall be completed before the initial setting starts, i.e. within 30 minutes of addition of water to the dry mixture.

5.9 Construction Joints

5.9.1 Concreting shall be carried out continuously upto the construction joints, the position and details of which shall be as shown in structural drawing or as directed by Engineer-in-charge. Number of such joints shall be kept to minimum. The joints shall be kept at places where the shear force is the minimum. These shall be straight and shall be at right angles to the direction of main reinforcement. Construction joints should comply with IS: 11817

5.9.2 In case of columns the joints shall be horizontal and 10 to 15 cm below the bottom of the beam running into the column head. The portion of the column between the stepping off level and the top of the slab shall be concreted with the beam.

5.9.3 When stopping the concrete on a vertical plane in slabs and beams, and approved stop-board shall be placed with necessary slots for reinforcement bars or any other obstruction to pass the bars freely without bending. The construction joints shall be keyed by providing a triangular or trapezoidal fillet nailed on the stop-board. Inclined or feather joints shall not be permitted. Any concrete flowing through the joints of stop-board shall be removed soon after the initial set. When concrete is stopped on a horizontal plane, the surface shall be roughened and cleaned after the initial set.

5.9.4 When the work has to be resumed, the joint shall be thoroughly cleaned with wire brush and loose particles removed. A coat of neat cement slurry at the rate of 2.75 kg of cement per square meter shall then be applied on the roughened surface before fresh concrete is laid.

5.10 Expansion Joints

5.10.1 Expansion joints shall be provided as shown in the structural drawings or as directed by Engineer-in-charge, for the purpose of general guidance. However it is recommended that structures exceeding 45 m in length shall be divided by one or more expansion joints. The filling of these joints with bitumen filler, bitumen felt or any such material and provision of copper plate, etc. shall be as shown in the structural drawings or as directed by Engineer-in-



charge. The measurement shall be taken upto two places of decimal stating the depth and width of joint.

5.11 Finishing

5.11.1 In case of roof slabs the top surface shall be finished even and smooth with wooden trowel, before the concrete begins to set.

5.11.2 Immediately on removal of forms, the R.C.C. work shall be examined by the Engineer-in-Charge, before any defects are made good.

(a) The work that has sagged or contains honey combing to an extent detrimental to structural safety or architectural concept shall be rejected for visual inspection test.

(b) Surface defects of a minor nature may be accepted. On acceptance of such a work by the Engineer-in-Charge, the same shall be rectified as follows:

1. Surface defects which require repair when forms are removed, usually consist of bulges due to movement of forms, ridges at form joints, honey-combed areas, damage resulting from the stripping of forms and bolt holes, bulges and ridges are removed by careful chipping or tooling and the surface is then rubbed with a grinding stone. Honey-combed and other defective areas must be chipped out, the edges being cut as straight as possible and perpendicularly to the surface, or preferably slightly undercut to provide a key at the edge of the patch.

2. Shallow patches are first treated with a coat of thin grout composed of one part of cement and one part of fine sand and then filled with mortar similar to that used in the concrete. The mortar is placed in layers not more than 10 mm thick and each layer is given a scratch finish to secure bond with the succeeding layer. The last layer is finished to match the surrounding concrete by floating, rubbing or tooling on formed surfaces by pressing the form material against the patch while the mortar is still plastic.

3. Large and deep patches require filling up with concrete held in place by forms. Such patches are reinforced and carefully dowelled to the hardened concrete.

4. Holes left by bolts are filled with mortar carefully packed into places in small amounts. The mortar is mixed as dry as possible, with just enough water so that it will be tightly compacted when forced into place.

5. Tiered holes extending right through the concrete may be filled with mortar with a pressure gun similar to the gun used for greasing motor cars.

6. Normally, patches appear darker than the surrounding concrete, possibly owing to the presence on their surface of less cement laitance. Where uniform surface colour is important, this defect shall be remedied by adding 10 to 20 percent of white cement to the patching mortar, the exact quantity being determined by trial.

7. The same amount of care to cure the material in the patches should be taken as with the whole structure. Curing must be started as soon as possible, after the patch is finished to prevent early drying. Damp hessian may be used but in some locations it may be difficult to hold it in place. A membrane curing compound in these cases will be most convenient.

(c) The exposed surface of R.C.C. work shall be plastered with cement mortar 1:3 (1 cement: 3 fine sand) of thickness not exceeding 6 mm to give smooth and even surface true to line and form Any RCC surface which remains permanently exposed to view in the completed structure, shall be considered exposed surface for the purpose of this specification. However, this shall be done only when specified in the drawings or as directed by Engineer-in-charge.

Where such exposed surface exceeding 0.5 sq m in each location is not plastered with cement mortar 1:3 (1 cement :3 fine sand) 6 mm thick, necessary deduction shall be made for plastering not done.

(d) The surface which is to receive plaster or where it is to be joined with brick masonry wall, shall be properly roughened immediately after the shuttering is removed, taking care to remove the laitance completely without disturbing the concrete. The roughening shall be done



by hacking. Before the surface is plastered, it shall be cleaned and wetted so as to give bond between concrete and plaster. RCC work shall be done carefully so that the thickness of plaster required for finishing the surface is not more than 6 mm.

(e) The surface of RCC slab on which the cement concrete or mosaic floor is to be laid shall be roughened with brushes while the concrete is green. This shall be done without disturbing the concrete.

6.0 GROUTING

Grout shall be provided as specified on the drawings. The proportion of Standard Grout shall be such as to produce a flowable mixture consistent with minimum water content and shrinkage. Surfaces to be grouted shall be thoroughly roughened and cleaned. All structural steel elements to be grouted, shall be cleaned of oil, grease dirt etc. The use of hot strong caustic solution for this purpose will be permitted prior to grouting; the hardened concrete shall be saturated with water and just before grouting water in all pockets shall be removed. Grouting once started shall be done quickly and continuously. Variation in grout mixes and procedures shall be permitted if approved by Engineer-In-charge.

7.0 MASONRY WORK : This specification covers the general requirements for brick, laterite and stone masonry.

7.1 BRICK MASONRY

7.1.1 Bricks used on the work shall be approved by the Engineer and shall conform to IS 1077. They shall be uniform in quality and size. The size required for the works is 225 x 115 x 75mm. The bricks shall be got tested as per IS 3495 at contractor's cost and the crushing strength shall not be less than 50 kgs/sq. cm.

7.1.2 The bricks will be hand or machine moulded, obtained from a source approved by the Engineer, of uniform size, shape and colour and must be well burnt so as to give a clean ringing sound when struck. They shall have plane rectangular faces with parallel sides and sharp straight right angle edges.

7.1.3 Sample of all bricks specified shall be taken at random and shall be deposited with Engineer or his representative before used in the works and all subsequent deliveries of bricks shall conform to the standard of the approved samples.

7.1.4 All mortars shall be prepared in accordance with IS 2250. The sand used shall conform to IS 2116. Re tempering of set mortar will not be permitted.

7.1.5 Unless otherwise specified in the schedule of quantities the cement mortar proportion shall be as follows:-

(1) 115thk brickwork and hollow block work : 1:4

(2) 230thk brickwork and solid block work : 1:6

7.1.6 CONSTRUCTION

7.1.6.a All masonry work shall comply with the requirements of IS 2212, be of English bond and all necessary closer bricks etc necessary to comply with the requirements of the Bond specified or to break joints effectively shall be procured by the CONTRACTOR and used for the work.

7.1.6.b Ordinarily there shall be four courses per 0.33m height or in other words, the horizontal bed joints shall be an average 10mm thick, and the vertical joints 10mm wide. No joint shall be more than 12 mm thick. The mortar shall be worked up to all joints and no hollow space shall be left in any portion of the work. Any brick dismantled from the work for the purpose of testing the workmanship shall in case of good work that could be passed, be completely covered with mortar, the work otherwise is liable to be rejected. All joints shall be laid truly horizontal and all vertical joints shall be truly vertical. Masonry work shall be raised in an uniform manner so that no one portion is being raised more than 1m above another portion at one time.

7.1.6.c For half brick walls (115mm th). which exceed 2.0M in height, a reinforced concrete band (concrete grade M15/10) shall be provided at intervals not exceeding 2M. The reinforcement in these bands consists of 2 NOS. 8mm TOR steel top and bottom 6mm binders spaced at 150mm centers. Such band shall also be provided at the free edge of all masonry work including windowsills and top of freestanding walls.



7.1.6.d All bricks shall be thoroughly soaked by keeping them under water for such a period as is sufficient for the water to penetrate, to be confirmed by field test. The practice of dipping the bricks in water just before use will not be allowed. All necessary water cisterns for this purpose shall be constructed or tubs brought by the contractor to the satisfaction of the Engineer to ensure proper soaking of bricks.

7.1.6.e No bats or broken bricks are to be used otherwise than as closures. No underburnt or overburnt bricks shall be used.

7.1.7 FIXTURES

Fixtures, plugs, frames for doors and windows, etc shall be placed in position while laying the course and not later by removing bricks already laid.

7.1.8 SCAFFOLDING

Scaffolding consisting of timber ballies, bamboos or steel tubular scaffolding adequately braced to resist all construction loads shall be provided as required by the working stages. Any holes made in the walls for tiling the scaffolding shall be made good by filling solidly with M10 grade concrete.

7.1.9 WATERING

The brickwork shall be kept wet for a period of at least 7 days commencing from 24 hours after laying.. The mortar shall not be allowed to dry at any time during this period. For block work the walls shall not be allowed to become excessively wet.

7.1.10 The work shall be checked with levels, plumb bob or square and shall be truly plumb and in all other respects of such a quality as to give entire satisfaction to the Engineer or his representative. All unfinished work shall be raked back in coarse, unless otherwise directed. When new work is to be joined to unfinished work, the surface of the unfinished work shall be cleaned and thoroughly wetted.

7.1.11 The finished work shall be true in line and level. All uneven, irregular and disturbed brickwork shall be pulled down and rebuilt with fresh brickwork at the contractor's expense. Masonry work shall not be raised by more than 1m in one single day.

7.1.12 Joints in brickwork shall be well raked out. Raking out of each day's work shall be done on the same day.

7.1.13 The permissible tolerance in brick work shall be as per IS 1905.

7.2 RANDUM RUBBLE MASONRY

7.2.1 The stone shall be of the type specified such as granite, trap, limestone, sand stone, quartzite, etc. and shall be obtained from the quarries, approved by the Engineer-in-Charge. Stone shall be hard, sound, durable and free from weathering decay and defects like cavities, cracks, flaws, sand holes, injurious veins, patches of loose or soft materials and other similar defects that may adversely affect its strength and appearance. As far as possible stones shall be of uniform colour, quality or texture. Generally stone shall not contain crypst crystalline silica or chart, mica and other deleterious materials like iron-oxide organic impurities etc. Stones with round surface shall not be used.

Note 1: Test for compressive strength shall be carried out as laid down in IS: 1121 (Part I).

Note 2: Test for water absorption shall be carried out as laid down in IS: 1124.

7.2.2 Normally stones used should be small enough to be lifted and placed by hand. Unless otherwise indicated, the length of stones for stone masonry shall not exceed three times the height and the breadth or base shall not be greater than three-fourth the thickness of wall, or not less than 15 cm. The height of stone may be up to 30 cm.

7.2.3 Random Rubble Masonry shall be uncoursed or bought to courses. Uncoursed random rubble masonry shall be constructed with stones of sizes as referred to in para 11.2 and shapes picked up random from the stones brought from the approved quarry. Stones having sharp corners or round surfaces shall, however, not be used.

7.2.4 Random rubble masonry brought to the course is similar to uncoursed random rubble masonry except that the courses are roughly levelled at intervals varying from 30cm to 90cm in height according to the size of stones used.



7.2.5 Each stone shall be hammer dressed on the face, the sides and the bed. Hammer dressing shall enable the stones to be laid close to neighbouring stones such that the bushing in the face shall not project more than 40 mm on the exposed face and 10 mm on the face to be plastered.

7.2.6 The mortar used for joining shall be in cement mortar 1:6.

7.2.7 All stones shall be wetted before use. Each stone shall be placed close to the stones already laid so that the thickness of the mortar joints at the face is not more than 20 mm. Face stones shall be arranged suitably to stagger the vertical joints and long vertical joints shall be avoided. Stones for hearting or interior filling shall be hammered down with wooden mallet into the position firmly bedded in mortar. Chips or sprawls of stones may be used for filling of interstices between the adjacent stones in heartening and these shall not exceed 20% of the quantity of stone masonry. To form a bond between successive courses plum stones projecting vertically by about 15 to 20 cm shall be firmly embedded in the heartening at the interval of about one metre in every course. No hollow space shall be left anywhere in the masonry. The masonry work in wall shall be carried up true to plumb or to specified batter.

7.2.8 Random rubble masonry shall be brought to the level courses at plinth, window sills, lintel and roof levels. Levelling shall be done with concrete comprising of one part of the mortar as used for masonry and two parts of graded stone aggregate of 20 mm nominal size.

7.2.9 The masonry in structure shall be carried uniformly. Where the masonry of one part is to be delayed, the work shall be raked back at an angle not steeper than 45°.

7.2.10 Bond Stones

7.2.10.a Bond or through stones running right through the thickness of walls, shall be provided in walls upto 60 cm thick and in case of walls above 60 cm thickness, a set of two or more bond stones overlapping each other by at least 15 cm shall be provided in a line from face of the wall to the back. In case of highly absorbent types of stones (porous lime stone and sand stone etc.) single piece bond stones may give rise to dampness. For all thicknesses of such walls, a set of two or more bond stones overlapping each other by at least 15 cm shall be provided. Length of each such bond stone shall not be less than two-third of the thickness of the wall.

7.2.10.b Where bond stones of suitable lengths are not available precast cement concrete block of 1: 3: 6 mix (1 cement: 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) of cross section not less than 225 square centimetres and length equal to the thickness of wall shall be used in lieu of bond stones. (This shall be applicable only in masonry below ground level and where masonry above ground level is finally required to be plastered). At least one bond stone or a set of bond stones shall be provided for every 0.5 sqm of the area of wall surface. All bond stones shall be marked suitably with paint as directed by the Engineer-in-Charge.

7.2.11 Quoin and Jamb Stones

7.2.11.a The quoin and jamb stones shall be of selected stones neatly dressed with hammer or chisel to form the required angle. Quoin stones shall not be less than 0.01 cum in volume. Height of quoins and jamb stones shall not be less than 15 cm. Quoins shall be laid header and stretcher alternatively.

7.2.12 Stones shall be so laid that all joints are fully packed with mortar and chips. Face joints shall not be more than 20 mm thick. The joints shall be struck flush and finished at the time of laying when plastering or pointing is not to be done. For the surfaces to be plastered or pointed, the joints shall be raked to a minimum depth of 20 mm when the mortar is still green.

7.2.13 Scaffolding

Single scaffolding having one set of vertical support shall be allowed. The supports shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed. The inner end of the horizontal scaffolding member may rest in a hole provided in the masonry. Such holes, however, shall not be allowed in pillars under one metre in width or near the skew back of arches. The holes left in masonry work for supporting scaffolding shall be filled and made good with cement concrete 1: 3: 6 (1 cement : 3 coarse sand : 6 stone aggregate 20 mm nominal size).



7.2.14 Curing

Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. In case of masonry with fat lime mortar curing shall commence two days after laying of masonry and shall continue for at least seven days thereafter.

7.2.15 Protection

Green work shall be protected from rain by suitable covering. The work shall also be suitably protected from damage, mortar dropping and rain during construction.

8.0 PLASTERING & POINTING

8.1 SCOPE

This specification covers the general requirement for the different types of plaster and pointing to be carried out on concrete brick masonry and laterite block walls.

The Indian Standard Codes applicable to this section shall include but not limited to the following :

- IS 1661 Code of Practice for application of cement and cement lime plaster.
- IS 269 Specification for Ordinary portland cement.
- IS 712 Building lime
- IS 1542 Sand for plaster
- IS 2394 Code of practice for application of lime plaster finish.

8.2 PREPARATION OF SURFACE

Concrete surfaces shall be roughened by wire brushing, hacking or brushing, hacking or brush hammering and chiseling. If the Engineer is not satisfied with the roughening achieved by these methods he may order other methods such as washing with acid etc. Loose layers of dust etc. on surfaces to be plastered shall be washed. The surface shall be cleaned to remove oil, paint or any other material that might interfere with satisfactory bond and saturated with water so as to be damp when the plaster is applied. To avoid cracks at the junction of concrete, with brick work the plaster shall be reinforced at such junctions by fixing standard wire mesh IRC S - 6 (6 x 6 x 6/6) as directed by the Engineer. The wire mesh shall overlap concrete and brick surface by at least 50 mm.

8.3 PROPORTIONING

The materials used in the preparation of plaster may be measured by volume using gauge boxes. The mix proportion of lime, unless otherwise stated generally refers to the volume of putty.

8.4 CEMENT AND SAND PLASTER

Cement and sand shall be mixed dry in the required proportions to obtain a uniform color. Water shall then be added to get the required consistency for the plaster.

8.5 CEMENT AND SAND PLASTER SMOOTH FINISHED

The cement mortar of the specified proportion shall be applied on all the walls brick or concrete surfaces to the specified thickness and shall be troweled smooth using a wood float. Use of dry cement to obtain smooth finish while troweling shall not be permitted. Care should be taken to ensure that the plastered surface does not dry out too quickly and also it is not over to avoid craze cracks.

9.0 FLOORING

9.1 SCOPE

The specification covers the requirement of providing labour, material, construction aids, workmanship etc. for providing and fixing flooring, skirting and dado work on floors and walls.

9.2 APPLICABLE CODES

Following specifications will be considered as part of this specification.

- IS 4631 Code of practice for laying epoxy resin floor topping.
- IS 1443 Code of practice for laying and finishing cement concrete flooring tiles.
- IS 777 Glazed earthen wall tile.
- IS 1237 Cement concrete flooring tiles
- IS 5491 Code of practice for laying in-situ granolithic concrete floor topping.



9.3 CEMENT CONCRETE FLOORING

This specification is applicable for laying flooring with cement concrete of specified grade and mix. Flooring shall be laid on concrete sub-grade where so provided. The sub-grade shall be provided with the slopes required for the flooring.

9.3.1 Surface Preparation

The surface of the base concrete shall be thoroughly cleaned and scrubbed with steel wire brush. The laitence of base concrete shall be completely removed to expose clean coarse aggregate. When roughening of surface by wire brushing is not possible, roughening shall be done by hacking at close intervals. Before laying the flooring, the sub-grade shall be wetted and smeared with a coat of cement slurry at 2kg of cement spread over an area of one sqm so as to get a good bond between the sub-grade and concrete floor.

9.3.2 Panel size

Flooring of specified thickness shall be laid in alternate panels. No dimension of a panel shall exceed 3 metre. Length of a panel shall not exceed 1½ times its breadth. The joints in panel shall be separated with 50mm wide x 4 mm thick glass strips.

9.3.3 Thickness

Generally average 40mm or as specified in drawings.

9.3.4 Laying

The cement concrete shall be placed in position in one operation in the panels. It shall then be leveled with the help of straight edge and trowel and beaten with a wooden "Thappy" 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 be ceased as soon as the surface is found covered with cream of mortar. The surface shall be tested with straight edge and made true to required slopes.

9.3.5 Finishing

The finishing of the surface shall follow immediately after the cessation of beating. The surface shall be left for some time, till moisture disappear from it. Excessive trowelling shall be avoided. Use of dry cement or cement and sand mixture sprinkled on the surface to stiffen the concrete or absorb excessive moisture shall not be permitted. Fresh quantity of cement at 2.0 kg of cement shall be mixed with water to form a thick slurry and spread over an area of one sqm of flooring while the concrete is still green. The cement slurry shall then be properly pressed and finished smooth.

9.3.6 Curing

Curing shall be continued for a minimum period of 7 days by ponding and not by merely sprinkling water.

10.0 CERAMIC AND GLAZED TILE FLOORING

Tiles shall be of 1st class quality of approved manufacture. The size and shade of the tiles shall be as specified in the Bill of Quantities.

10.1 Laying of Tiles

Surfaces on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tile shall be cement mortar 1:3 or as specified. The average thickness of the mortar shall be 20 mm. Mortar shall be spread, tamped and corrected to proper levels and slopes and allowed to harden sufficiently to offer a fairly rigid cushion for the tiles to be set. Over this bedding neat gray cement paste shall be spread over such an area as would accommodate about twenty tiles. Tiles shall be washed, cleaned and shall be fixed in this grout one after another, each tile being gently tapped with wooden mallet till it is properly bedded and in level with the adjoining tiles. The joint shall be kept as thin as possible and in straight line or to suit the required pattern. The surface of the flooring during laying shall be frequently checked with a straight edge about 2 m long, so as to obtain a true surface with the required slope. After tiles are laid, surplus cement grout shall be cleaned off.

10.2 Pointing and finishing

Joint shall be cleaned of the gray cement grout with wire brush or trowel and all dust and loose mortar removed. Joints shall then be flush pointed with white cement. The floor shall then be kept wet for 7 days.



10.3 Glazed Tile Dado, Skirting and Risers

Laying

12mm thick plaster of cement mortar 1:3 or mix as specified shall be applied and allowed to harden. The plaster shall be roughened with wire brushes or by scratching diagonal lines at about 75mm centers both ways. The back of tile shall be buttered with gray cement paste and set in the bedding mortar. This shall be tamped and corrected to proper plane and lines. Pointing and finishing shall be carried out in similar manner as described for flooring.

11.0 STEEL/ WOODEN DOORS, WINDOWS

SCOPE : This specification covers the general requirement for wooden, steel doors and windows and rolling shutters.

11.1 WOOD WORK

11.1.1 Timber used for joinery shall be of good quality locally available country wood as approved and shall be well seasoned (IS 1141) cut square, free from excess wane, from sapwood, dead knot or other defects. (Ref. IS 3364)

11.1.2 All timber for carpentry, joinery, rough frame work backings, grounds, fixing strips and the like shall be treated with an approved wood preservative(Ref. IS 401) and the Contractor shall strictly observe the manufacturer's instructions for using this material. The maximum permissible moisture content in timber shall be in accordance with IS 287 – latest.

11.1.3 All workmanship shall be of the best quality (IS 6534) scantlings and boardings shall be accurately sawn and shall be of uniform width and thickness throughout. All carpenter's work shall be left with a sawn surface except where otherwise specified. Work shall be accurately set out in accordance with the drawing and be framed together and securely fixed in the best possible manner and with properly made joints. All brands, nails, screws, plugs, pin etc. to be provided as necessary and as directed and approved.

11.1.4 Joints in various members forming any timber frame shall be provided only as shown in the drawings or as directed by the Engineer. Two millimetres will be allowed for each wrought face of the sizes specified except when described as finished in which case they shall hold to the full dimensions specified.

11.1.5 All work is to be properly tensioned, shouldered, wedged, pinned, braided to the satisfaction of the Engineer and all properly glued with best quality glue. All joinery shall be finished off in a proper manner, planed and sand papered as required (IS 2338)

11.1.6 Use of nails shall not be permitted. Fixing of members shall be done by using screws or round braids, heads of which shall be properly punched in ends of timbers built into walls shall have air space left between themselves and the walls.

11.1.7 All exposed faces of woodwork shall be sand papered once before erection for approval of the Engineer. No colour or other preservatives shall be applied without prior approval of the Engineer.

11.1.8 For fixing timber frames to masonry, frames of doors and windows will be provided with mild steel holdfasts made of 40 mm x 3 mm thk flats, 300 mm long and fixed into joints M15 / 10 PCC. 1200 mm high frames will be provided with 4 nos. holdfasts, 2000 mm high frames with 6 nos. and frames above 2000 mm with 8 nos. holdfasts. Each holdfast will be fixed to the frame with 3 nos. 50 mm GI screws.

11.1.9 For fixing frames to concrete, rawl plugs and screws of 16 gauge shall be used wherever specified. Rawl plugs and screws of gauge 16 shall also be used for fixing framing, hangers, hat hooks, curtain rails etc. Unless otherwise specified, screws used for the work shall be galvanised.

11.1.10 All timber surfaces coming into contact with masonry or concrete shall be given two coats of wood preservative or solignum approved by the Engineer.

11.1.11 Panelled and glazed shutters, styles and rails shall be as APPROVED BY THE Engineer In-charge, moulded and mortised together (Ref. IS 1003). The shutters shall be square and free form twist.

11.1.12 All glazing is to be sheet glass of selected quality and approved by the Engineer. It shall be clear and free from defects. It shall be cut to the required size and fixed to frame either with spring clips, with approved quality putty or with teakwood beading as per details.



11.1.13 The Engineer may order any timber frame to be put together on the ground and submitted to suitable tests to his satisfaction before being placed in position. The cost of any such test shall be borne by the Contractor.

11.1.14 All fixing holes shall be pelleted and concealed from view. 35 mm thick flush type Block board (IS 2202) shall be manufactured from selected timber well seasoned and shall be of solid particle board core construction with 25 mm thick teak wood lipping all around the edge. The stiles and rails shall be of one piece or alternatively, two or more pieces glued together. The thickness of the cross band shall not be less than 3 mm and the thickness of the facing shall be of best quality commercial ply thickness not less than 13.5 mm. Where veneer finish, or formica finishes or any other type is specified they shall be glued separately. All the plywood shall be glued under pressure. Glue used shall be phenol formaldehyde resin.

11.1.15 Fixtures

All doors and windows shall be provided with best quality fixtures as specified in the drawing. The Contractor shall submit samples of all fittings for approval. Unless otherwise specified, hinges, tower bolts, aldrops, handles, and baby latches etc. shall be of best quality brass oxidised of specified size. Mortice lock, hydraulic closer and other fixtures shall be of approved make. All the fittings shall be fixed with brass screws.

11.1.16 Painting

Painting shall be carried out only after the joinery has been inspected and approved by the Engineer. The surface preparation and applying of primer coats of paint and final coats of paint shall be carried out as per specifications for painting. Unless otherwise specified a minimum of 2 coats of primer paint and 3 coats of final paint to applied. Where polishing or varnishing is specified, the surface to be varnished or polished shall be protected from contamination such as inadvertent painting and surface damage. The polishing or varnishing shall be according to the specifications for varnishing or polishing under the section Painting.

11.2 STEEL WINDOWS AND DOORS IS 1361 AND IS 1038

11.2.1 All steel windows shall be obtained from approved manufacturer and the steel section used shall conform to IS 7452. Coupling members for composite windows shall be fabricated from steel conforming to IS 2062.

11.2.2 The fabrication of frames shall be of best workmanship. The joints shall be welded and ground properly without leaving any cavity. Intersection of Tee. Section for glazing shall be tenoned and gap shall be closed by hydraulic pressure.

Necessary holes required for fixing coupling sashes, glazing clips etc. shall be provided.

11.2.3 All necessary MS hold fasts required for embedding shall be fixed to frame. Wherever steel frame is to be fixed to concrete members, necessary holes shall be made for fixing with screws.

11.2.4 Bottom hung, top hung and side hung shutters shall be provided with standardised steel hinges and / or side arms (which when shutter is closed is invisible) Center hung shutters shall be mounted on a pair of brass cup pivots, each pivot consisting of inner and outer cup and capable of remaining open in any direction. The frame shall be provided with bronze spring catch.

11.2.5 The handles and peg stays shall be heavy duty and shall be brass oxidised. Unless otherwise specified, the frames shall be finished with hot dip galvanising. Where specified painting shall be done in accordance with the specifications for painting.

11.2.6 The frames shall be erected in accordance with manufacturer's instructions. The frame shall be aligned and kept plumb by suitable supporting arrangement. As the masonry is being constructed the holdfasts are embedded in concrete mix M15 / M10. Where required for fixing with concrete member, rawl plug and GI screws shall be used. The joints between the steel frame and masonry work after being finished with plaster shall be finished with approved bitumen mastic. Glass panels, unless otherwise specified shall be of 4 mm thickness and shall be free from flaws, specks and bubbles. It shall have properly squared corners and straight edges, and shall be fixed to frame with glazing pins and approved putty.



12.0 ROLLING SHUTTERS (IS 6248)

12.1 Rolling shutters shall be as per the size to suit the dimensions of the opening shown in the drawing. Unless otherwise specified, they shall be fabricated out of 18 Gauge mild steel laths of convex corrugation with rolling center either 75 mm or 65 mm and with minimum 12 mm corrugation depth. The laths shall be interlocked by alternate end clips.

12.2 The side guides shall either be of rolled section of one piece or pressed construction and shall be of size 25 mm wide 75 mm deep, thickness shall not be less than 3 mm.

12.3 The shutter shall be provided with bottom lock plate 3 mm thick and reinforced by an angle iron stiffener at the bottom and MS flat at the top.

12.4 The suspension shaft shall be of adequate design and unless otherwise specified shall be formed form 8 gauge seamless tube, 60 mm O. D. with suitable flange coupling.

12.5 The springs shall be of approved high tensile steel flat or coil spring hardened and tempered. These shall be fitted inside the fabricated housing.

12.6 The ball bearings shall be double self sligning ball bearings fitted inside CI housing fixed on side brackets holding the suspension brackets at either ends.

12.7 The suspension of the shutter shall be bolted on specially fabricated cages formed from MS flats and plates all arc welded.

12.8 The hood cover shall be made of 20 G MS sheets unless noted otherwise with necessary stiffeners and framework.

12.9 The locking arrangement shall consist of hoop and staple on the bottom plate, lockable from both the sides.

12.10 Unless otherwise specified, for overall area of rolling shutters upto 5 sq.mt. pull and push type with ball bearings shall be provided and for area larger than 5 sq.mt. mechanically operated gear type and / or electrically operated shutters shall be provided.

12.11 The shutters, hood covers etc. shall be given 2 coats of zinc chromate primer after thorough surface preparation and a further 2 coats of paint of approved quality and colour.

12.12 The erection of these shutters shall be carried out according to manufacturer's specifications. Chiselling of concrete for fixing bolts will not be allowed.

13.0 STRUCTURAL STEEL

13.1 This specification covers the supply, fabrication, transportation to actual site and erection on prepared foundations, of structural steel work consisting of steel bldg., pipe supports, trusses, bracings, beams, columns, etc. The work shall generally be in accordance with relevant Indian Standards. In case of conflict between the clauses mentioned here and the Indian Standards, those expressed in this specification shall govern.

13.2 Fabrication shall be in accordance with IS 800, section V in addition to the following. All workmanship and finishes shall be of the best quality and shall conform to the best approved method of fabrication. All material shall be finished straight and shall be free from burrs. Shearing and chipping shall be neatly and accurately done. Material at the shop shall be kept clean and protected from weather.

13.3 All connections shall be either welded or bolted as specified in drawings. Tapered washers of flat washers shall be used with all bolts. All members likely to collect rain waters shall have drain holes provided. Not more than one shop splice shall be provided to make up the full length of member.

13.4 Assembling

Before making holes in individual members, for fabrication the steel work intended to the bolted together shall be assembled and clamped properly and tightly so as to ensure close abutting or lapping of the surfaces of the different members. The abutting joints shall be cut or dressed true and straight, and fitted close together. Column splices and butt joints of compression members depending on contact for stress transmission shall be accurately machined and close-buttet over the whole section. In column caps and bases, the ends shall be accurately machined so that the parts connected, butt against each other over the entire surfaces of contact. Connecting angles or channels shall be fabricated and placed on position with great accuracy so that they are not unduly reduced in thickness by machining.



13.5 WELDING

Electrodes for shielded arc manual welds shall comply with the requirements if IS 814 and IS 9595 and shall be approved by Engineer.

13.5.1 Preparation of members for welding

(a) Assembly of structural members shall be made with proper jigs and fixtures to ensure correct positioning of members (angles, axes, nodes etc.) Sharp edges, notches, irregularities and fissures due to faulty cutting shall be chipped or ground or filed over the length of the affected area, deep enough to remove faults completely. Edge preparation for welding shall be carefully and accurately made so as to facilitate a good joint. Generally no special edge preparation shall be required for members under 8 mm thick. Edge preparation (Bevelling) denotes cutting or the same so as to result in V, X, K or U seam shapes as per IS 9595.

(b) The members to be assembled shall be clean and dry on the welding edges. Under no circumstances shall wet, greasy, rust or dirt covered parts be assembled. Joints shall be kept free from any foreign matter, likely to get into the gaps between members to be welded.

(c) Before assembly the edges to be welded as well as adjacent area extending for at least 20 mm shall be cleaned (until metallic polish is achieved) While assembling members, proper care shall be taken of welding shrinkage and distortions, as the drawing dimensions cover finished dimensions of the structure.

(d) The elements shall be got checked and approved by the Engineer before assembly. The permissible tolerances for assembly of members preparatory to welding shall be as per IS 9595 and IS 7215.

(e) After the assembly has been checked, temporary tack welding in position shall be done by electric welding, keeping in view finished dimensions of the structures.

13.6 Types of Welding

Welds used for joining structural members are generally of two types and known as butt welds and fillet welds.

1. Fillet Welds

The cross section of fillet weld is like a triangle and it is used to join two surfaces normally at right angle to each other. This type of weld is used more frequently in structural connections than any other type, and is usually in the form of isosceles triangle. The fillet welds shall be continuous or intermittent as specified in the design.

2. Butt Welds

These are classified according to the method of grooving or preparing of the base metal. The metal pieces shall be filled or chiselled to the required shape for butt welding at the throat.

13.7 Welding Plant

The welding plant and equipment shall be of the best type and of modern design and shall be approved by the Engineer. Either direct or alternating current (but not both kinds) may be used throughout the work. An ammeter shall be provided to each arc and so situated that the Engineer can check easily the current being used by the Operator. Each welder may be supplied with portable current regulator to enable him to adjust the welding within the approved limits without leaving his work. Qualified operators shall be employed for welding and they shall be trained and shall be tested after every three months as per provisions of IS 817 and IS 7318.

1. Electrodes

The electrodes required for metal arc welding shall be covered electrodes and shall conform to IS 814.

2. Types of covering

The types of covering shall be as per IS 815 - 1974.

14.0 WHITE WASHING, DISTEMPER PAINTING

The specification covers the general requirement of white washing, distempering, water proof cement based paint, synthetics enamel painting etc.



14.1 WHITE WASHING

White washing shall in general comply with IS ; 6278 latest. Only freshly burnt fat lime good quality from un burnt stone and other forging matter shall be used, slaking shall be done at site with an excess of water and lime allowed to remain under water for two days. The mixture of lime and water shall be, placed in a suitable receptacle and clean water added to bring it to the consistency of thin cream. The wash so prepared shall be strained through a coarse cloth of fine sieve and mixed with gum water. The quantity of gum to be used shall be at the rate of 2kg/m³. The surface to be white washed shall be thoroughly bromide down so as to remove all dust and holes if any shall be stuffed with material similar to the surface. Three coats of white wash shall be applied with proper brush. Each coat must be allowed to fry and will be subject to inspection before next coat is applied.

14.2 OIL BOUND DISTEMPERING

Approved distemper shall comply with IS 427 or 428 latest. Ready mixed washable distemper of an approved brand shall be used. Preparation of distemper from ingredients by the Contractor shall not be allowed. The tint of distemper shall be as directed by the Engineer-In-Charge and a sample application of it shall by the Contractor if so directed. The surface shall be cleaned and all cracks holes, irregularities etc. shall be repaired to get a smooth and even surface. It shall be completely dry and dust free before commencement of distempering.

14.3 WATERPROOFING CEMENT BASED PAINTS IS 5410

14.3.1 The waterproof cement paint shall be of an approved manufacturer such as Snowcem, Oricem or other equivalent and approved and shall be brought to the original airtight containers with seal intact.

14.3.2 Preparatory work: Surface shall be thoroughly cleaned free from dirt, dust etc. by brushing and washing down with clean water. Any grease, oil paint, varnish and oil bound washable distemper shall be removed by means of an approved paint remover.

14.3.3 Mixing and application: The dry cement paint shall be thoroughly mixed with clean fresh water so as to produce a paint of required consistency for normal Work shall be ordinary paints. In mixing and application, the Contractor shall conform to manufacturer's instructions.

14.3.4 Paint for application by brush shall through a paint strainer and paint for spraying shall be twice strained. The paints shall be kept stirred during use and no paint which has been mixed for a period longer than shall used. The paint to surface other then roughcast may be applied by means of brushes or spraying with pressure pot sprayer. Spraying, however, may only be carried out if the Engineer-in-charge approves. The paint applied to roughcast surface shall be by means of spraying.

14.3.5 Absorbent surface shall be thoroughly dampened so as to give even suction. In dry weather freshly painted surface shall be kept damp for at least 2 days and protected from the sun. When more than one coat is ordered, subsequent coats shall not be applied until preceding coat has thoroughly hardened and is approved.

14.4 PAINTING OIL PAINT, SYNTHETIC ENAMEL, ETC

As per respective I. S. Codes, paints of approved manufacturer only shall be used and shall be applied as per specifications of the manufacturer. Paints appropriate for the surface to be painted shall be used.

14.5 PAINTING PLASTERED SURFACE (IS 2395)

14.5.1 Primer Coat

For plastered surface to be painted, the same shall be rubbed down with a dry brush to remove loosely adhering matter. One coat of cement or other approved primer shall be applied to the surface. After 24 hours a second coat of primer shall be applied. All cracks in the surface shall be made good by applying approved putties.

14.5.2 Final Coat

The paint shall be constantly stirred by thinned by appropriate thinning agent. If shall be applied uniformly on the surface. The second coat may be applied within three hours of the first coat.



14.6 PAINTING WOOD WORK

14.6.1 Preparation of surface

The surface shall be rubbed smooth with sandpaper, first with coarse grade and then with medium grade. When finished no scratches from the coarse paper should be seen.

14.6.2 Knotting

Before priming, all the knots in the woodwork shall be filled with an application of coats of an approved substance through which the resin can not exude.

14.6.3 Prime coat

Primer coat shall be the ready mixed primer coat of approved make and shall be applications of the manufacturers.

14.6.4 Final Coats

14.6.4.1 After priming, all small holes, cracks, open joints etc. Shall be closed with approved putty consisting of pure whiting mixed with linseed oil to a proper consistency and lead for hardening. Putty should not be used before application of priming coat.

14.6.4.2 After applying priming coat the surface shall be lightly rubbed down smooth with sandpaper and the subsequent coats of paint of the specified shade and finish approved by the Engineer, shall be applied. It shall be spread as smooth as possible with approved by means of crossing at right angles to the grains and the laying off with the brush in the direction of the grain over the crossing. The final coat shall be very carefully crossed and laid off so that no brush marks are visible. Each coat of paint shall be allowed to dry thoroughly and shall be lightly rubbed down before the application of the next coat. Each coat shall be got approved before the application of next. The finished surface shall be free from any hair marks, ridges, puddles and other defects.

14.6.4.3 Unless otherwise specified, three coats of paint exclusive of primer coat shall be applied for all timber work. If the final coat is not approved, an extra coat of paint shall be applied at no extra coat so as get the specified finish.

15.0 ASBESTOS CEMENT ROOF SHEETING & ACCESSORIES

15.1 This specification covers the requirement of asbestos cement sheet roofing and cladding including corner ridge pieces, eaves filler pieces etc. and all other accessories as per relevant IS codes.

15.2 Translucent Sheets

The Translucent sheets shall be of clear translucent variety with light transmission coefficient 70% minimum and shall be made form fibre-glass reinforced polyester "KRISTALITE" or equivalent make conforming to IS Code. The sheets shall be corrugated, matching with Asbestos cement corrugated sheets as per IS 459. The minimum thickness shall be 1.5 mm and shall be capable of spanning 1.40 metres minimum. The sheets shall be fixed to purlins as per manufacturer's specifications and there shall be no leakage of water through joints and fixtures.

16.0 SANITARY & PLUMBING WORKS

16.1 This specification is intended to establish and define the materials and constructional requirements for plumbing and building drainage work. All materials, fixtures and workmanship shall be in accordance with the relevant Indian Specifications and Codes of practices.

16.2 SANITARY FITTINGS

All glazed earthenware shall be either of Parryware, Hindustan Sanitary ware or equivalent approved make, white or in colour and of one piece construction. All metallic fixtures like taps, stop cocks, holders etc. shall be of CP brass of "Leader" or Equivalent approved make. All wall fittings shall be fixed with wooden cleats and CP brass screws and washers.

16.3 GI PIPES AND FITTINGS

16.3.1 All GI pipes and fittings shall conform to IS 1239 and shall be of medium grade for water supply system. All screwed tubes and sockets shall have pipe threads in accordance with the requirements specified in IS 554. Unless specified otherwise pipes shall be supplied screwed with taper threads and sockets parallel thread. All fittings shall be galvanised iron approved by the Engineer-In-charge. Fittings in GI line shall include all coupling, elbows, tees,



bends, unions, nipples, reducers, flanges with nuts bolts and rubber insertions, bushes and all other fittings to make a complete job.

16.3.2 Screwed GI pipes shall be jointed with screwed socket joints using screwed fittings. Care shall be taken to remove any burr from the end of the pipes after threading. White lead with a few strand of fine hemp shall be applied while tightening. Compounds containing red lead shall not be used.

16.3.3 All pipes above ground shall be fixed with G. I. holders bat clamps clear off the wall at 1.2-m centers. If the pipes are fixed in encased or embedded in wall, they shall be secured in position by iron hooks at 1.2-m centers.

16.3.4 All visible pipes and clamps within and outside the building shall be painted with two coats of oil paint as directed by the Engineer-In-charge. No extra payment shall be made for clamps, hooks, and cutting holes in walls, chasing and making good the same.

16.3.5 All underground pipes shall have a minimum earth cover of 600 mm or as directed by the Engineer-In-Charge. No extra payment shall be made for excavation in trenches, refilling the same and removal of surplus earth. Before any pipes are painted or covered up they shall be tested to a hydro pressure of 6 kg / sq.cm.

16.4 GUN METAL VALVE

All full way and globe valves shall be of heavy gunmetal and tested at 300 psi and shall be approved by the Engineer-In-charge. Valves shall conform to IS 778.

16.5 SOAK PIT

All earthwork in excavation, brick work, sand filling, aggregate filling etc. shall conform to relevant IS Standard, specifications and drawings.

16.6 SEPTIC TANK

Septic tank shall consists of sewage receiving chamber inspection doors, vent pipe, inlet and outlet connections, manhole cover C.I. steps etc. The construction of the same shall be as per drawings, specifications of relevant items of work.

16.7 STONE WARE PIPE

16.7.1 All pipes with spigot and socket ends and fittings shall confirm to IS 651. These shall be sound, free from visible defects such as fire cracks or hair cracks. The glaze of pipes shall be free from crazing. The pipes shall give a sharp clear tone when struck with a light hammer. There shall be no broken blisters.

16.7.2 For all sewers and drains, glazed stoneware pipes shall be used as far as possible in preference to other types of pipes. These are suitable, particularly where acid effluents or acid sub-soil conditions are likely to be encountered.

16.7.3 The trench shall be so dug that the pipe can be laid to the required alignment and at the required depth. When the pipe line is under a roadway, a minimum cover of 90 cm is recommended for adoption, but it may be modified to suit local conditions. The trench shall be excavated only so far in advance of pipe laying as specified by the Engineer-in-Charge. The trench shall be so shored and drained that the workmen may work therein safely and efficiently. The discharge of the trench dewatering pumps shall be conveyed either to drainage channels or to natural drains.

16.7.4 The excavation shall be carried out with manual labour or with suitable mechanical equipment as approved by the Engineer-in-charge.

16.7.5 Unless otherwise specified by the Engineer-in-charge, the width at bottom of trenches for different diameters of pipes laid at different depths shall be as given below:—

(a) For all diameters, upto an average depth of 120 cm, width of trench in cm=diameter of pipe + 30 cm.

(b) For all diameters for depths above 120 cm, width of trench in cm=diameter of pipe + 40 cm.

(c) Notwithstanding (a) and (b) the total width of trench shall not be less than 75 cm for depths exceeding 90 cm.

16.7.6 All pipes shall be laid on a bed of cement concrete with thickness and mix as specified projecting on each side of the pipe to the specified width of the trench. The pipes with their crown level 1.20 m depth and less from ground shall be covered with 15 cm thick. Concrete above the crown of the pipe and sloped off to meet the outer edges of the concrete, to give a minimum thickness of 15 cm a around the pipe. Pipes laid at a depth greater than 1.20 m at



crown shall be concreted at the sides up to the level of the centre of the pipe and sloped off from the edges to meet the pipe tangentially.

16.7.7 The pipe shall be carefully laid to the alignments, levels and gradients shown on the plans and sections. Great care shall be taken to prevent sand etc. from entering the pipes. The pipes between the manholes shall be laid truly in a straight line without vertical or horizontal undulation. The pipes shall be laid with socket up the gradient. The body of the pipe shall for its entire length rest on an even bed of concrete and places shall be excavated in the concrete to receive the socket of the pipe.

16.7.8 Where pipes are not bedded on concrete, the trench floor shall be left slightly high and careful bottomed up as pipe laying proceeds, so that the pipe barrels rest on firm and undisturbed ground. If the excavation has been carried too low, the desired levels shall be made up with concrete 1:5:10 (1 cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size) for which no extra payment shall be made.

16.7.9 If the floor of the trench consists of rock or very hard ground that cannot easily be excavated smooth surface the pipe shall be laid on a levelling course of concrete as desired.

16.7.10 When S.W. pipes are used for storm water drainage, no concreting will normally be necessary. The cement mortar for jointing will be 1:3 (1 cement : 3 fine sand).

16.7.11 Tarred gasket of hemp yarn soaked in thick cement slurry shall first be placed round the spigot of each pipe and the spigot shall then be slipped home well into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the gasket caulked tightly home so as to fill not more than 1/4th of the total depth of the socket. The remainder of the socket shall be filled with stiff mixture of cement mortar in the proportion 1:1 (1 cement: 1 fine sand). When the socket is filled, a fillet shall be formed round the joint with a trowel forming an angle of 45 degree with the barrel of the pipe.

16.7.12 After a day's work any extraneous material shall be removed from the inside of the pipe. The newly made joints shall be cured for at least seven days.

16.7.13 Stoneware pipes used for sewers shall be subjected to a test pressure of 2.5 m head of water at the highest point of the section under test. The test shall be carried out by suitably plugging the lower end of the drain and the ends of the connection if any and filling the system with water. A knuckle bend shall be temporarily jointed in at the top end and a sufficient length of vertical pipe jointed to it so as to provide the required test head, or the top may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitable for observation.

16.7.14 If any leakage is visible, the defective part of the work shall be cut out and made good. A slight amount of sweating which is uniform may be overlooked, but excessive sweating from a particular pipe or joint shall be watched for and taken as indicating a defect to be made good. Any joint found leaking or sweating, shall be rectified or embedded into 15 cm layer of cement concrete (1:2:4) 30 cm in length and the section retested.

16.7.15 In cases where pipes are not bedded on concrete special care shall be taken in refilling trenches to prevent the displacement and subsequent settlement at the surface resulting in uneven street surfaces and dangers to foundations etc. The backfilling materials shall be packed by hand under and around the pipe, and rammed with a shovel and light tamper. This method of filling will be continued up to the top of pipe. The refilling shall rise evenly on both sides of the pipe continued up to 60 cm above the top of pipe so as not to disturb the pipe. No tamping should be done within 15 cm of the top of pipe.

17.0 ROADWORKS

17.1 This specification provides general requirements for construction of Water bound Macadam Roads. All material & workmanship shall conform to relevant IRC codes. Water bound macadam shall consist of clean crushed coarse aggregates mechanically interlocked by rolling, and voids thereof filled with screening and binding material with the assistance of water laid on a prepared subgrade, sub-base, base. Water bound macadam may be used as a sub-base, base course or surfacing course. In each case, it shall be constructed in accordance with the specifications given below and in conformity with the lines, grades and cross-sections shown on the drawings or as otherwise directed.



17.2 SUBGRADE

17.2.1 The subgrade shall be levelled approximately to the proper level and camber by filling depressions and cutting off protuberances (due allowance being made for consolidation). All soft spongy parts of the subgrade shall also be excavated and refilled with approved materials in 150 mm thick layers. The subgrade shall be watered as directed at least 12 hours before a roller is put on it.

17.2.2 The subgrade shall be then rolled with a 8 to 12 tonne roller. The rolling shall progress from edges to the center of the road in strips parallel to the centerline of the road. The rolling shall be done by lapping uniformly, each preceding rear wheel track by at least one half width of the track. On super elevations, rolling shall be started at inner edge and shall progress towards outer edge. During and after rolling, the surface shall be checked for grade and camber with camber boards. The rolling shall continue until a compact and uniform surface is obtained. On completion of the day's work, the roller shall be made to stand on the side width of the road.

17.3 MATERIALS

17.3.1 Coarse Aggregates— Coarse aggregates shall be crushed or broken stone of requisite quality as stated hereinafter. Crushed or broken stone shall be hard, durable and generally free from fiat, elongated, soft and disintegrated particles. It shall also not have excess of dirt or other objectionable matter. As far as possible, coarse aggregates shall conform to one of the grading given in Table below. Grading 1 is more suitable for sub-base courses, but it is not tenable for a compacted layer thickness of less than 90 mm.

The size of aggregates to be used in a given case would depend on the type of aggregates available and compacted thickness of the layer. The use of grading I shall, however, be restricted to sub-base courses only.

Size and grading requirements of coarse aggregates for WBM

Grading No.	Size range	Sieve designation (IS: 460)	Per cent by weight passing the sieve
1.	90mm to 45 mm	125mm	100
		90 mm	90 100
		63 mm	25 60
		45 mm	0 15
		22.4 mm	0 5
2.	63 mm to 45 mm	90 mm	100
	63mm	63 mm	90 100
		53 mm	25 75
		45mm	0 15
		22.4 mm	0 5



17.3.2 Screenings - Screenings to fill voids in the coarse aggregates shall generally be of the same material as the coarse aggregates. However, from economic considerations, predominantly non-plastic material such as kankar nodules, moorum or gravel (other than river-borne rounded aggregate) may also be utilised for this purpose provided that the liquid limit and plasticity index of such material) is below 20 and 6 respectively and the fraction passing 75 micron sieve does not exceed 10 per cent.

As far as possible, screenings shall conform to the grading shown in Table below.

Table : Grading requirements of screenings for water bound macadam

Grading Classifications	Size of screenings	Sieve designation (IS : 460)	Percent by weight passing the sieve
A	13.2 mm	13.2 mm	100
		11.2 mm	95—100
		5.6 mm	15—35
		180 micron	0—10

17.3.3 Binding Material -- Binding material to prevent ravelling of water bound macadam shall consist of a fine grained material passing 100 per cent through 425 micron sieve and possessing **P.I.** value of 4—9 when the WBM is to be used as a surfacing course, and upto 6 when the WBM is being adopted as a sub-base base course with minous surfacing. If limestone formations are available nearby, limestone dust or kankar nodules may be usefully employed for this purpose.

Application of binding material may not be necessary where the screenings consist of crushable type material like moorum or gravel. However, for WBM used as a surfacing course, the P.I. of crushable type screenings is less than 4, application of a small amount of binding material having P.I. of 4—9 would be required at the top. The quantity of screenings could be reduced slightly on this account.

17.4 CONSTRUCTION PROCEDURE

17.4.1 The sub grade, sub-base or base to receive the water bound macadam course shall be prepared to the required grade and camber and cleaned of all dust, dirt and other extraneous matter. Any ruts or soft yielding places that have appeared due to improper drainage, service under traffic or other reasons shall be corrected and rolled until firm.

17.4.2 Where the water bound macadam is to be laid on an existing unsurfaced road, the surface shall be scarified and reshaped to the required grade and camber as necessary. Weak places shall be strengthened, corrugations removed and depressions and potholes made good with suitable material before spreading the coarse aggregates for WBM.

17.4.3 Where the existing road surface is black-topped, 50 mm x 50 mm furrows shall be cut in the existing surface at 1 metre intervals at 45 degree to the centre line of the carriageway before proceeding with the laying of coarse aggregates.

17.4.4 In all cases, the foundation shall be kept well-drained during the construction operations.

17.4.5 Provision of Lateral Confinement of Aggregates

Before starting with WBM construction, necessary arrangements shall be made for the lateral confinement of aggregates. One method is to construct side shoulders in advance to a thickness corresponding to the compacted layer of the WBM course. After shoulders are ready, their inside edges may be rimmed vertical and the included area cleaned of all spilled material



thereby setting the stage for spread of coarse aggregates. The practice of constructing WBM in a trench section excavated in the finished formation must be completely avoided.

17.4.6 Spreading Coarse Aggregates

The coarse aggregates shall be spread uniformly and evenly upon the prepared base in required quantities from stockpiles along the side of the road or directly from vehicles. In no case shall these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed base be permitted. The aggregates shall be spread to proper profile by using templates placed across the road about 6 metre apart. Where possible, approved mechanical devices shall be used to read the aggregates uniformly so as to minimise the need for their manipulation by hand.

17.4.7 The WBM course shall normally be constructed in layers of not more than 75 mm compacted thickness. Each layer shall be tested by depth blocks. No segregation of large or fine particles shall be allowed; the coarse aggregates as spread shall be of uniform gradation with no pockets of fine material.

17.4.8 The coarse aggregates shall normally not be spread in lengths exceeding three days' average work ahead of the rolling and bonding of the preceeding section.

17.5 ROLLING

17.5.1 After the laying of coarse aggregates, these shall be compacted to full width by rolling with either three wheel power roller of 6 to 10 tonnes capacity or an equivalent vibratory roller. The weight of the roller shall depend on the type of the coarse aggregates.

17.5.2 The rolling shall begin from edges with roller running forward and backward until the edges have been firmly compacted. The roller shall then progress gradually from edges to the centre, parallel to the Centre line of the road and lapping uniformly each preceding rear wheel track by one half width and shall continue until the entire area of the course has been rolled by the rear wheel. . Rolling shall continue until the road metal is thoroughly keyed and the creeping of stone ahead of the roller is no longer visible. Slight sprinkling of water may be done, if required.

17.5.3 On superelevated portions of the road, rolling shall commence from the lower edge and progress gradually towards the upper edge of the pavement.

17.5.4 Rolling shall not be done when the subgrade is soft or yielding nor when it causes a wave-like motion in the base course or subgrade. If irregularities develop during rolling which exceed 3mm when tested with a 3metre straight edge, the surface shall be loosened and aggregates added or removed as required before rolling again so as to achieve a uniform surface conforming to the desired cross section and grade. The surface shall also be checked transversely by template for camber, and any irregularities corrected in the manner described above. In no case shall the use of screenings to make up depressions be permitted.

17.6 Application of Screenings

17.6.1 After rolling of coarse aggregates the screenings to fill the interstices shall be applied gradually over the surface. Dry rolling shall be done when the screenings are being spread so that the jarring effect of roller causes them to settle into the voids of the coarse aggregates.

17.6.2 The screening not to be dumped in piles but applied uniformly in successive thin layers either by the spreading motion of hand shovels, mechanical spreaders, or directly from trucks. Trucks plying over the base course to spread screenings shall be equipped with pneumatic tyres and so operated as not to disturb the coarse aggregates.

17.6.3 The screenings shall be applied at a slow rate in three or more applications as necessary. This shall be accompanied by rolling or brooming. Either mechanical brooms/hand brooms or both may be used. In no case shall the screenings be applied so fast and thick as to form cakes or ridges on the surface making the filling of voids difficult or preventing the direct bearing of roller on the coarse aggregates. The spreading, rolling and brooming of screenings shall be taken up on sections which can be completed within one day's operation. Damp and wet screenings shall not be used in any circumstances.



17.7 Sprinkling and Grouting

After application of screenings, the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screenings into the voids, and to distribute them evenly. The sprinkling, sweeping and rolling operations shall be continued and additional screenings applied where necessary until the coarse aggregates are well-bonded and firmly set and a grout of screenings and water forms ahead of the wheels of the roller. Care shall be taken that the base or subgrade does not get damaged due to addition of excessive quantities of water during the construction.

17.8 Application of Binding Material

After the application of screenings as per paras 4.3.5. and 4.3.6., binding material where it is required to be used (see para 3.4.), shall be applied at a uniform and slow rate in two or more successive thin layers. After each application of binding material, the surface shall be copiously sprinkled with water and the resulting slurry swept in with hand brooms/mechanical brooms or both to fill the voids properly. This shall be followed by rolling. with a 6-10 tonne roller during which water shall be applied to the wheels to wash down the binding material that may get stuck to them. The spreading of binding material, sprinkling of water, sweeping with brooms and rolling shall continue until the slurry of binding material and water forms a wave ahead of the wheels of moving, roller.

17.9 Setting and Drying

After final compaction of the course, the road shall be allowed to cure overnight. Next morning, hungry spots shall be filled with screenings or binding material, lightly sprinkled with water if necessary, and rolled. No traffic shall be allowed till the macadam sets.

17.10 Plying of Construction Traffic

In general, construction traffic may ply over completed portions of the WBM course provided vehicles move over its full width avoiding any rutting or uneven compaction. However, the Engineer-in-Charge shall have full authority to stop the passage of construction traffic when in his opinion this is leading to excessive damage.

18.0 PLINTH PROTECTION

Plinth protection shall be provided as specified, to the required width. It shall consists of a layer of brick bats of 75mm thick over well compacted sub base and interstices filled with fine sand. Over the brick bat layer, 75 mm thick cement concrete in 1:3:6 (1 cement, 3 coarse sand, 6 graded stone of aggregate 20 mm size) shall be laid and shall be compacted including finishing the top.

19.0 METHOD OF MEASUREMENT

IS 1200 prevailing latest Parts shall be following for method of measurement of building and civil engineering works.

B : For Electrification and Electrical fittings -

1.0 SCOPE OF WORK : The scope of work Electrification of facilities below. Work includes Supply, Installation & testing commissioning of Electrical Items for following facilities as per approved drawings, documents, time schedule and instruction. Supply & Installation listed under Clause-3.0.

- 1) Houses . 03 nos.
(01 Drawing room + 02 Bed rooms, 02 Toilet + 01 Kitchen + 01 Store room + + 02 garage + Stairs)
- 2) Site Office – approx. 25mtrs x 8mtrs at present in good condition.
- 3) Covered Store – approx. 30mtrs x 10mtrs
- 4) Open Storage Space – approx. 50mtrs x 40mtrs.

2.0 ELECTRICAL WORK

2.1 The scope of work has to be completed in the entire manner to meet the functional requirement by covering all the left out allied work in BOQ given in 3.0, thereby



to commission the system as a whole. All the material used to be approved by Engineer-in-charge and in case of non-availability of approved make of material; BHEL Engineer-in-charge is authorized to substitute the same.

2.2 The contractor should note while quoting the tender, there may be minor variations in the scope/quantity extra and it is to be taken care while execution for total completion and no extra payments will be given for any such variations.

2.3 The entire scope of work is with the contractor and BHEL will not provide any material, manpower etc. for the satisfactory completion of work. The decision of the Engineer-in-charge is final and binding.

2.4 For electrification lighting work shall be as follows:

2.4.1 Providing common main panel to cater requirement of all total layout, laying incoming cable for the meter panel from the outside from nearest source, providing MCB feeder panel, lights & sockets requirement etc., laying interconnecting panel between common main panel and feeder main panel, providing MCB distribution board to cater lights, sockets & fans requirement.

2.4.2 Providing earth electrode and earth conductors as per requirement.

2.4.3 Complete Electrification along with necessary lighting-fixtures, fans, necessary cables, MCB, ELCB, Main switch, Energy meter, Junction box, switches, switch boards, Plug points etc. are in the contractor's scope so that installation is fully safe & meets local authorities statutory requirement. The necessary covers required for the MCB, energy meter etc., are to be provided by the contractor. Necessary earthing along with earth pit required as per the standards is to be provided by the contractor.

2.5 PREAMBLE TO BILL OF QUANTITIES FOR ELECTRICAL WORKS:

1. The contractor shall prepare the layout/location of the electrical installation and get approval of the same.
2. Samples of all the fixtures to be submitted to the BHEL engineer for approval before supply and installation of the same.
3. Necessary civil works/base/foundations to be included for installation of fixtures shall be in the quoted rates.
4. All light fixtures shall be supplied with lamps.
5. Installation work shall be complete with testing and commissioning of the same.
6. All fluorescent tube light fixtures shall be complete with control gear and power factor correction capacitors.
7. Necessary down rods, hanging or fixing arrangement etc. (Unless otherwise specified) shall be part of the fixtures.

2.6 REGULATION & STANDARDS:

The installation shall comply with the following acts/rules/specifications amended upto date:

- a. Indian Electricity Act
- b. Indian Electricity Rules
- c. Code of Practice for Electrical wiring Installation IS 732 of 1963 amended up to date.
- d. CPWD Specifications for internal electrification.
- e. The work shall also conform to any special requirement of Local Electricity Department
- f. The necessary Fire Regulations as per latest National Code Book
- g. Wherever the specifications given herein call for higher standards of material/workmanship, then these shall take precedence over (a) to (e) stated above.



- h. The general layout of wiring points, switches and plug points shall be as per approved drawings.

The exact location of points, fittings and fixtures may be altered to suit site requirements and the contractor shall have no claim for extra on this account.

2.7 System/Details of Wiring:

- a. Wiring shall be with FRPVC insulated, stranded copper conductor cables of 1100 volts grade ISI marked. The wiring shall run in PVC conduits above the false ceiling and on surface in PVC channels with double interlocks (conduits & channels to be got approved from BHEL Engineers).
- b. Minimum size of PVC conduits for electrical wiring shall be 19 mm dia. and the wiring should run in separate conduits and PVC channels of suitable size as per applicable standard.
- c. Number of points in each light circuit and power circuit shall be as per approved drawings.
- d. Size of Cable shall be as under:
 - i. 1.5/2.5 sq. mm FRPVC insulated stranded conductor cable of 1100 volts grade ISI marked for light circuits and light points and 5 Amps. Plug sockets.
 - ii. 4/6 sq. mm FRPVC insulated copper conductor cable of 1100 volts grade ISI marked for power points for 15/32 Amps plug sockets / AC's.
 - iii. All sub-mains shall be as per approved drawings.
 - iv. FRPVC insulated single core stranded copper conductor cables of 1100 volts graded ISI marked for sub-main.
- e. Looping system of wiring shall be used invariably throughout the installation. Live wire shall only be tapped from the controlling switch and neutral from outlet. Tap off joints in the pull boxes/draw boxes will not be permitted.
- f. For each 15 Amps power point outlets one 6 pin (6A/15A) switch socket controlled by 15 Amps switch shall be provided.
- g. On one of the switch plates of all the rooms in each dwelling unit, one indicator lamp shall be provided. This shall be preferably the switch plate near the entrance door to the particular room

2.8 DISTRIBUTION BOARDS

Distribution boards (DBs)

1. Distribution board shall be located as directed by the BHEL engineer and as shown on the drawings.
2. Distribution Boards shall be wall-mounted cubicle type
3. The D.B's shall conform to protection clause IP-42 and be dust and vermin proof. They will be of double door construction with hinged 'doors.

2.9 EARTHING

There shall be 05 Nos. Earth pits. The earth pit shall be of pipe Earth Electrode type. Using GI pipe of minimum 100mm dia. Both the electrodes to be connected to each other with 21 X 3mm thick GI strip or 25 mm GI pipe. The minimum distance of electrodes should be 3mtrs. The pit shall be filled with required salt & charcoal.

2.10 EARTH WIRE

In storage yard the connection from Electrode to Distribution Board to be provided with 8 Swg. GI wire from each Electrode and in office the earthing connection to be taken from two risers of earthing grid through two Earth conductors. From D B to power socket & switch board to be provided by 1.5 Sqmm PVC insulated green colour Cu conductor to be laid along with the wiring.

2.11 MATERIALS

All materials for fittings accessories etc. to be incorporated in this work shall be ISI marked as per the approval of BHEL, and if Indian standards have not been issued then it shall be as per the approval of BHEL.



2.12 SWITCHES

All 5 and 15 Amp switches shall be fire retardant polycarbonate plastic modular plate type. All 5 Amps Socket shall be 5-pin type. All 15 Amp socket shall be 6-pin type suitable for 15/5Amp. All switches, sockets, controlling the lights or fans shall be connected to the phase wire of the circuit. Switches shall be located at 900 mm above finished floor level unless otherwise indicated on drawings, or as directed by BHEL.

2.13 WALL SOCKET PLATE

All 5 and 15 Amp socket outlet shall be 5 and 6 pins respectively. Each outlet shall have a switch located beside the socket. The earth terminal of the socket shall be connected to the earth wire.

2.14 WIRING :

All internal wiring shall be carried out with PVC insulated wires of 1100 volts grade. The circuit wiring for points shall be carried out in looping in system and no joint shall be allowed in the length of the conductors. Circuit wiring shall be laid separate conduit originating from distribution board to switch board for light/fan. A light/fan switchboard may have more than one circuit but shall have to be of same phase. Looping circuit wiring shall be drawn in same conduit as for point to point or in light/fan switch boards. A separate earth wire shall be used for point wiring, colour coded wire shall be used for phase and black colour wire for neutral. Circuit wiring shall be carried out with red, yellow or blue colour PVC insulated wire for RYB phase wire respectively and black colour PVC insulated wire for the neutral wires. Bare or insulated green colour copper wire shall be used as earth continuity conductor and shall be drawn along with other wires.

Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Before the wires are drawn into the conduit, the conduits shall be thoroughly cleaned of dust and dirt. Drawing & jointing of copper conductor wires & cables shall be as per CPWD Specifications.

2.15 JOINTS

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

2.16 MAIN AND SUB-MAINS

Mains and Sub main cable where called for shall be of the rated capacity and approved make. Every main and sub main shall be drawn into an independent adequate size conduit. Adequate size draw boxes shall be provided at convenient locations to facilitate easy drawings of the sub main & main cables. As independent earth wire of proper rating shall be provided for every sub main. Three-phase sub main shall be provided with two-earth wire. Where mains and sub mains cables are connected to the switchgear, sufficient extra lengths of sub main and mains cable shall be provided to facilitate easy connections and maintenance for termination of cables, during crimping type cable socket/lugs shall be provided. Same colour code as for circuit wiring shall be followed.

2.17 LOAD BALANCING:

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

2.18 COLOUR CODE FOR CIRCUIT & SUBMAIN WIRING:

Colour code for circuit & sub main wiring installation shall be Red, Yellow, Blue for three phased Black for neutral and yellow/green or green only for earth in case of insulated earth wire.

2.19 LIGHTING FIXTURE AND FANS:

(a) The contractor shall supply and install lighting fixtures including but not limited to



lamps, ballasts, accessories, fixing hardware necessary for installations, as shown on the drawings, as required.

- (b) All fixtures shall be delivered to the site complete with suspension accessories, canopies, hickey, casing, sockets, holders, reflectors, ballasts, diffusing material, louvers, plaster frames, recessing boxes, etc. all wired and assembled.
- (c) Fixtures, housing, frame or canopy, shall provide a suitable cover for fixture outlet box or fixture opening.
- (d) Fixtures shall comply with all applicable requirements as herein outlined unless otherwise specified or shown on the drawings.
- (e) Fixtures shall bear manufacturer's name and the factory inspection label.
- (f) Fixtures shall be completely wired and constructed to comply with the IEE wiring regulations requirements for lighting fixtures, unless otherwise specified
- (g) Re-clamping the fixture shall be possible without having to remove the fixture from its place.
- (h) Lamps of the proper type, wattage and voltage rating shall be furnished and installed in each fixture.
- (i) Fluorescent fixtures shall be wired with rated size PVC covered wire. No splice or tap shall be located within an arm, stem or chain. Wire shall be continuous from splice in outlet box of the building wiring system to lamp socket or to ballast terminals.

2.20 FIXTURE SAMPLES

Detailed catalogue for all fixtures or if so required by the BHEL sample fixtures shall be submitted for prior approval of BHEL before orders for the fixtures are placed.

2.21 DISTRIBUTION BOARDS:/SWITCH FUSE UNITS

- The distribution boards with enclosures, bus bars, neutral links and earth links shall be of original manufacturer's only.
- D.B's shall be fixed on the walls in an approved manner and the damage to walls made good as per original.

2.22 MOULDED SWITCH & SOCKETS:

Type of plug and sockets as approved shall be used. Panel mounted type controlled by SP, DP & 4P-TPN MCB's depending upon single phase/three phase supply and have insulated extended earthing terminal and degree protection IP-56.

3.00 Schedule of Supply (Price Schedule)

Enclosed as Schedule-C
