Contents

TECHNICAL SPECIFICATIONS FOR SUPERSTRUCTURE (R.C.C.) & ALLIED WORK

1. EXCAVATION AND EARTHWORK

1.1 General

The excavation will generally refer to open excavation of foundation in wet or dry conditions in all sorts of soils. All instruction/modification/approval/direction should be properly maintained in site books.

1.2 Examine the Site

The Contractor shall visit and ascertain the nature of the ground to be excavated and the work to be done and shall accept all responsibility for the cost of the work involved.

1.3 Setting Out

The Contractor shall set out the center line of the building or other involved work after clearing the site and get the same approved from PMC/Employer. It shall be the responsibility of the Contractor to install substantial reference marks, bench marks, etc. and maintain them as long as required by the PMC/Employer. The Contractor shall assume full responsibility for proper setting out, alignment elevation and dimension of each and all parts of the work. The center, longitudinal or face line and cross line shall be marked by means of small masonry polar provided with a distinct mark at the center to enable theodolite to be set over it.

1.4 Ground Level and Site Level

Before starting the excavation the requisite block level of the entire plot shall be taken by the Contractor in consultation with the PMC/Employer and a proper record of these levels kept, which shall be jointly signed by the Contractor and the PMC/Employer. A block level plan showing all ground levels of the plot shall be prepared and shall jointly be signed by the Contractor and PMC/Employer.

1.5 Excavation and Preparation of Foundation for Concrete

Excavation shall include all types of soil in dry and wet condition at all depth, lead, lift for construction of foundation and substructure (including mass excavation for under-ground reservoir and basement where applicable) exactly in accordance with lines, level grades and curves shown in drawing or as directed by PMC/Employer including clearing of shrubs, land vegetation, bush wood, saplings, uprooting of trees. The earth work should also include dismantling removing of abandoned old building structures, pipeline sewer debris etc. within or adjacent to the excavation area and recovering and stanching and handing over of serviceable materials, removal and immediate disposal of all surplus earth and unserviceable materials as directed by the PMC/Employer. The bottoms of excavation shall be carefully leveled, rammed, both longitudinally and transversely or stepped or benched horizontally as directed by PMC/Employer.

Should the Contractor excavate to a greater depth than shown on the drawings or as directed by the PMC/Employer he shall at his own expense fill the extra depth or width in cement concrete as required as per direction of the PMC/Employer.

The concrete mix shall not be leaner than 1:4:8 concrete

The Contractor shall report to the PMC/Employer then the excavation is ready to receive concrete. No concrete shall be placed in foundation until the contractor has obtained PMC/Employer's approval.

After the excavation is passed by the PMC/Employer and before laying the concrete, the Contractor shall note the depth and dimensions of excavation and earth excavated shall be removed.

Excavated materials shall not be placed within 1 m of the edge of the excavation. Every precaution shall be taken against slips and falls of earth, clay, sand or the materials in the excavation, but in the event of any occurrence, the same shall be made good as per the direction of PMC/Employer at the Contractor's own expense.

Classifications of Excavations

Excavation in all kinds of soil except hard rock shall mean excavations grouped under ordinary soil hard/dense soil and disintegrated rock as per IS 1200 part I 1974.

1.6 Protection

If instructed by the PMC/Employer all excavation shall be strongly fenced and marked with red lights at night and watchmen engaged by Contractor to avoid accidents and make other adequate protective measures, required for safety of the excavations and people working in and near the foundation trenches, property and the people in the vicinity shall be taken care of by the Contractor at his own cost, he being entirely responsible for any injury and damage to property caused by his negligence or accident due to his constructional operations.

1.7 Rates to include for Excavation Items

Apart from other factors mentioned elsewhere in this contract, rates for item of excavation shall also include for the following: -

i) Clearing site of shrubs, bush, wood, sapling and uprooting of trees.

ii) Setting out works as required including making reference polar etc.

iii) Excavation at all depth as shown in the drawing in all types of soil, in wet or dry condition including dismantling and removing of old building structures, pipelines, sewers, debris, etc., and removal of all materials of whatever nature wet or dry and necessary for the construction of basement foundation underground reservoir etc. and preparing bed before

laying concrete.

iv) Necessary adequate protection for safety of labour, material, adjoining property and equipment to ensure safety protection against risk or accident.

v) Bailing and pumping out water as required for the work and as directed.

vi) All necessary lead and lift.

vii) Filling with earth or concrete (mix not leaner than 1:4:8) portions excavated to a greater depth of foundation trench than shown in the drawing.

1.8 Removal of Excavated Materials

All materials excavated shall be removed from site with all lead and lift (except those selected earth that have been permitted by PMC to be used for back filling). Removal of surplus excavated material shall be paid separately (except selected earth) have been removed from the site, (as and when excavated) and from adjoining areas, e.g. roofs, footpath, etc.

Mode of Measurement for Removal of Excavated Material

Removal of excavated material shall be measured in cubic meter and the quantities of such shall be the same quantity as measured for each work in excavation.

1.9 Measurement for Excavation

Excavation for foundation of basement column, beams, walls and the like shall be measured and paid net as per drawing, dimensions of concrete (bed concrete where so specified) at the lowest level in regard to length and breadth and depth shall be computed from the concerned excavation levels and ground levels taken before excavation. Any additional excavation required for working space, form work, shoring, plumbing, de-watering and shuttering, etc. shall not be measured and paid separately, rates quoted for excavation shall include for all these factors. No increase in bulk after excavation shall be made.

1.10 Shoring

The Contractor shall provide adequate measure and protect the sides of the excavations closely timbered, shored in such a way as is necessary to secure them from collapsing and falling inside the pit.

Shoring shall be maintained in positions as long as necessary. The Contractor shall be responsible for the proper design of the shoring to hold the sides of the excavation in position and ensure that the excavation does not damage adjoining structures and ensure safety and injury to persons. The shoring shall be removed as directed after the items for which it is required are complete.

1.11 De-watering

Rate for excavation shall include bailing or pumping out water which may accumulate in the excavation during the progress of work either from seepage, shoring, rain or any other cause and diverting surface flow if any by bunds or other means, pumping out water shall be done in such approved manner as to preclude the possibility of any damage to the foundation trench concrete or masonry or adjacent structure when water is not in foundation trenches or in tank excavations. Pumping out water shall be from auxiliary pits, shall be refilled with 1:4:8 concrete after de-watering is over at the cost of the Contractor.

1.12 Interruption of Work

PMC/Employer reserves the right to interrupt or otherwise alter the sequence of any one or more portions of work or item of execution of work; if such interruption or alterations is necessitated on account of change of design or any special requirement at site or change in the sequence of work thought best by the PMC/Employer in the interest of the work.

1.13 Unforeseen Work

The specifications and drawings given for execution of construction/erection work are obligatory on the tenderer for the construction work. If in the course of construction work some additional problems arise, which are not covered by the given specifications, the Contractor will be given proper instruction by the PMC/Employer. Such instructions will be binding and will be observed in full by two Contractors regarding specifications, drawings, method of conducting work and other measures necessary for the fulfillment of construction time tables, as well as instruction on problems concurring the order of work.

2. CONCRETE

2.A General

A.1 Supervision

A competent person approved by PMC/Employer shall be employed by the Contractor whose first duty will be to supervise all stages in the preparation and placing of the concrete. He shall be responsible for taking test cubes and other site tests will be carried out under his direct supervision.

A.2 Approval of concreting arrangement etc.

Before construction commences the Contractor shall supply to the PMC/Employer for their approval drawings showing the general detailed arrangements for his concreting plant, system of form work and all other devices which he proposes to use for the construction of the structural form work.

A.3 Samples and Tests

Every facility shall be provided to enable the PMC/Employer to obtain samples and carry out tests on the materials and construction. If those tests show that any

of the materials or construction do not comply with the requirements of this specifications, the Contractor will be responsible for replacement of the defective materials and/or construction at his own cost. The necessary cost of all such tests has to be borne by the Contractor.

A.4 Rejected Materials

All materials which have been damaged, contaminated or have deteriorated or do not comply in any way with the requirements of this specification shall be rejected and shall be removed immediately from the site at the Contractor's own expense.

A.5 Loading of Floor slabs

No materials shall be stored or stacked on suspended floors and roofs without the PMC/Employer prior approval.

A.6 The Contractor shall be responsible for the co-ordination with sub-contractors or other contractors engaged on the work for incorporating any inserts or electrical conduit pipes, fixing blocks, chases, holes etc., in concrete members and brick work for electrical sanitary and air conditioning work as required. The Contractor shall ensure that these requirements have been approved by the PMC/Employer before concreting operation and implemented. All fixing blocks, chases inserts, holders etc. to be left in the concrete shall be of the sizes specified in the drawing or as instructed and be instructed and be accurately set out and placed before pouring concrete. The Contractor's rates quoted for concrete items shall include all the factors. No holes and chases shall be cut in concrete without prior approval of the PMC/Employer.

A.7 Inserts to Concrete

The Contractor should note that he shall provide necessary wooden plugs, sleeves etc. required for the work for which no extra payment will be made. He will have to provide if so directed by PMC/Employer and inserts, wooden plugs, sleeves for other Contractors, such as Electrical Contractor, Plumbing Contractor, Air conditioning Contractor, Erection Contractor for lifts etc., for which he will be entitled for payment but in case the other Contractors provide such inserts, then he will have to take proper measures (at his expense) and take care not to disturb their work while laying concrete.

A.8 Equipment

The Contractor shall have to install at site a cube testing machine, cost of which will be borne by the Contractor entirely. He will also have to keep at Work site testing equipment for aggregate and concrete, like test sieve, balance, slump cones etc., all required conforming to relevant I.S. Specification/C.P.W.D. specification.

A.9 I.S. 1200 "Method of Measurement of building work" is to be followed in all measurements saved in so far as the same are hereby expressed or implied varied in these specification and/or schedule of quantities. In case of any conflict

between the I.S. 1200 and this specification and/or schedule of quantities, the later shall be prevailed.

2B. Materials

All materials shall be of approved quantity. Conforming to the relevant I.S. Specifications/C.P.W.D. Specification.

B.1 a) Ordinary Portland cement shall conform to the I.S. specification IS 269/1967. Portland Pozzalana cement shall conform to I.S. 1489-1967 unless specially permitted by PMC/Employer Pozzalana cement shall not be used.

b) Cement at site shall be stored in dry weather proof godown (or shed) built at the cost of the Contractor in stack of which are no higher than 10 bags. Sufficient space shall be provided for circulation and rotation of bags in order to minimize the length of storage of any of the bags. The floor of the godown shall consist of wood sleepers resting on base prepared by dry bricks laid on the edge.

c) The Contractor shall be fully responsible for the quality of cement brought by him at the work site. The Contractor shall satisfy himself that the cement brought to the work site by him conforming to the requirement of I.S. 269-1967 or relevant Indian Standard and shall procure Manufacturer" Certificate to this effect and submit the same to PMC/Employer.

d) In case the PMC/Employer has any doubt about quality of cement, they can order on the Contractor to have the cement tested or they can take samples in the presence of Contractor from cement bags stored at work site and forward them to a Government Laboratory for testing. The cost of such testing shall be borne by the Contractor.

e) Cement concerning which there is doubt shall not be used pending testing and satisfactory results. All cement not conforming to specifications and rejected by PMC/Employer and cement that had deteriorated, damaged or set shall not be allowed to be used. All such cement shall be immediately removed from work site by the Contractor. The cost of all such cement shall be borne by the Contractor.

B.2 Aggregate

Aggregate shall conform to I.S. 383-1970.

B.3 Fine Aggregate

Sand :

a) The fine Aggregate – Sand shall be hard, strong, dense, durable clean with un-coated grains. The maximum size of the particles shall be 4.75 mm (3/16 in) and shall be graded down. The sand shall not contain any harmful materials such as iron, pyrites, coal, mica, silt, clay, alkali, sea shells, organic impurities, loan etc. or in case of reinforced concrete work, any materials which might attack the reinforcement or be detrimental to

concrete. The total silt content in sand shall not exceed 4% as determined by the laboratory tests. If directed it shall be washed or screened before use without any extra cost. Aggregate which are chemically reactive with the alkalies of the cement shall not be used. The maximum quantity of deleterious materials shall not exceed the limit specified in the relevant I.S. Specification.

b) Grading

Sand for concrete work shall conform to I.S. 383 and that for Mortar shall conform to I.S. 383 that for Mortar shall conform to I.S. 1542.

c) The Contractor shall arrange to supply graded aggregate conforming to I.S. 383.

B.4 Coarse Aggregate

a) Coarse aggregate shall consist of hard, dense, durable, uncoated crushed rock. Gravel aggregate shall be allowed to be used only if specially specified in the bill of quantities. Otherwise it shall be taken that only crushed rock shall be permitted as coarse aggregate conforming to I.S. 456.

b) The aggregate shall be free from soft, friable, thin or long laminated pieces. Aggregate shall be free from injurious amounts of alkali, organic matter other than deleterious materials. Flacky or weathered stones shall not be used. The test and maximum percentage of deleterious materials shall be as specified in the relevant I.S. 2386. The aggregate shall be screened and washed.

c) The contractor shall arrange to supply graded aggregate conforming to I.S. 383.

d) Size of Aggregate

i) Nominal maximum sizes of aggregates in beams and columns should be restricted to 5 mm less than the minimum clear distance between the main bars or 5 mm less than the minimum cover to the reinforcement whichever is less.

ii) In no case the maximum size of aggregate be greater than one quarter of minimum thickness of the member so as to facilitate concrete to be placed without difficulty to surround all reinforcement.

iii) Generally for reinforced concrete work nominal maximum size of 20 mm is considered suitable.

e) In selecting the aggregate, the Contractor shall satisfy him that the source is suitable for regular supply and a watch should be maintained on the particles shape and grading remain reasonably uniform throughout the

progress of work,. Unless otherwise specified this shall be obtained from Pakur.

f) Where so directed by PMC/Employer aggregate shall be washed by approved methods of Contractor's expenses.

B.5 Water

Water used for both mixing and curing shall be clean and free from injurious amounts for deleterious materials, which are likely to affect the strength and durability of concrete. Water containing any sugar shall not be allowed for use. Water for this purpose shall conform to I.S. 456-1978.

2.C Proportioning and Work Control

C.1 Nominal Mix Concrete

C.1.1 General

Nominal mix concrete shall be used for all plain cement concrete water and were shown in drawing or allowed by the PMC.

C.1.2 Mix Proportion

Mix proportion for nominal mix concrete shall be as follows :-

TABLE - 1

CONCRETE MIX PROPORTIONS

Grade of Concrete	ORDINARY CONCRETE		
1	2	3	4
	Total quantity of dry Aggregate by mass per 50 kg. of cement to be taken as the sum of individual masses of fine and coarse aggregate	Proportion of fine aggregate to coarse aggregate	Quantity of water per 5 kg. of cement
	Maximum		Maximum
M-7.5	625 Kgs.	Generally 1:2 for fine aggregate to coarse aggregate, but subject to a upper limit of 1½ and a lower limit of 1:2½	45 Litres
M-10	480 Kgs.		34 Litres
M-15	350 Kgs.		32 Litres
M-20	250 Kgs.		30 Litres

Note : Regarding explanation to the above mix proportion refer to Table – III of I.S. 456-1978.

In proportioning concrete minimum quantity of cement shall be as specified in Table III of this specification and the amount to be used shall be determined by actual weight. The quantities of fine and coarse aggregates shall be determined by weight. In case uniformity in the materials used for concrete making has been established over a period of time, the proportioning may be done by volume batching provided periodic check are made on mass/volume batching ship of the materials. Where weight batching is not practicable, the quantities of fine and coarse aggregate (not cement) may be determined by volume. If fine aggregate is moist and volume batching is adopted allowance shall be made for bulking in accordance with I.S. 2386 (Part III). Allowance shall be made for surface water present in the aggregate when computing the water content. The amount of surface water shall be determined by one of the field methods described in I. S. 2386 (Part III). All the above data shall be maintained properly to the satisfaction of the PMC.

The water cement ratio shall not be more than those specified in Table-I. The cement content of any nominal mix proportion specified shall be increased if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compacting so that the water cement ratio specified for a particular mix is not exceeded. No extra payment shall be made to the Contractor

for use of extra cement.

If nominal mix concrete made in accordance with the proportions given in Table I for a particular grade does not yield the specified strength and fails to satisfy the requirements of "Acceptance Criteria" for concrete as specified in I.S. 456 the cement content shall be increased as directed by the PMC to obtain a specified strength at no extra cost to the owner. The use of richer mix shall be continued until the PMC instructs otherwise. Nominal mix concrete proportioned for a given specified grade including cases where the PMC directs use of additional cement over the quantity specified for the particular grade shall not, however, be placed in a higher grade on the ground that the test strengths are higher than the minimum specified for desired grade.

C.2 Design Mix concrete

C.2.1 General

Design mix concrete shall be used for all reinforced concrete work except where specified otherwise.

C.2.2 Mix Proportion

The mix proportion for all grades of concrete shall be designed to obtain durability and workability necessary for the job and strength corresponding to the values specified in I.S. 456 for respective grade of concrete. Preliminary tests, as specified in the I.S. code or as required by the PMC, shall be carried out sufficiently ahead of the actual commencement of the work with different grades of concrete made from representative samples of aggregates and cement expected to be used on the job to ascertain the ratios by weight of cement to total aggregate, of fine to coarse aggregate and the water cement ratio required to produce a concrete having specified strength and sufficient workability to enable it to be well consolidated and to the worked into corners of shuttering and around the reinforcement.

C.2.3 Mix Design Criteria

Concrete mixes will be designed by the Contractors to achieve the necessary durability and workability and a characteristic strength not less than that specified for the job by the most economical use of the various ingredients. In general the design will keep in view the following consideration :-

a) Consistent with the various other requirements of the mix, the quantity of water should be kept at lowest possible level.

b) The nominal maximum size of coarse aggregate shall be as large as possible within the limits specified, but in no case greater than ¼th of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners.

c) The various fractions of coarse and fine aggregate should be mixed in such proportions so as to produce the best possible combined internal grading giving the densest and most workable mix.

d) The quality of mixing water shall conform to Clause 4.3 of I.S. 456-1978.

e) The aggregate shall conform to I.S. 383.

f) The Contractor shall design the mix for 10% higher strength than specified and for different slump requirement.

g) Admixtures may be used to improve various properties of concrete with permission of the PMC when an admixture is used to improve a particular property of concrete the Contractor shall make necessary adjustments in the mix proportion so that other properties of concrete (including strength) are not impaired. For concrete structure subjected to periodical freezing and thawing, only air entertained concrete shall be used.

Integrated water proofing admixture shall conform to I.S. 2645 other admixtures shall conform to I.S. 9103.

The choice of water cement ratio in designing a concrete mix will depend on :

a) The requirement of strength.

b) The requirement of durability.

However the water cement ratio dictated by durability consideration is lower than required from strength requirement, the former shall be adopted. Tables 19 & 20 in I.S. 456-1987 gives the maximum water cement ration and minimum quantity of cement permissible from durability consideration. This specification contains Table II & III giving maximum water cement ratio in different conditions and minimum cement content for different grade of concrete respectively. In a particular situation where the specification differs from I.S. 456 the specification shall be followed. Table III shall be followed for nominal mix concrete also.

The minimum cement content mentioned above are for average conditions. The PMC shall have the right to revise the minimum cement content and the Contractor shall allow a corresponding rebate. Sufficient number of trial mixes (to be decided by the PMC) shall be taken in an approved laboratory for the various mix designs and graphs of water cement ratio v/s crushing strength at various ages shall be prepared. The cost of the mix design and testing shall be borne by the Contractor.

On the basis of the above test reports, a portion of the mix by weight and water cement ratio shall be approved by the PMC, which will be expected to give the required strength, consistency and workability and the proportions so decided for different grades of concrete shall be adhered to during the concreting operations. If, however, at any time the PMC feels that the quality of materials being used has changed from those used for preliminary mix design, the Contractor shall have to run similar trial mixes to ascertain the mix proportion and water cement ratio for obtaining the desired strength and consistency.

In designing the mix proportion of concrete, the quantity of both cement and aggregate

shall be determined by weight. The PMC may allow the quantity of aggregates to be determined by the equivalent volume basis after the relationship between the weight and volume is well established by trial and the same shall be verified frequently. Water shall be either measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean and serviceable condition, and their accuracy periodically checked.

To keep the water cement ratio to the designed value, allowance shall be made for moisture contents in both fine and coarse aggregates and determination of the same shall be made as frequently as directed by the PMC. The determination of moisture contents shall be according to I.S. 2386 (Part III).

2.D Mixing and Placing of Concrete

2.D.1 Cement

Cement shall be batched with weight even though aggregate are batched by volume. Where the weight of the cement is determined by accepting the maker's weight per bag, a number of bags directed by PMC/Employer shall be weighed separately to check the net weight. Where the cement is weighed at site and not in bags, it should be weighed separately from aggregate.

TABLE – II

MAXIMUM PERMISSIBLE WATER/CEMENT RATIOS FROM DURABILITY CONSIDERATIONS FOR DIFFERENT TYPES OF STRUCTURES AND DEGREE OF EXPOSURE USING PORTLAND CEMENT

	EXPOSURE CONDITIONS					
	Serve wide range of temperature of frequent alterations of freezing and thawing (use air-trained concrete only)			Mild temperature rarely below freezing or rainy		
	In Air	At the water line or within the range of fluctuating water level or spray		In Air	At the water line of - with the range or fluctuating water level or spray	
		In fresh air	In sea water or in contact with sulphate (concentration more than 0.2 P.C.)		In fresh air	In sea water or in contact with sulphate (concentration more than 0.2 P.C.)
1	2	3	4	5	6	7
This section such as railings, kerbs, sills, ledges, ornamental or architectural concrete piles, pipes and all sections with less than 15 mm concrete cover to reinforcement	0.49	0.44	0.40	0.53	0.49	0.40
Moderate sections such as retaining walls, , pillars, girders, beams	0.53	0.49	0.44	-	0.53	0.40
Exterior portions of heavy mass sections	0.58	0.49	0.44	-	0.53	0.44
Concrete deposited by under water	-	0.44	0.44	-	0.44	0.44
Concrete slab laid on ground	0.53	-	-	-	-	-

Concrete which will later be Protected by enclosure or backfill but which may be exposed to freezing & thawing for several years before such protection is offered. Concrete protected from the weather interior of buildings, concrete below ground which is free from sulphate attach	-	-	-	-	-	-

*Water/Cement ratio should be selected on basis of strength and workability requirements.

TABLE – III

Minimum cement content specified for different grade concrete.

Grade of Concrete	Maximum cement content per cum of finished concrete
M-15	325 kgs.
M-20	360 Kgs.
M-25	420 Kgs.

D.2 Aggregate

The aggregate shall be batched by volume. The weight of aggregate as derived from mix design is converted into volume and measuring boxes of fixed volume are made for use. The measuring boxes, if used shall be of the correct sizes to be certified by the PMC/Employer before use. Heaping of aggregates on measuring boxes is prohibited and aggregates shall be filled level measuring boxes and struck off with a horizontal timber for steel rule. Where sand is measured by volume, bulk-age allowance as determined by the PMC/Employer shall be accounted for while measuring sand.

D.3 Water

Water shall be measured either by volume in calibrated tanks/vessels having a conical shape narrow at top or water shall be weighed. Water shall not be measured using ordinary buckets which are wider at top and narrower at the base. The measurement of water to control and maintain a constant water cement ratio is of utmost importance and adequate attention to this end by the

Contractor to the satisfaction of the PMC/Employer shall be made.

Mixing of Concrete

D.4 Machine Mixing

Concrete shall be mixed in a Mechanical Mixer. Mixing shall be continued until there is uniform distribution of materials and the mass is uniform in colour and consistency. The mixing time from the time of adding water shall be in accordance with I.S. 1971-1968 but in no case mixing shall be done for less than two minutes. Ingredients shall be poured in the drum of mixtures while it is revolving. The consistency of the mix shall be checked by slump tests and other approved test etc. as specified in the relevant I.S. Codes or Practice and as per the direction of PMC/Employer.

D.5 Transporting, Placing, Compacting and Curing of Concrete

D.5.1 Transportation

Concrete shall be handled from the place of mixing to the place of final deposit as rapidly as practicable by method which will prevent the aggregation or loss of any of the ingredients. If segregation occurs during transport, the concrete shall be re-mixed before use. The concrete shall be placed in position and compacted within 20 minutes after water is added and shall not be subsequently disturbed. During hot or cold weather concrete shall be transported in deep container to reduce loss of water by evaporation during hot weather and loss of heat during cold weather. Deep containers are specified on account of their lower ratio of surface area to mass.

D.5.2 Dropping of Concrete

Concrete shall not be dropped into position from a height greater than 1.0 meter, unless dropped by a chute or similar method approved by the PMC.

D.5.3 Debris etc. removed

All debris saw dust etc. shall be removed from the shuttering before any concrete is placed. Care shall be taken to see that the shuttering is watertight and has been properly treated with approved composition to prevent absorption of water.

D.5.4 Compaction

Concrete shall be thoroughly compacted during operation of placing by the use of Mechanical Vibrations. Sufficient number of vibrators (including stand by) of adequate capacities shall be used for compaction concrete. Vibration shall be carried out by those trained in the use of Vibrators and vibrated concrete. Vibration is not effective careful rolling and tapping shall be carried out and sufficient men employed to ensure that thorough consolidation takes place. Where manual compaction becomes necessary the workability of the mix should be controlled to suit such mode of compaction subject to strength requirement if specified along being complied with.

D.5.5 Protection and Placing in Layers

Concrete shall be placed gently in layers not exceeding 300 mm thickness. Concrete after placing shall be protected by use of covering to approval of the PMC/Employer during first stage of hardening against high winds, hot and/or rain or surface water. No. shock or vibration shall be allowed to be imported to form supporting fresh concrete.

D.5.6 Continuous Concreting

Concreting shall be carried out continuously upto predetermined positions of construction joints. The position for construction joints shall be approved by the PMC/Employer. Rest pauses for meals etc. shall be subject to the PMC/Employer's approval. Joints in concrete shall be staggered in different layers.

D.5.7 Packing Round Reinforcement

In the case of reinforced concrete work, the concrete shall be carefully and packed round the reinforcement and care shall be taken to ensure that reinforcement is not displaced during the placing and compaction concrete. If reinforcement moves out of its place, it must be brought back in position immediately.

D.5.8 Curing

All concrete work shall be water cured for minimum period of 14 days after concreting or as advised by PMC/Employer. Horizontal surfaces shall be kept covered with water ponded by means of bunds and vertical surfaces like those of columns, fins, etc. by burlaps kept constantly wet by means of water sprays. Mere sprinkling of water on vertical surface without sacks of burlaps will not be allowed. In respect of concrete made out of pozzalana cement, curing shall be continued for another 8 days. Masonry work over foundation concrete shall not be commenced before 48 hours of laying concrete. Curing, however, shall be continued.

D.6 Trained Supervision

It is essential that the Contractor's supervisor who is in charge of the construction of all concrete work whether reinforced or not, shall be skilled in this class of work and shall superintend personally the whole construction and pay special attention to:-

a) The quality, testing, proportioning and mixing of the material and particularly control of water cement ratio.

b) Laying of materials in place and thorough consolidation of the concrete to ensure solidity and freedom from voids.

c) Size and position of reinforcements.

2.D Construction Joints

a) Location

The position of all construction joints shall be approved by the PMC/Employer. The contractor shall submit details of the location where he proposes to provide construction joints for the approval of the PMC/Employer.

b) Water Bar & Water Sealer

Wherever shown in the drawing or wherever instructed by the PMC/Employer water bar or water sealer of approved quality shall be used in construction joints for R.C. work. It is necessary to ensure that water bars from continuous diaphragms. The water bars shall be made out of special chemically erected PVC materials for retaining the flexibility indefinitely. Unless otherwise instructed by the PMC/Employer and not shown in the drawings or schedule, the water bars shall be "center bulb" corrugated and (type) with grip. Corrugation and end grips specified for better grip and 'Center bulb' to shape with anticipated movements of adjacent concrete masses. These shall be of 230 mm width thickness shall be about 10 mm. The payment for supplying and fixing water bar in construction joints shall be made as a separate item as entered in the schedule of quantities and the rate in running meter and the same shall include for all the appliance necessary got fixing the same in position as well as the extra cost for all necessary intersection pieces, I.S. 457 shall be followed unless otherwise specified.

E.2 Construction Joints in Basement

a) Location as formation

The Contractor shall prepare a drawings showing the proposed construction joints and have it approved by the PMC/Employer. After such approval, it is necessary to place water bars well in advance at predetermined positions and carry out the concreting right up to the stop boards. Under no circumstances, as procedure to determine the position of construction joints as concreting operations come to close shall be allowed.

Particular care is required to from and treat construction joints in basement to ensure water tightness for which the Contractor shall be responsible.

b) Joints in Base Slabs

Joints in base slabs and beams of basement shall be located so that the joint is parallel to the principal reinforcement, where it is unavoidable and is at right angle to the principle reinforcement, the joints shall be in the middle of the span of the slab or beam.

c) Formation Horizontal Joints

Horizontal joints in wall shall be rebated and care shall be taken to establish as proper and good bond between the hardened concrete and freshly laid concrete to produce a water tight joint which shall be Contractor's responsibility.

d) Formation Vertical Joints

Vertical construction joints in base slab and walls of basement shall be formed by using P.V.C. water bars in predetermined positions.

e) Walls Slab Junctions

Each layer must be compacted before placing the next layer. Concrete in the solays at the junction of wall and the slab shall be placed without joint at the time of concreting the slab.

E.3 Treatment of Construction Joints in Basement

i) When work is resumed on the surface which has hardened, such surface shall be roughened. It shall be thoroughly cleaned and wet and covered with a 12 mm layer of mortar composed of cement and sane in the same ratio as cement and sand in the concrete mix. This 12 mm layer of mortar shall be freshly mixed and placed immediately before the placing of the concrete.

ii) Where the surface has not fully hardened the latiance shall be removed by scrubbing the wet surface with wire bristle brush, care being taken to avoid dislodgment of aggregate particles. The surface shall be thoroughly wet and all free water removed. The surface shall then be coated with neat cement thick grout. The first layer of concrete to be placed on this surface shall not exceed 150 mm in thickness.

iii) Care shall be taken to obtain good bond between the hardened and freshly placed concrete. Careful ramming and molding of concrete around water bar, is very important. Extra labour and material for treatment of concrete joints are included in the rate of respective items.

2.F Tests for Concrete

Tests shall be conducted in accordance with I.S. 516-1959 with upto date amendments. Cost of all tests shall be borne by the Contractor.

Test Cubes

a) Work test cubes shall represent quality of concrete incorporated in the work and taken out in sets of 6 cubes. The concrete for preparation of one set of 6 cubes shall be taken from one batch of mixed concrete discharged from the mixer. The cubes shall be moulded in accordance with Indian Standard Code of Practice.

b) A minimum of one set of 6 cubes shall be taken for every 28 cum or part thereof concrete poured and they shall be considered as representative for said quantity. This is an average figure and may be decreased to cater to special conditions like special structure different mixes etc. At the discretion of the PMC/Employer at site.

c) The cubes shall be cured as per I.S. Code of Practice. The entire operation of casting, curing and testing will be carried out by the Contractor under the supervision of the PMC/Employer. Out of 6 cubes, 3 approved Government Laboratory.

d) The cubes shall be initialed, numbered, dated jointly by the Contractor's representatives and the PMC/Employer's representative with a piece of wore or nail so that an identification of the initials is left on the cubes.

e) A register shall be maintained at site by the Contractor with the following details entered and initialed by the Contractor and the PMC/Employer.

i) Reference to specific structural members receiving the batch of concrete from which the cubes were tested.

ii) Mark on cubes

iii) The mix of concrete

iv) Date and time of casting

v) Crushing strengths as obtained at the end of 7 days for 3 cubes out of a set of 6 and the end of 28 days for the other 3 cubes.

vi) Laboratory in which tested and reference to test certificate.

vii) Any other information directed by the PMC/Employer.

f) A record of the quality of concrete incorporated in the work that is represented by the quantity of concrete of the set of cubes along with the description of the structural members where concrete has been deposited shall be mentioned. For floor beams and slabs, such record shall be supported by Drawing the areas of concreting carried out and representing the set of cubes taken out shall be properly de-marked with cube reference entered in the drawing at the relevant portions. This record shall be initialed by the Contractor and maintained by the PMC/Employer.

2.F.2 Vibration of Concrete

a) Placing

Concrete should be placed before initial setting time as per IS:456 and IS: 403. Concrete shall be placed in layers not over 45 to 60 cm (18 to 24 inches) deep and each layer shall be vibrated into places by methods

which will not permit the ingredients to separate. Surfaces shall be smooth and free from voids caused by stone pockets, where necessary vibration shall be supplemented by hand padding to secure their results. Concrete in which initial set has already started should not be used.

b) Number and size of Vibrators

Vibrators shall be of sturdy construction, adequately powered and capable of transmitting to the concrete not less than 3,000 impulses per minutes when operating under load. The vibration shall be sufficiently readily into place and visibly affect the concrete over a radius of atleast 450 mm (18") when used in concrete having slum of one inch. A sufficient number of vibrators (atleast two vibrator for a rate of concreting of 1.5 cum (50 cft.) per hour shall be vibration throughout the entire volume of each layer of concrete and complete compaction are secured I.S. followed unless otherwise specified.

c) Manipulation of Vibrators

Internal vibrators shall be kept constantly moving in the concrete and shall be applied at points uniformly placed not further apart than the radius over which the vibrator is visibly effective. The vibrator shall not be held in one location long enough to draw a pool of grout from surrounding concrete. The vibration shall be such that the concrete becomes uniformly plastic and there shall be at least 200 seconds of vibration per square meter (20 second of vibration per sq.ft.) of surface of each layer of concrete, computed on the basis of visibly affected radius and taking overlap into consideration.

2.G Defective or Poor Concrete

G.1 If in the PMC/Employers opinion, there is doubt as to the strength of the structure due to the work test cubes failing to attain specified strength, due to poor workmanship like honey combing, etc. or any reason attributable to negligence on the part of the Contractor, then the PMC/Employer's decision regarding dismantling of such concrete or rectification if concrete is allowed to be retained in its place shall be final and binding on the Contractors.

G.2 Where the PMC/Employer in order to save time and where they consider that the defective concrete may be strengthened as directed by them, the Contractor shall carry out all rectification measure, to the approval of PMC/Employer at the expense of the Contractor.

G.3 Honey Combing

a) Where honey combed surface are noticed in the concrete the Contractor shall not patch up the same until examined by the PMC/Employer and decision given

regarding the acceptance with rectification or rejection of the same. If the Contractor patches up such defects without the knowledge of the PMC/

Employer, the PMC/Employer at liberty to order demolition of the concerned concrete members to the extent they consider necessary in such case, the Contractor at his expense, shall reconstruct demolished work. The demolished work shall not be measured and paid for.

b) If in the opinion of the PMC/Employer the honey combing is harmful to the structure and where so directed by the PMC/Employer the full structural members affected by honey combing as decided by PMC/Employer shall be dismantled and reconstructed to PMC/Employer approval at the Contractor's expense. The demolished concrete will not be measured and paid for.

c) Where in the opinion of the PMC/Employer the structural members containing honey combing can be allowed to be retained with rectification, the rectification shall be carried out as directed by the PMC/Employer by gunitting (with cement mortar 1:3 proportion) the areas concerned at the Contractor's expense.

d) Such honey combed areas are not severe in the opinion of the PMC/Employer and where so directed shall be patched up with cement mortar consisting of 1 part of cement and 3 parts of sand after removing defective concrete down to sound concrete to the satisfaction of PMC/Employer all at the expense of the Contractor.

G.4 Load Testing

The PMC/Employer reserves the right to carry out load testing on structure and proceed to deal with purely at their discretion. They may instruct the Contractor to make a loading test on the work part thereof. The nature of the test and the loading shall be left to the discretion of the PMC/Employer. The Contractor shall bear the cost of the test and the cost of dismantling and reconstructing or concreting the defects by rectification in accordance with their instructions.

Within 24 hours after removing shuttering of any part of structure the Contractor should bear the responsibility of getting approval from the PMC/Employer that no load test is required for the said structure.

In case of doubt regarding quality of concrete grade used, the PMC/Employer may ask the Contractor to carry out core test or load test as per I.S. 456-1978 all cost to be carried by Contractor.

G.5 Other Defects

Any other defects in concrete shall be made good as directed by the PMC/Employer at the Contractor's expenses.

2.H Contractor's Rates to Include

The rates of the Contractor for providing and laying cement concrete in various grades or proportion in the schedule of quantities shall apart from any other factors specified elsewhere in the tender documents include the following:

a) For the factors and method of work described in this specification.

b) For all materials, labour, tolls and plants, scaffolding etc. mixing conveying and placing concrete in position, ramming, vibrating, trawling, curing, providing necessary scaffolding and removing the same after the work is complete.

c) Unless otherwise specified in the Schedule of Quantities the cost for concrete items shall include for providing, stays, struts bolts, nuts and everything necessary to keep the form rigid, smoothing the striking and stripping framework as per specification, hacking the concrete surfaces, required to receive plaster etc. Where shuttering is described as separate item in the schedule of quantities the rate for shuttering shall be inclusive of all the work mentioned in specification for framework and also elsewhere in this contract. Shuttering to curve structure will be measured and paid separately as detailed in schedule of Quantities.

d) Rates for concrete items shall cover for any shape of a structural member like columns, beams, fascia, fins, louvers, etc. and for cantilever beams, slabs, etc. including curve structures.

e) Formation and treatment of construction joints, and expansion joints where PVC or similar types of water bars are specified such materials shall be paid in separate rates.

f) Design of mixes where sop required by specification in an approved government laboratory and on tests of materials and work required in the opinion of the PMC and described in these specification.

g) Fixing all inserts like pipes, plugs, forming holes etc. as described.

h) Weigh batching using a Mechanical weigh batcher of a batching plant or where so specified for volumetric batching.

i) For taking out dowel bards, fan hooks, etc. through shuttering.

j) For forming drip moulds in chajja, sills etc. and where shown in the drawings or as directed.

k) Form work at all levels.

l) The cost of all labour involved and tools used in demolishing and dismantling including scaffolding also the charge for separating out and stacking.

2.1 Mode of Measurements of cast-in-situ reinforced and plain concrete

Unless otherwise stated all concrete work shall be measured in cubic meters. The measurement of concrete will be as per detail drawings, shapes and sizes based on net structural sizes as per drawing, i.e. excluding plaster. No deductions shall be made for the following :-

a) Ends of dissimilar materials for example : beams, posts girders, rafters, purloins, trusses, corbels and steps upto 500 cm^2 in cross sections.

b) Opening upto 0.1 m^2.

c) Volume occupied by reinforcement.

d) Volume occupied by pipe, conduits, sheathing etc. not exceeding 100 m^2 each in cross sectional area.

e) Small voids when the voids are not exceeding 40 cm^2 in cross section.

f) Moulds, drip moulding, chamfers, splays, rounded or curved angles, beds, grooves, rebuts upto 10 cm in width or 15 cm in breadth.

g) Stops, meters, returns, rounded ends junction dishing, etc. in connection with linear super labours.

Columns shall be measured from top of column base to underside of floor slab. In case of columns for flat slab flare of columns shall be included with column for measurement.

Beams shall be measured from face to face of columns and shall include haunches, if any between columns and beams. The depth of beams shall be measured from top of slab to top of beam.

The chajja shall be measured inclusive of bearing, when chajja combined with lintel, beam or slab, it shall be measured as clear projection, wherever fin/fascia and chajjas are combined, chajjas shall be measured clear between fin/fascia. The vertical fin and fascia shall be measured through.

3. FORM WORK

3.A. Materials and Design

a) The framework shall be of approved dressed timber tide to line not less than 2.5 cm thick surface to be in contact with concrete to be planned except where otherwise stated. As an alternative sufficiently rigid steel shuttering may be used. In every case joints of the shuttering are to be such as to prevent the loss of liquid from concrete. In timber shuttering the joints shall therefore, be either tongued or grooved or the joints must perfectly close and be lined with craft paper or other types of approved materials. In case of steel shuttering also the joints are to be similarly lined. If any particular material or materials be specified in the Schedule of Quantities for framework such particular specified material or materials shall be used in work. The framework shall be constructed as to remain sufficiently rigid during placing of the concrete and till the framework is struck off. All shuttering and framing must be adequately stayed and braced to the satisfaction of the PMC/Employer for properly supporting the concrete during the period of hardening. The forms shall have sufficient strength and rigidity to hold concrete and withstand the pressure of ramming and vibration and more so when the concrete is vibrated. The

surface of all forms in contact with concrete shall be clean rigid, watertight and smooth. Suitable devices shall
be used to hold corners, adjacent ends and edges of panels of other forms together in accurate alignment. The bolts must be used in place of wire ties or nails in case of mechanical vibrators are used, posts over 2.4 meters in height should be braced as per relevant method.

	Part of Form Work	Size of Form work thickness/ Cross - section
1.	a) Sheeting, beam & column sides	25 –40 mm
	b) Beam bottom	25-40 mm depends on spacing of supports spacing 1000 to 1200.
2.	a) Joists ledger	50X75 – 50X58
	b) Ballies	Not less than 100 dia at mid length and 80 at thin end

In case of ballies, the maximum spacing will be 1.2 meters center to center. Ballies shall rest squarely on wooden sole plates of 40 mm thickness and minimum beating of 0.1 sq.m.

b) The form work shall conform to the shape, lines, dimension to suit the R.C.C. members as shown in drawing and be so constructed. Framework shall be adequately designed to support the full weight of workers, fresh placed concrete without yielding settlement or deflection, and to ensure good and truly aligned concrete finish in accordance with the construction drawings. A camber in all direction of 4mm per mtr. (1 in 250) span in all slab and beam centering shall be given to all for unavoidable saffing due to compression or other causes.

c) The form work shall be so designed that the sides of the beams be first struck leaving the soffit of beams and the supporting props in position. Props shall be designed to allow accurate adjustment and to permit of their being struck without jarring the concrete.

d) Temporary openings shall be provided at the base of columns forms and at other points where necessary for facilities of cleaning and observation immediately before concrete is deposited.

e) <u>Vertical Shuttering</u>

The vertical shuttering shall be carried down the solid surface as is sufficiently strong to afford adequate support and shall remain in position until the newly constructed work is able to support itself. Props shall be securely braced against lateral deflection. Where

timber props are used like bullies, they shall be of minimum diameter of 10 cm and shall be straight and adequately strong. The spacing of such struts

shall be designed to carry loads imposed on it without undue deflection of the members supported by the props. The spacing of props shall be approved by the PMC/Employer and any alterations suggested by them shall be carried out at Contractor's expense. Branching shall be provided as directed without extra cost. The Contractor shall allow in his rates for providing props in struts for any height shown in the working drawings issued to the Contractor from time to time.

Form work for concreting of upper floor shall not be done until concrete of lower floor is set for atleast 14 days. The above limitation for framework are applicable only for spans of 4.50 meter and height upto 3.50 meter beyond which relevant designs are to be made for the same. The Contractor should keep one carpenter ready at site to keep constant watch on the props while the concreting is in progress.

Type of form work (e.g. steel or wooden) and support of form (e.g. steel or wooden) to be used must be approved by PMC/Employer.

3.B Water Tightness

It is the Contractor's responsibility to ensure that the forms are checked for water tightness before concreting operation starts and to make good any deficiencies. If instructed by the PMC/Employer building paper will have to be used without any extra charge for the same.

3.C Cleaning and Treatment of Forms

All rubbish, particularly chipping, shavings and saw dust shall be removed from the interior of the forms before the concrete is placed and framework in contact with the concrete shall be cleaned and thoroughly wet and coated with soap solution, raw linseed oil, form oil of approved manufacturer or any other approved material (such as Polythene/Polythene sheets) to prevent adhesion of concrete to framework. Soap solution for the purpose shall be prepared by dissolving yellow soap in water to get the consistency of paint. Inside surface of forms shall be thoroughly cleaned before application of any of the materials mentioned above. Release agents shall be applied strictly in accordance with manufacturer's instructions and shall not be allowed to come in contact with any reinforcement. Care shall be taken that such approved composition is kept out of contact with the reinforcements. Interior of all moulds and boxes must be thoroughly washed out with hose pipe or otherwise to be perfectly cleaned and free from all extraneous matter before disposition of concrete. Prior approval of the framework should be taken from PMC/Employer before placing reinforcement on the framework.

Re-use of shuttering shall be permitted only after the inside surface has been thoroughly cleaned in the manner described above. Contractor shall take due

approval from PMC/Employer before placing any concrete in such forms to permit him to inspect and accept the framework as to its strength alignment and general fitness, but the inspection shall not relieve the Contractor of his responsibility for safety of man, machinery, materials and for result obtained.

3.D Stripping

Form shall be left in place until their removal is authorised by the PMC/Employer and shall then be removed with care so as to avoid injury to concrete. In no circumstances shall form be struck until the concrete reaches a strength of atleast twice the stress to which the concrete may be subjected at the time of striking. The strength referred to shall be that of concrete using the same cement and aggregate with same proportion, and cured under conditions of temperature and moisture similar to these existing on the work. Where possible, the framework should be left longer as it would assist the curing.

In a slab and beam construction, sides of beam shall be stripped first, then the underside of the beam

Framework must be so designed that they can be stripped in the order required i.e. (a) shutters to vertical (non load bearing) faces e.g. column boxes, beam, sides, wall forms (b) shutters forming soffits to slabs, horizontal and inclined which carry only light load e.g. slabs, roofs, floors and canopies etc. (c) soffit shutters carrying heavy load e.g. beam and girder bottoms.

3.E Stripping Time

In normal circumstances (generally where temperatures are above 20°C and where ordinary cement is used) forms may be struck after expiry of the following periods unless otherwise directed at site by the PMC/Employer.

Location		Striking time in days	
		Ordinary Portland Cement	Pozzalana Cement
a)	Vertical slides of walls, slabs, beams and columns	2	4
b)	Bottom of slabs upto 4.5M span	7	14
c)	Bottoms of slabs above 4.5M span bottoms of beams upto 6M span	14	21
d)	Bottoms of beams over 6M span and arch rib bottoms above 6M span	21	30
For rapid-hardening cement, 3/7 of the above periods will be sufficient in all cases except vertical sides of walls, slabs, beams and columns which should be retained for a minimum period of 24 hours.			

3.F All the measurements of form work shall conform to I.S. 1200 (Part V)

3.G Form work in lifts for continuous surfaces

Where forms for continuous surface are placed in successive units, (as for example in columns or walls) the forms shall fit tightly over the completed surface so as to prevent leakage of mortar from the concrete and to maintain accurate alignment of the surface.

3.H Procedure while removing the form work

All form work shall be removed without such shock or vibration as would damage the reinforced concrete. Before the soffit where necessary in order to ascertain that the concrete has sufficiently hardened proper precautions shall be taken to all for the decrease in the rate of hardening that occurs with all cement in the cold weather.

3.I Tolerance

The following shall be the maximum permissible tolerance :-

a) On general setting out dimensions upto 4 M in length a tolerance upto 3 mm will be allowed.

b) On lengths of more than 4 M tolerance of not more than 5 mm will be allowed.

c) On the cross sectional dimensions of columns, beams, slab faces, chajja, millions, grill fins, louvers and such other member tolerance of more than 3 mm will not be allowed.

d) Columns, walls and other vertical members shall not be more than 3 mm out of plumb in their storey height and not more than 6 mm out of plumb in their full height.

e) If work is not carried out within the tolerance set out above in (a) to (d), the cost of all rectification measures of dismantling and reconstructing as decided by the PMC/Employer shall be borne by the Contractors. In case of work dismantled, the same shall not be measured and paid for.

3.J Measurements

Where it is stipulated that the form work shall be paid for separately, measurement shall be taken of the area of the area of shuttering in contact with the concrete surface. Dimensions of form work shall be measured correct to a cm. The measurements shall be accounted as stipulated in the Schedule of Items:-

a) Foundations, footings, base of columns etc. and mass concrete.

b) Walls (any thickness) including attached plasters buttresses, plinth and strip courses etc.

c) Suspended floors, roofs, landings, shelves and their supports and balconies.

d) Lintels, beams, girders, bressumers and cantilevers.

e) Columns, pillars, posts and struts.

f) Stair (excluding landings) except as in (g) below.

g) Spiral stair cases (including landing).

h) Arches

i) Well steining, and

j) Vertical and horizontal fins individually of forming hot, louvers and bands.

4. STEEL REINFORCEMENT

4.1 General

The item provided for supply fabrication and fixing of steel reinforcement bars including cutting, bending, binding with annealed binding wires and erecting in position as reinforcement in the RCC work.

4.2 Material

Reinforcement steel shall be mild steel tested quality bars conforming to IS:432 and/or high yield strength deformed bars confirming to I.S. 1786 and/or I.S. 1139 of tested quality. Grade of the steel shall be as follows :-

a) For mild steel bars – fe-250 i.e. yield stress 250N/sq.mm.

b) High yield strength deformed bars – Fe-415 i.e. yield stress of 415 N/sq. mm.

All reinforcement shall be clean and free from dirt, oil paint, grease, mild scale or loose or thick rust.

The Contractor shall produce test certificates of the manufacturers. Notwithstanding that the Contractor has produced test certificates, the PMC/Employer shall be entitled to order tests on reinforcement steel that he considers necessary and the cost of such tests shall be borne by the Contractor.

4.3 Storage

Reinforcement steel shall be stored above ground upon platforms/skids or such other supports to avoid distortion and sag. Reinforcement shall be protected as far as practicable for deterioration by direct contact or by exposures to conditions producing rust and corrosion. All bars of same size shall be stacked separately in

racks and distinctly marked.

4.4 Mild Steel Building Wire shall be of 0.91 mm diameter (20 gauge) as specified and shall conform to I.S. 280.

Black or galvanized wores may be used for binding reinforcement bars. Binding wires shall be free from rust, oil, paint, grease, loose mill scale or any other coating which will prevent adhesion of cement mortar.

4.5 Bar Bending Schedules

The Contractor shall prepare and submit to the PMC bar bending schedules in triplicate for approval, but no such approval shall relieve4 the Contractor of any of his responsibility for the reinforcement or its placing.

4.6 Binding Reinforcement

Bends, cranks and other labours on reinforcing bars shall be carefully formed in exact accordance with the Drawings or bar bending schedules; otherwise all bars shall be in accordance with I.S. 2503 and bends shall be made cold round a former having a diameter of four times the diameter of the bars. Stirrups and binders shall be bent two times radius of the bars, against which they are to be in contact. Heating of the bars for any purpose whatsoever will not be allowed.

4.7 Cover to Reinforcement

The reinforcement shall in all cases be covered with no more and no less than the minimum thickness of concrete specified or shown in the drawings. Where two bars cross, the outer should have the minimum cover and no more.

4.8 Splicing Reinforcement

Where splices or overlapping in reinforcement are required, the bars shall be provided with such splices or overlaps as are shown in the drawings/Bar bending schedules. No bars may be joined by welding unless special permission in writing has previously been given by the PMC; in applying for such permission the Contractor shall supply full details of the method he proposes to adopt.

4.9 Fixing Reinforcement

The number, size form and position of all steel reinforcing bars, ties, links, stirrups and other parts of the reinforcement shall be in exact accordance with the drawings, and such parts shall be kept in the correct positions in the forms without displacement during the process of working the concrete into place. Spacer bars, supporting stools and distance pieces to maintain the reinforcement in the correct position shall be used.

The use of timber blocks for wedging the steel off the form or mould will not be permitted.

All strength bars be fixed parallel to each other and to the sides of the forms. Any ties, links or stirrups connecting the bars shall be taut so that the bars are properly braced; the inside of their curved parts shall be in actual contact with the

bars around which they are intended to fit.

4.10 Bars shall be bound together with black annealed steel wire No. 20 S.W.G. thick and binding shall be done tight with proper piers or automatic blinders. The free ends of the binding wire shall be sent inwards.

4.11 All steel reinforcement before the concrete is deposited shall be clean and free from all loose mill scale, dust and loose rust and coating such as paint, cement, grout, etc.

4.12 No concrete shall be deposited until all form work and reinforcement has been inspected and approved by the PMC.

4.13 Measurement of Reinforcement

Reinforcement will be measured as the net calculated weight supplied and fixed in accordance with the contract documents and drawings and the rates entered in the bill of quantities shall include for all cutting and waste, short and long lengths, rolling margin, bending, fixing and the provision of all necessary spacer bars, binding wires, etc. Payment shall be made as per weight arrived at by measuring the length and multiplied by weight per meter of respective size as per Indian Standard as given below :

Diameter of bars in mm	Weight in Kilograms per meter
6	0.22
8	0.39
10	0.62
12	0.89
16	1.58
20	2.47
22	2.98
25	3.95
28	4.83
32	6.31
36	7.99
40	9.86

Places of decimals in meters and the weight payable would be worked out correct to 0.1 kg. payment will be made for approved laps in reinforcement which are shown in the drawings or on approved bar bending schedules. Payments will not be made for laps other than these.

The rates quoted by the Contractor are deemed to include the cost of binding wire and no separate payment will be made for laps other than these.

4.14 Inspection of reinforcement

No concern shall be commenced until PMCs/Employer have inspected the reinforce3ment in position and until their approval have been obtained. A notice of atleast 24 hours shall be given to the PMC/Employer by the Contractor for inspection of reinforcement. If in the opinion of the PMC/Employer any material

is not in accordance with the specification or the reinforcement is incorrectly spaced, bent or otherwise defective. The Contractor shall immediately remove such materials from the site and replaced with new and rectify any other defects in accordance with instruction of the PMC/Employer and to their entire satisfaction.

4.15 Rates quoted for reinforcement shall in addition to any factors mentioned elsewhere shall also include for

a) All cutting to length, labour in bending and cranking forming hooked ends, handling, hoisting and everything necessary to fix reinforcement in work as per drawing.

b) De-coiling, straightening (coiled bars, bent bars to facilitate transporting).

c) Cost of binding wire required as described.

d) Cost of pre-cast concrete cover blocks to maintain cover and holding reinforcement in position.

e) For fabricating and fitting reinforcement in any structural member irrespective of its location, dimensions and level.

f) Removal of rust and every other undesirable substances, using wire brush etc. as described.

g) Work at all levels

h) Stock piling of reinforcement as described

i) Cost of all wastage

j) Welding reinforcement bars whenever directed by PMC/Employer.

4.16 Cover for Reinforcement

For normal condition of exposure reinforcement shall have concrete cover and thickness of such cover (exclusive of plaster or other decorative finish) shall be as follows :-

a) At each end of a reinforcing bar, 25 mm or twice the diameter of such rod or bar, whichever is greater.

b) For longitudinal reinforcing bar in beam 25 mm or the diameter of such rod or bar, whichever is greater.

c) For tensile, compressive shear or other reinforcement in a slab 15 mm or the diameter of such reinforcement whichever is greater.

d) For reinforcement in any other member such as a lintel chajja, canopy or pardi 13 mm or the diameter of such reinforcement, whichever is greater.

e) For main reinforcement in isolated footings (side and bottom) clear cover shall be 50 mm.

f) For column bars clear cover shall be 40 mm unless otherwise specified as in drawing. In case of column of minimum dimensions of 200 mm or under the clear cover may be used as 25 mm.

g) For bars in slabs of strip footings and mat foundations the clear cover shall be 50 mm. Beam bars shall be placed over slab bars in respect of beam and slab type foundation.

5. SILVER SAND FILLING

5.1 Silver sand

It shall be clean and free from dust organic and other foreign matter.

Filling shall be done in layers not exceeding 150 thick adequately watered and consolidated. The surface of the consolidated sand shall be dressed to required level and slope.

5.2 Measurement

Volume of consolidated sand filling shall be measured. Dimensions shall be measured correct to the nearest 10 mm and cubical contents worked out to cubic meters correct to two places of decimal.

5.3 Rates to include:

a) Supplying of silver sand

b) Filling in layers with adequate consolidation

c) Dressing of surface of required level and slope

6.0 DAMP PROOF COURSE

Damp proof courses shall be 25 mm thick artificial stone (1:2:4) 1 part cement, 2 parts sand and 4 parts of 6 mm down stone chips, screened and washed. Approved waterproofing compound @3% by weight of cement should be mixed with the concrete during mixing, as per manufacturer's specification. Before laying the concrete surface shall be thoroughly cleaned of dirt, loose particles, cake mortar dropping and laitance of any kind by scrubbing with coir or steel wire trust or by hacking necessary. The surface shall be moistened before laying the concrete. The concrete should be laid, in every case, the full width of the plinth or as shown in the drawing. The top surface shall be kept rough for adhesion to the mortar for brick work. Proper curing should be done before starting the brick work over the damp poof course.

6.1 Rates quoted for D.P.C shall include

a) Concreting to the required thickness as mentioned in the schedule of item.

b) Cleaning the top of brick wall and providing checkered mark impression on the concrete surface with expanded metal or other approved device and curing.

c) All size shuttering

d) All concrete admixture and cement grouting for jointing and all dye work.

6.A PRECAST CONCRETE WORK AND PRECAST R.C.C. JALLI

6.A.1 Precast Concrete Work

The sizes of the precast units as shown in the drawings will be normally adhered to. However, during the progress of work, owing to such exigencies of circumstances as

may be decided by the PMC/Employer the sizes of the units and their method of jointing, their construction and erection may be subject to changes by the PMC/Employer for which the Contractor will not be entitled to any extra over the rates quoted for such items of work. The Contractor should quote rates to include these into account while submitting tender.

6.A.2 The rates to be affixed to the items on manufacturing and supplying precast concrete work shall include all labour and material (reinforcement measured separately) unless, otherwise, mentioned in Schedule of quantities including providing moulds/from moulds and/or form work, all surfaces and edges finished to line and level and treated with approved finish to faces, including profuse curing in curing vats provided by the Contractor, hoisting, transporting, stacking as directed and fixing in positions as per drawing and direction of the PMC/Employer. Work and the entire cost of supplying, fixing and removing from samples of precast unit should be submitted for inspection and approval by the PMC/Employer as regards texture, colour and quality.

6.A.3 Unless otherwise mentioned in Schedule of quantities (the proportion for precast concrete work shall be 1:2:4) (1 cement, 2 coarse sand, 4 aggregate).

6.A.4 Water cement ration for this class of concrete work should not exceed 0.5.

6.A.5 From/mould shall be composed of high quality timber of approved variety consisting mainly of two basic unit moulds and parameter frame as per drawing. Mould units are to be assembled with convenient device for demoulding of precast R.C.C. members.

6.A.6 Where required, joints of precast units are to be grouted with sand cement (2:1) mortar with admixture of approved waterproofing compound as per manufacturer's specification.

6.A.7 Curing of concrete units should be as prolonged as possible (not less than 21

days) but they should be allowed to dry before fixing for as long a period as possible, and should however be fixed in a green or set condition.

6.A.8 Tolerance to the dimension of precast unit should be limited to ± 0.125.

6.A.9 During installation of the precast unit in position special care should be taken to avoid the possible damage to the units and danger to workmen. Any loss, damage or injury caused to the units or workmen due to carelessness, will be the Contractors responsibility and if ordered by the PMC/Employer the damaged units are to be replaced by new units which shall be absolutely at the risk and cost of the Contractor.

6.A.10 The rates of the Contractor for the same, unless otherwise mentioned in Schedule of Quantities, shall be inclusive of supplying and casting of the concrete blocks of specified thickness, necessary form work as specified in drawings, installation of the units in position with light crane, fixing the units to adjacent units (precast or cast in situ) and supporting frame work as shown in drawing, finally to have the cement rendering of 6 mm thick cement plastering, with all other ancillary and contingent works which may arise, to have the work finished as per drawing and to the entire satisfaction of the PMC/Employer.

PRECAST R.C.C. JALLI

Specification same as 'precast concrete work'.

7. BRICK WORKS

7.1 Bricks

a) The bricks shall be first class kiln burnt bricks of regular and uniform size, shape and colour, uniformly well burnt throughout but not over burnt. They shall have rectangular faces with parallel sides and shape, straight and right edges. They shall be free from cracks or other flaws. They shall have frog of 20 mm depth on one of their flat faces.

b) They shall give a clear metallic ringing sound when struck together.

c) They shall show a fine grained, uniform, homogeneous and dense texture on fracture and be free from lumps of lime, laminations, cracks, air-holes, soluble salts causing efflorescence or other defects which may in any way impair their strength, durability, appearance or usefulness for the purpose intended. They shall not have any part under burnt. They shall not break when thrown on the ground on their flat face in a saturated condition from a height of n60 cm (about 2').

d) The size of brick shall be 250 mm x 75 mm x 125 mm. Only bricks of one standard size shall be used on one work unless specially permitted by the PMC/Employer. The following tolerance are permitted in the standard conventional size adopted on a particular work :-

Length – plus or minus 1/8" (about 3.0 mm)

Breadth – plus or minus 1/16" (about 1.5 mm)

Depth – plus or minus 1/16" (about 1.5 mm)

e) After immersion in water, absorption by weight shall not exceed 20% of the dry weight of the brick when tested according to I.S.S. No. 1077-1970. Unless otherwise specified the load to crush the brick when tested according to I.S.S. No. No. 1077-1970 shall not be less than 75 kg/sq. cm.

f) The brick to be used for the entire work shall be approved by the PMC/Employer before hand from time to time.

7.2 MORTAR

Unless otherwise specified, mortar for brick work shall be composed for 1 part of cement to 6 parts of approved sand, for walls of one brick thick (25 cm) and over, and one part of cement to 4 parts of approved sand for half brick thick and brick on edge walls. Other specification for mortar in brick work shall be as per I.S.S. No. 2116-1965.

7.3 CONSTRUCTION DETAILS

a) All bricks shall be immersed in water for 24 hours before being put into work so that they will be saturated and will not absorb water from the mortar.

b) Bats

No bats or cut bricks shall be used in the work unless absolutely necessary around irregular openings or for closures, in which case, full bricks shall be laid at corners, the bats being placed on the middle of the courses.

c) Laying

The bricks shall be laid in mortar to line, level and shapes shown on the plans, slightly pressed and thoroughly bedded in mortar and all joints shall be properly flushed and packed with mortar so that they will be completely filled with mortar and no hollows left anywhere. Bricks shall be handled carefully so as not to damage their edges. They should not be thrown from any height to the ground but should be put down gently. All courses shall be laid truly horizontal and all vertical joints made truly vertical. Vertical joints on one course and the next below should not come over one another and shall not normally be nearer than quarter of a brick length. For battered faces beading shall be at right angles to the face. Fixtures, plugs, frames etc. If any laying the courses only and not later by removal of bricks already laid.

Care shall be taken during construction to see that edges of bricks at quoins, sills, head etc. are not damaged.

The verticality of the walls and horizontality of the courses shall be checked quite often with plumb bob and spirit level respectively.

d) Bond

Unless otherwise specified, brick work shall be done in English Bond. All walls, coming in contact with reinforced concrete columns, beams etc. should be properly bonded by inserting reinforcements and extra labour shall be included in the rates (reinforcement will be measured and paid separately).

e) Joints

Joints shall not exceed 100 mm (about 3/8") in thickness and this thickness shall be uniform throughout. The joints shall be raked out not less than 10 mm (about 3/8") deep when the mortar is sill green, where pointing is to be done. When the brick surface are to be plastered, the joints shall be raked to a depth of 5 mm when the mortar is green, so as to provide good key to plaster.

f) Uniform Raising

Brick work shall be carried up regularly in all cases where the nature of work will admit, not leaving any part 60 mm. Lower than another. But where building at different levels are necessary, the bricks shall be stepped so as to give later as uniform level and effective bond. Horizontal courses should be in line and level, and face plumb or to later as shown on the plan. The rate of laying masonry may be upto a height of 80 cm (about 32") per day if cement mortar is used and 45 cm (about 18") if line mortar is used.

7.4 SCAFFOLDING

The scaffolding must be strong and rigid, stiffened with necessary cross braces and always decked and beard on the sills with closed board ceilings and swings to prevent any injury to persons or materials. The Contractor shall have to allow other trades to make reasonable use of his scaffolding as directed by the PMC/Employer for the interest of work the Contractor has to erect scaffolding in other's properties, including Laval bodies or corporation, the arrangement for the same including the cost of licensing fees, etc. shall have to be borne by the Contractor and the Employer should be kept free from any liability on this account. Put log holes shall be made good by bricks to match the face work when put logs are removed after ensuring that the holes behind are slightly filled in with 1:4:8 cement concrete.

7.5 CURING

All brick work shall be kept well watered for 14 days after laying. Where pozzalana c4ement is used for mortar the curing shall be extended by one week at Contractors expenses.

7.6 EXPOSED BRICK WORK

Where exposed brick work is specified, the usual specification for 'Brick work' as mentioned above will be applicable for 'Exposed Brick work', but in addition a special selected brick shall be used for facing, ensuring regular and clean faces of uniform colour. No bricks which are broken, chipped, wrinkled or which have irregular edges or corners shall be used. Depending on the quality of bricks and if instructed by the PMC/Employer exposed faces of every brick shall be rubbed before laying with extra charge. Wooden fillets 10 mm thick and 10 mm wide shall be placed at the edge of joints so that the mortar comes on the surface of the bricks and regular thickness of joint is maintained. The surface shall be rubbed down brushed if necessary, and thoroughly washed. No mortar shall be allowed to stick to the surface, which shall be left clean to the PMC/Employer's satisfaction with all joints, even and true to straight line. Double scaffolding shall be used for exposed brick work.

7.7 HALF BRICK WORK

Half brick thick and brick on edge walls, shall be provided with 20 swg. Wire netting reinforcement. For half brick thick wall and brick on edge wall, wire

netting shall be provided in every third course and in alternate course, respectively, according to standard practice, with galvanized staples. Wire netting for the purpose shall be 40 mm mesh made of 20 swg. black soft iron wire.

7.8 RATES TO INCLUDE

Apart from other factors mentioned elsewhere in this contract, the rates for items of brick work shall be include for the following :-

a) All labour, materials, use of tools, equipment and other items incidental to the satisfactory completion of brick masonry at all heights and levels with all leads and lifts.

b) Erecting and removing of all scaffolding, ladders and plant required for the execution of the work to the height and depth and shapes as shown on the plan, PMC/Employer and maintaining the scaffolding till the surface finishing work are completed, including the extra labour and materials for using cut bricks in the construction of wall of varying thickness other than one brick, one and half bricks, half brick and brick on edge walls, as per drawings and inclusive of all necessary bye work.

c) Constructing brick work through to lines, levels, batters, pillars, curve, projection, cutting, tooting, etc. in strict conformity with the drawings and to any position or shape, to any heights or levels, including racking out joints and housing frames, fixtures, etc. and of all materials.

d) Curing brick work at all heights, depths and levels.

e) Extra labour, materials and bye work for bending brick work to R.C. work as specified.

f) Removing of all stains and adhering mortar lumps on the brick work surface.

g) Cost of reinforcement in half brick walls and brick on edge walls.

h) Raking out joints for receiving plaster as specified.

i) Providing forming and or cutting grooves, chases, channel holes/openings for Electrical, Air-conditioning, plumbing and drainage work wherever required, even though they may not be shown in the drawing, including mending the damages to the required finish of the adjoining surface after completion of the above mentioned work,

including scaffolding, additional shuttering, providing additional reinforcement/fixtures, welding in position, plastering, curing, etc. as directed and to the entire satisfaction of the PMC/Employer.

7.9 MEASUREMENTS

a) Half brick thick and brick on edge walls shall be measured in sqm. unless otherwise mentioned.

b) One brick wall and thicker walls shall be measured cum brick walls upto and including 3 brick in thickness should be measured in multiples of half bricks which shall be deemed to be inclusive of mortar joints. Width more than three bricks in walls will be measured actually and limited to the width specified.

c) No deduction or addition shall be made on any account for :-

   i) Ends of dissimilar materials (i.e. joists, beams, lintels, posts, girders, rafters purloins, trusses, corbels, steps, etc.) upto 500 sq.m. in section.

d) For details of measurements not mentioned elsewhere in the contract, the method of measurement should be as per relevant I.S. code.

7.10 BRICK FLAT SOLING

For soling the bricks shall be first class picked jhama of approved sound, hard, tough, durable, dense, clean, free from soft spots, cracks, decay and other defects. Brick bats shall not be used. All the fillings shall be watered and compacted to get maximum consolidation. All necessary trimming or filling for laying of the soling in line and required grade shall be done.

The sub-grade shall be marked by tacks and strings for required depth for laying of soling. The cushioning will also consist of local sand.

The bricks shall be laid on flat (unless otherwise specified) touching each other. Brick shall be laid in parallel rows, breaking bond or in-herring bone bond pattern as directed and firmly embedded, true to line and filled with local sand. Measurement shall be in sq.m.

CEMENT PLASTER (INTERNAL & EXTERNAL)

a) Preparation of surface

The walls to be plastered shall have all joints raked out to a depth of 10 mm. If not already done, R.C.C. surface shall be properly backed to get good key to the plaster. All dust and oily and extraneous matter, if any, shall be wire brushed and cleaned and the surface to be plastered shall be kept wet for 6 hours before plastering is commenced.

b) Proportion of Mortar

Unless otherwise mentioned, the proportion for walls, lintels and column plaster shall be done with cement mortar consisting of one part cement and six parts of sand by volume. In the case of ceiling, ceiling beams, projected slabs, sills, chajja, marquise domes etc. the mortar should be mixed in the proportion 1:4 (1 part cement and 4 parts sand) and shall be as per I.S. 1542-1960 as applicable to wall and ceiling plastering. Rough cast plaster shall consist of two coats – under layer of 1:5

cement plaster and top layer of 1:3 no more cement mortar shall be prepared than can be used within half an hours.

c) Application of Plaster

The mortar shall be applied evenly with force on the surface to be plastered. The cement plaster finished rough with sponge mortar surface shall be finished at once by being rubbed over with a trowel till the cement appears on the surface. All corners, angles and junctions shall be truly vertical and horizontal as the case may be and carefully and neatly finished. Rounding off corners and junctions, where required shall be done without extra charge. The mortar shall adhere to the surface intimately when set and there should be no hollow sound when struck. The thickness of plaster

shall be minimum of 12 mm. Over the proudest part of the surface, of interior brick wall and R.C.C. surface and 19 mm over stone walls and for external brick walls, plaster for ceiling, projected slab, walls, chajja, marquis, domes, exposed surface of beam, etc. it shall be 6 mm thick.

d) When neat cement finish is specified over the plaster surface, a coat of pure portland cement slurry, 13 mm thick shall be applied and well rubbed to the plastered surface while the plaster surface is till fresh. Top layer for rough cast plaster shall be of 6 mm thickness and of cement plaster 1:3 (1 cement : 3 coarse sand) finished rough with sponge.

e) When no finish is specified, the plastered surface shall rub in well to an even plain with a wooden float for external surface and finished smooth with a steel trowel for internal surface.

f) When thickness of the plaster is more than 12 mm thick the surface will be plastered in two operation. For rough cast plaster, 18 mm thick shall consist of two coats under layer 12 mm thick and top layer 6 mm thick and finished rough.

g) Scaffolding

Scaffolding shall be rigidly tied and strong and stout to cater the safety requirements and shall be double or single according to requirements.

h) Rates to include

Apart from other factors mentioned elsewhere in the contract rates for the item of plaster shall include for the following :

i) Erecting, strong and stout, double or single scaffolding including maintaining the same, dismantling and removing the scaffolding.

ii) Preparing the surface to receive the plaster.

iii) Providing cement plaster with screened sand, of the specified average thickness to the required finish, line and level, at all heights, with all lead and lift and adopting all safety measures.

iv) All labour, materials, use of tools, consumables and equipment required to complete the plastering as per specification.

v) Curing for seven days.

vi) Any moulding work if shown on the drawing or as specified unless separately provided in the tender.

vii) Labour for plastering the surface in two operations when thickness of plaster is more than 12 mm thick.

viii) Plaster work in bends, jambs, sills, crises, rounded angles, fair edges, narrow returns, quarks, 'V' joints splays, drip mouldings, making good to metal frame, junctions with skirting or dados, narrow openings, holes, conduits, timber, sills, holes, sill brackets, railings, etc. and making good all damages after all the sub-contractors or nominated sub-contractors have done their work.

ix) Neat cement finish when specified in the item.

h) Mode of Measurement

Plaster shall be measured in square meter.

i) Walls

The measurement of wall plastering shall be taken between the walls or partitions (the dimensions before plastering shall be taken) for the lengths, and from the top of floor or skirting to the ceiling for the height.

7.11 SURFACE DRAINS

Surface drains are to be as follows and are to be completed in all respects with foundation works and finishing as described :

a) 125 mm (5") or 250 (10") thick brick in cement mortar on wall side or as per drawing.

b) 250 mm (10") thick brick in cement mortar on outer side.

c) Bed of one brick flat soling and 100 mm (4") cement

d) Channel of 250 mm (10") finished with overall width 662 mm (26.1/2") laid to proper gradient with a minimum of 75 mm (3") in depth to invert at the starting point to finished with 20 mm cement plaster (1:3) finished smooth with angles rounded off. Unless otherwise shown in drawing the gradient shall be 1 in 200. However, this gradient has to be finally corrected to suit the site requirement.

e) Excavation to suit the gradient of drain and site requirement.

8.F ARTIFICIAL STONE FLOORING, DADO & SKIRTING

8.F.1 ARTIFICIAL STONE FLOORING

a) Preparation of Sub-grade

The surface of the structural slab shall be struck of reasonably true and at level 40 mm or as specified below the level of finished floor. All water, latencies or dirt on the surface of the structural slab shall be removed before the base course is laid. The slope required should be provided in the concrete of the structural slab as far as possible or the base course in order to obtain uniform thickness of artificial stone towards the predetermined positions of outlets. Unless otherwise mentioned in the drawing slopes to the extent of 1 in 120 for office space and 1 in 60 to 80 for toilets and bathroom, verandah and kitchen shall be provided.

b) Base course

The mix for the base of the artificial stone shall be 1 part of portland cement, 2 parts of fine aggregate and 4 parts of coarse aggregate by volume. The stone ships for the base course should be 6 mm and down and should be properly screened and washed before use. This nominal mix may be slightly varied, depending upon local conditions and mark of concrete as the PMC/Employer may direct. No more than 27,1/2 litres (5.1/2 gallons) of mixing water, including the moisture in the aggregate, shall be used for each bag of portland cement in the mixture. The concrete shall be of the driest consistency possible to work with sowing motion of the strike-off board or straight edge. Changes in consistency shall be obtained by adjusting the proportions of aggregate and cement. In case should the specified amount of water exceed, the base course shall have a maximum thickness of 16 mm and 28 mm for 25 mm and 40 mm finished flooring, respectively. The base course shall be laid as per I.S. 2571-1970.

c) Sectors

Artificial stone flooring shall be laid in sections not exceeding 4 sqm with a maximum length of 2.5 M, in squares or rectangles, flooring of the panels dying diagonally shall be completed first. The edges of the 50 mm wide oiled wooden batten of the finished floor thickness. Immediately before the placing of the concrete the sub-base will be given a coat of neat cement grouting.

d) Top Layer

After striking off the base course to the required slopes, it shall be compacted with a wooden float. The surface shall be tested with straight edges to detect high and low spots which shall be rectified before the concrete of the base course has hardened. Top layer having sufficient skin thickness for polishing (not less than finished thickness of 6 mm) shall be

laid when the base course is still green but firm enough to receive the top layer. The mix for this course shall be 1 part of Portland cement and 2 parts of 3 mm and down, cleaned and washed, fine stone chips. The concrete shall be of dry consistency as possible. The top layer shall be laid as per I.S. 2571-1970.

This top coat of the wearing coat should then be thoroughly worked so that slurry water just comes to the surface. This should then be allowed to dry out. No dry cement or mixture of dry cement and sand shall be sprinkled directly on the surface to absorb moisture or hasten the hardening. When the water dries the whole surface should be rubbed smooth using English trowel with neat cement punning of sufficient thickness (not below 3 mm) using not less than 2.2 kg of cement per square meter area of flooring for allowing of being cut down with polishing stone and then rubbed with fine cloth (polishing cloth preferable) and the whole thing left undisturbed for 10 to 12 hours. After this period a minimum period of 14 days.

When working on alternate day principle, the pounding of flooring should be deferred till the whole floor is complete. But the portions already completed should be occasionally damped with water, moist sand spread over the surface, till the whole floor is complete. After this the whole floor will be flooded with water, etc. For coloured finish a suitable colour admixture shall be added on top of cement finishing coat. The quality of colouring matter to be added to cement should be in the proportion of one part of pigment to 3 parts of Portland cement mixed thoroughly and screened before making a paste. The pigment shall be of approved manufactured and tints shall be uniform. Any cracks, rust disfiguration or discolouring of surface shall have to be made good without any extra charges, to the satisfaction of the PMC/Employer.

In every case of artificial stone flooring and skirting the Contractor should quote the rates considering for allowances in the top layer being cut down with polishing stone (after polishing to the specified thickness as in thew schedule of quantities, have been reached) no matter whether polishing is done by the Contractor or not.

e) The polishing shall be done by expert trained labourers only. Where desired, all internal angles are to be covered without any extra cost. The polishing shall not be done before proper maturing, which takes about 2 months. Polishing shall be done by wet rubbing down with three approved grades of carborandum and pumic stone. When the floor is perfectly smooth, even and dry it will be rubbed with fine lines or chamois leather after applying wax polish on the surface.

f) <u>Rate to include</u>

Apart from other factors mentioned elsewhere in this contract the rates quoted for 'Artificial stone flooring' shall include the following:

i) Preparing/treating the sub-base course of bearing structural slab surface to the required line, level and slopes.

ii) All labour, materials and equipment, consumables, cleaning the sub- grade, laying base course and top layer to have finished 40 mm thick flooring or specified thickness and configuration (after the high polishing) as per above specifications and all dye work for achieving the required surface finish.

iii) Curing

iv) High polishing

v) Cleaning the floor from all stains etc.

vi) Forming curves at junctions of walls and rounding or nosing at the edges including cutting and or making holes or openings, wherever required and neatly finishing with adjoining surface finish.

vii) Work at all positions, heights, depths, line and level with all lead and lift.

Mode of Measurement

The measurement shall be in square meters for the actual flooring provided.

8.F.2 ARTIFICIAL STONE DADO AND SKIRTING

i) The specification for materials and workmanship will be same as that of Artificial stone flooring except that the finished thickness of dado and skirting will be 20 mm. The thickness of base course and top layer will be adjusted accordingly, in order to have a finished thickness of 20 mm after polishing. The rate quoted for same shall include for all the stages as mentioned in case of flooring over and above that it shall be truly in plump and perfectly in line or curve as shown in drawing and or as directed and curing done with appropriate device and for the finished thickness of 20 mm. Dado and skirting shall be measured in square meter. The measuring of skirting or dado shall be on the basis of wall length of area in contract with skirting and the dado respectively.

ii) Rate to include

Apart from other factors mentioned elsewhere in this contract the rate quoted for 'Artificial stone dado and skirting' shall include for the following:

a) Preparing/treating the sub-base course or bearing structural slab surface to the required line, level and slope.

b) All labour, materials and equipment, consumables, cleaning the sub-grade, laying base course and top layer to have finish 25 mm

thick floor or specified thickness and configuration (after the high polishing) as per above specification and all dye work for achieving

the required surface finish.

c) Curing

d) Cleaning the floor from all stains, etc

e) High polishing

f) Forming curves at junctions of walls and pounding or nosing at the edges including cutting or making holes or openings wherever required and neatly finishing with adjoining surface finish.

g) Work at all positions, heights, depths, line and level with all lead and lift.

8.G ARTIFICIAL STONE FLOORING WITH HARDENER

a) Metallic hardening compound

The compound shall be of approved manufacturer and quality consisting of uniformly graded iron particles, free from non-ferrous metal particles, oil, grease, sand and soluble alkaline compounds where so directed by the PMC the actual sample shall be tested as per standard practice.

b) The surface of the structural slab shall be struck of reasonably and at a level of 40 mm or 65 mm or as specified below the level of finished floor. All water latencies or dirt on the surface of the structural slab shall be removed before the base course is laid. The slope required should be provided in the concrete of the structural slab to obtain uniform thickness of Artificial stone towards the predetermined positions of outlets.

c) The mix fore the base of the artificial stone shall be one part of Portland cement, 2 parts of fine aggregate and 4 parts of course aggregate by volume. The stone chips for the base course should be 12 mm and down and should be properly cleaned and washed before use. This nominal mix may be slightly varied, depending upon local conditions and mark of concrete and as the PMC may direct. Not more than 27.1/2 liters (5.1/2 gallons) of mixing water, including the moisture of the aggregate, shall be used for each bag of Portland cement

in the mixture. The concrete shall be of the driest consistency possible to work with a sowing motion of the strike off board straight edge. Changes of consistency shall be obtained by adjusting the proportion of aggregate and cement. In no case the specified amount of water exceed. The base course shall have maximum thickness of 30 mm for 400 mm finished flooring and 55 mm for 65 mm thick finished flooring.

d) Sectors

Artificial stone flooring shall be laid in sections not exceeding 6 sq.m. (with a maximum length of 2.5 M) in squares or rectangles. Flooring of the panel

laying diagonally shall be completed first. The edges of the panels to be concreted shall be bounded by about50 mm wide oiled wooden batons of the finished floor thickness. Immediately before the placing of the concrete, the sub-base will be given a coat of neat cement grouting.

e) Topping

This shall consist of 10 mm thick maximum layer as specified of mix 1:2 (1 cement : 2 stone aggregate of 6 mm nominal size) by volume or as specified with which metallic hardening compound is mixed in the ratio of 1:4 (1 metallic concrete hardener : 4 cement) used by weight. Concrete hardener shall be dry mixed thoroughly with cement on a clean dry pacca platform. This dry mixture shall be mixed with stone aggregate 6 mm nominal size or as otherwise specified in the ratio of 1 : 2 (1 cement, 2 stone aggregate) by volume and uniformly mixed in a mixer machine and turned over. Just enough water shall then be added to this dry mix as required for floor, concrete.

The mixture so obtained shall be laid in 10 mm or of specified thickness of cement concrete floor within 2 to 4 hours of laying of the base course. The topping shall be laid true in line and level and slope to provide a uniform and even surface. It shall be firmly pressed into the bottom concrete so as to have good bond with it. After the initial set as started, the surface shall be finished smooth and true to slope with seal floats. Wherever necessary the top surface shall have checkered mark treatment.

The junction of floor with wall plaster, dado or skirting and the finishing operations. Shall be dealt with as described earlier.

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

The specification for 'curing', 'precaution', 'measurements' and 'rates' shall be as described under 8.F.

f) Curing

The floor shall be kept continuously moist for at least 14 days by means of wet gunny bags, 50 mm thick layer of damp sand spread over the surface or pooling with water on the surface.

g) Rates to include

Apart from other factors mentioned elsewhere in this contract the rate quoted for 'Artificial stone flooring with hardener' shall include the following:-

i) All labour, materials and equipment, cleaning the sub-base, laying base course and top layer with hardener, polishing etc. complete.

ii) Preparing/treating the sub-base course of bearing structural

slab surface to the required line, level and slopes.

iii) All labour, materials and equipment, consumables, cleaning the sub- grade, laying base course and top layer to have finished 40 mm thick flooring or specified thickness and configuration (after the high polishing) as per above specifications and all dye work for achieving the required surface finish.

iv) Curing

v) High polishing

vi) Cleaning the floor from all stains etc.

vii) Forming curves at junctions of walls and rounding or nosing at the edges including cutting and or making holes or openings, wherever required and neatly finishing with adjoining surface finish.

viii) Work at all positions, heights, depths, line and level with all lead and lift.

SOIL TREATMENT (ANTITERMITE TREATMENT)

Soil Treatment shall conform to the following specification:-

Pre-construction antitermite treatment shall be done with Chloropyriphos 20%E.C manufactured by any approved manufacturer as per IS: 6313 1981 Part II & III of Bureau Of Indian standards.
To make 1% solution of Chlorophyriphos 20% EC.

i)Mix 1 lit of the chemical in 19 ltr. of water.

ii) For wood treatment mix 1 ltr. of the chemical in 19 ltr. of kerocine oil.

The tender shall clearly indicate along with his quotation the chemical he proposed to use. A daily record shall be maintained by the Contractor indicating the amount of work done and the quantity of chemical consumed for the work. This record book shall be the property of the Employer.

Method of application

The following paragraphs specify the manner and sequence of operation, which must be followed. They also indicate the rates of application of chemicals of stated concentration for various operation. It shall be distinctly understood that these represent the minimum rates of application for each operation and that the Contractor shall actually apply chemicals at rates higher than those specified herein to the extent he may consider them necessary for effectiveness during the 10 years guarantee period. In other work the onus of responsibility of applying adequate amount of chemicals as required to sustain the 10 years guarantee shall be that of the Contractor, but in no case shall actual rates of application be less than these specified herein.

i)The bottom and sides of foundation pits shall be trated to a height of 300 mm at the
rate OF 5 Litres of 1% solution of chemical in water per square metre.

ii)The refill rearth shall be treated at the rate of 5 litres of 1% solution of the chemical in water per linear metre on both sides of built up walls.

iii)Before laying the floor, the top surface of the consolidated earth within the plinth wall shall be treated at the rate of 5 litres of 1% solution of the chemical in water per square metre. It is advisable to make 20mm dia 500mm deep holes at the rate of 300 mm c/c before pouring the chemical.

iv)After completion of the building the 300mm of earth along the external perimeter of the building shall be treated at the rate of 5 litres of 1% solution of the chemical in water per square metre.

v) All timber faces in contact with masonary work as in door frames shall be brushed twice with 1% solution of the chemical in kerocine oil.

vi)Treatment shall not be made when the soil or fill is excessively wet or immediately after heavy rains to avoid surface flow of the toxicant from application site. Unless the treated areas are to be immediately covered, precautions shall be taken to prevent disturbance of the treatment by human or animal contact with the treated soil.

Guarantee: 10 years.

In the unlikely event of any treatment becoming necessary subsequently during the guarantee period, required inspection and treatment shall be carried out free of cost. The Contractor shall submit an undertaking to the Employer, on a stamp paper, duly notarised, to carry out such repairs as and when required.

Instruction to Contractors for Quotation Rates

The tenderer should include in his rates given in schedule of quantities in sq.m. area all the stages of treatment to bottom of foundation, sides of trenches, underside of the floor, underside/damp proof course, in the outer face of external wall upto window sill level, door and window frames to ground floor area. Which comes in contact with the brick wall and finally the trenches treatment all round the buildings as per detailed specification mentioned above.

Where the rate of application of the insecticide, has not been specified clearly the rates should be governed to that during the guarantee period no trouble may arise. Payment will be made on the plinth area measurement mentioned above and no extra on this account will be entertained.

9. GLAZED TILES DADO AND CERAMIC TILES ON ROOF

a. Tiles: Glazed or coloured, plain or with design glossy and mat finish of size (4"X 8") tiles including specials shall be of approved make and quality shall have a gloss or mat unfading stable finish of uniform colour fine grained in texture dense and homogenous free from flaws and defects and shall conform to I. S. 777-1961 in all respects. Samples of tiles shall be got approved by the Employer/ PMC, who will keep them in his office for verification as to whether the materials bought, used conform to the approved samples.

b. Fixing Dado tiles: Dado work shall be done only after fixing tiles on the floor or flooring laid in situ. Tile fixing adhesive of approved make to be coated on the plastered surface as per manufacturers specification before fixing the tiles. The fixing shall be done from bottom of wall upwards without any hollows in the joints. Each tile shall be fixed as close as possible to the one adjoining tile so that all tiles faces are in one vertical line. The joints between the tiles shall be filled with non-staining white cement/ white cement mixed with pigment for coloured tiles and shall not exceed 1.5 mm in width.

c. Cleaning: After the tiles have been fixed the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. After the complete curing, the dado or skirting work shall be washed and thoroughly cleaned.

   (i) Cleaning for unglazed tiles at roof: After the tiles have been fixed, the surplus grout that may have come out of the joints shall be cleaned and raked off the joints before it sets. After complete curing the joint shall be sealed with epoxy or polysulphide as per the instructions of manufacturers. Before using the sealing material the same shall be approved by Employer/ PMC.

d. Rates to include: Apart from other factors mentioned elsewhere in this contract, the rates for the items of dado or skirting shall include the following:

   (i) Preparing/treating the surface of the base or structural member surface to the required line level or slope to the specified configuration with all by-works.

   (ii) Backing mortar.

   (iii) Providing and fixing tiles including all specials like round edges, angles, cappings, etc. in neat cement float over backing mortar, including cutting of tiles and wastage of tiles etc.

   (iv) Jointing of the tiles with white cement or white cement mixed with pigment slurry (white cement and pigment to be provided by the contractor).

   (v) Curing.

   (vi) Cleaning the dado/ skirting surface and flooring from all stains and removal of all debris.

   (vii) All labour, materials, use of tools and equipments and consumables for

carrying out the items as specified above including all by-works for achieving the required surface finish.

(viii) Forming coves at junctions of wall and rounding or nosing at the edges, including cutting or making holes in tiles for providing, opening in walls wherever required and finishing with adjoining surface.

(ix) Work at all positions, heights, depths line and level with all lead and lift.

(x) Cost of Epoxy or Poly-sulphide & all labour, tools tackles at any height for sealing purpose (for un- qlazed ceramic tiles at roof).

f) Mode of Measurements: Dado land ceramic tiles on roof shall be measured in square metres as provided.

10. STEEL DOORS, WINDOWS , VENTILATORS, GRILLS, RAILINGS & GATES.

I.S. SPECIFICATION:

Unless otherwise stated the Indian Standard Specification applicable for steel doors, windows and ventilators shall be IS: 1038-1968- "Specification for steel doors, windows and ventilators" and IS: 1361, as appropriate and as shown in drawing.

OPENING:

All the windows and ventilator shutters should open outside unless otherwise specified.

FLASH WELDING

Both the fixed and opening frames of the doors, windows and ventilators shall be formed by cutting section to required lengths, and metres. The corners shall be electrically flash welded. Sash bars of the units shall be tenoned and revetted into the frames. Slote shall be cut in the fixed frames and the hinges shall be inserted inside and welded to frames.

HANDLES, PEGSTAYS ETC.

Each side-hung shutter shall be provided with suitable protruding hinges and pegstay arms, 300 mm (12") long and shall have holes to keep the shutter open in three different positions upto 90. (The peg and the arm for the pegstay shall be reverted). The handle shall be mounted on a handle plate and the plate shall be welded to the opening frame. The handle shall have two-point nose, which will engage with suitable tapered striking plate provided on the fixed frame to keep the shutter open in a slightly open position as well as in a gast position.

TOP/BOTTOM HUNG VENTILATORS :

Top hung and bottom hung ventilators shall be provided with two plain hinges, with 300 mm (12") pegstay arms, which will keep the shutter open in three different positions and will act a stopper too.

CENTRE HUNG VENTILATORS:

Centre hung ventilators shall be made with two puter frames with mastic waterproof compound embedded between these two outer frames. They shall also be provided with a spring catch which when pulled by a cord, the upper half shall open inside and the lower half shall open out.

BEADING:

Where metal beading is specified in the drawing or elsewhere or the glazing, the contractor should provide windows with threaded holes for fixing 9 the beading with screws.

SAMPLES OF WINDOWS:

A typical approved sample window for each building should be kept in the office of the PMC/ Employer until the satisfactory completion of the building. All windows and ventilators supplied and fixed at site should be of the same quality as of the approved sample; otherwise they shall be rejected.

The decision of the PMC/Employer or their authorised representatives on whether window or ventilator compares well with the approved sample shall be final and binding on the contractor.

APPROVAL OF PMC /EMPLOYER:

All windows and ventilators are subject to the approval of the PMC/Employer and they shall be strictly in accordance with the specification without any bends, dents, etc.

AS PER DRAWINGS:

All windows and ventilators shall be manufactured as per drawings supplied to the contractor.

FIXING TO BRICK WORK/ CONCRETE:

Steel windows and ventilators shall be fixed to brick work by means of standard M.S. lugs of size 160 x 160 x 16 x 3 mm and to concrete work by means of 125 mm long counter sunk screws with sawl plugs of other approved fastener after drilling into concrete with a power drill. Steel windows/ ventilators, etc. shall be fixed as per manufacturer's recommendations or I. S. specifications. Holdfaster shall be grouted in concrete (112:4) mix of dimensions as directed. Quoted rates shall cover for all these factors.

STRUCTURAL SUFFICIENCY OF WINDOWS:

All windows, doors and ventilators shall be manufactured from a standard extruded sections of approved, appropriate sizes suitable for the particular type and size of the windows, etc. details shape drawings indicating the full design of every type of windows and ventilators shall be furnished in duplicate, for approval before undertaking the work. Contractor shall assume full responsibility regarding soundness of the windows, doors

and ventilators and adequacy of the sections used for the particular sizes required to provide appropriate stiffness and strength. If, in the opinion of the PMC/Employer the sections used are found to be deficient, the contractor shall replace the windows, ventilators, etc. at his expenses by these made from approved sections.

IMPORT LICENCE:

No import licence shall be made available for obtaining any material not available in India.

ALL TYPES OF WINDOWS:

Rates quoted for steel windows and ventilators shall cover for all types of windows and ventilators whether of standard sizes of purpose made. Where composite or continuous windows over long lengths (in plan) are required rates shall cover for mullions, transoms, at vertical or horizontal junctions of approved design and rates should also cover for partly fixed and partly openable type of continuous windows shutters of any type like side hung, centre hung, top hung etc. as per detailed drawings.

GLAZING:

Unless otherwise mentioned the whole of the Glass shall be of 4 mm thick/sheet glass and free from speck, waves, bubbles and other imperfections. The glazing shall be fixed with beads or bedded and packed and puttied with approved quality putty suitable for use in tropical countries. Putty for glazing to wood work shall be the best oil putty. In case of metal windows it shall be special gildpaise putty. The glass should be of approved quality obtained from approved manufacturer. Prior to placement of order the sample for all glasses to be used will have to be approved by the PMC/ Employer as regards their thickness, quality and tint, etc. and the same should be kept in the office of the PMC/Employer. The quality of all the glasses used in the site should conform with the approved one or otherwise the PMC/Employer will be at liberty to reject the same for which no claim shall be entertained. On completion of the works the general building contractor shall clean and wash all the glass and leave the same perfectly clean. The details of fixing of glasses shall be as specified in the drawings and or as directed by the PMC/ Employer.

RATES TO COVER:

Unless otherwise stated, contractors rate for steel windows, ventilators, shall apart from any other factors mentioned elsewhere in this contract, include for providing and fixing the following:

a) Window/ventilator frames and shutters with hinges as described.
b) M. S. hold fasts or lugs as specified projecting 100 mm x 16 mm x 3 mm in the position and as per design and I. S. specification or where fixed to concrete 125 mm long countersunk screws with rawl plugs or other approved fasteners.
c) Rolled steel mullions.
d) Transomes with projected weather bars for side hung shuttering and plain ones for fixed windows.
e) Aluminium beading with screws of specified.
f) Bolts, nuts, screws.

g) Manganese brass handle and pegstays
h) Manganese brass spring catches.
i) Cords for centre hung windows.
j) 4 mm thick wired steel glass with beads or putty etc. as described.
k) Grouting of holdfasts in 1:2:4 concrete.
l) Replacement of cracked/damaged/broken glass by new glass.

MEASUREMENT:

Measurement shall be square metre.

11. M. S. GRILLS, RAILING & GATES:

M. S Grills, railings and gates shall be fabricated and fixed in position strictly as per design and drawings. All intersections or meetings of all members shall be welded and workmanship shall be of a high quality to the entire satisfaction of the PMC/ Employer. After fixing in position, these shall be cleaned off dust, dirt, rust or scales and rubbed with emery and an anticorrosive prining coat with red lead shall applied. The rate for M. S. grills to window shall also include the cost of wooden screws to be used for fixing, for M. S. railings for the cost of 1:2:4 cement concrete for jamming, for the hold fasts of the railing etc. The rates are for the complete work in all respects. No escalation in price of steel casement consequent to an order from Government, the H. P. C. Steel manufacturers, distributors etc. or for any other reasons whatsoever, shall be entertained.

12. COLLAPSIBLE GATE:

Collapsible gate will be of approved manufacturer. The rate should include the cost of rails, runners, channels including locking and hanging arrangements. It will be fitted and fixed in position with lugs set in cement concrete and including cutting necessary holes, chasing etc. in all floors etc. and making good damages including one coat of black japan painting, red lead shop primer and two coats of approved aluminium paint, complete. The rate shall be inclusive of all these operations unless otherwise mentioned in the Schedule of Quantities.

13. ROLLING SHUTTERS

GENERAL

The shutters shall conform to specifications given in I. S. 6248-1971. Rolling shutters shall be supplied in the following alternative types or as specified in Schedule of Quantities. The shutters shall be complete with accessories. The fixing arrangement shall be as per the drawing with regard to whether it shall be fixed on the inside or outside between jambs of opening, on or below the lintel, etc.

a) Self-ceiling type (push and pull type or manually operated type). It shall be used up to a maximum of about 8 sqm. clear area without ball bearings and up to area of about 12 sqm. with ball bearings.
b) Gear operated type (Mechanical type): It shall be fitted with ball bearings. It shall be used up to a maximum of about 25 sqm. clear area, if the rolling shutter is operated

by a bevel gear box and crank handle and up to a maximum of about 35 sqm. clear

area, if the rolling shutter is operated by chain wheel and hand chain mounted directly on the work shaft.

Shutter shall be constructed with interlocking lath sections formed from cold rolled steel strips not less than 0.9 mm thick and 80 mm wide for shutters up to 3.5 mm width and not less than 1.25 mm thick and 80 mm wide for shutters more than 2.5 mm in width and above, unless otherwise specified.

The guide channels shall be of mild steel, deep channel section and of rolled pressed or build up (fabricated) joint-less construction. The thickness of sheet used shall not be less than 3.15 mm.

Hood covers shall be made of mild steel sheets not less than 0.90 mm thick. For shutters having a width of 3.5 m and above, the thickness of M. S. sheet for the hood cover shall not be less than 1.25 mm.

14. WOOD WORK AND JOINERY

TIMBER:

i. Unless otherwise specified, all timber for frames and shutters for doors, windows, ventilators, cupboards, etc. shall be first class, sound, well seasoned, C. P. or other equivalent and approved teak and shall be free from knots, shakes, fissures, flaws, sub-cracks and other defects. The planned surface shall be smooth and free from blemishes and discolourations.
ii. All timber for carpentry and joinery in touch with masonry or concrete shall be creosoted before fixing.
iii. All full fabricated timber shall be air seasoned on site of work for a period of not less than two months to allow for any shrinkage that may take place. The preparation of timber for joinery is to commence simultaneously with beginning of the project work
iv. and should generally proceed continuously until all the wood work is prepared and fixed/stacked on or near the site as the case may be.
v. Each member of all frames, transoms, mullions, etc. of doors and windows shall be made out of single piece to timber only.
vi. Unless otherwise specified, all joints shall be through tennoned having thickness not less than 1.25 cm and close fitted truly and fully without filling into the mortise of the adjoining member of the frame to the full width 'of the latter and pinned with corrosion resisting metal pins or wooden dowels not less than 8 mm and 10 mm respectively, as approved by the PMC/Employer. The surfaces in contact with tennon and mortises shall be treated with an approved adhesive before joining together.
vii. Door and window frames shall be held and ensured square and flat at the time of delivery and while fitting and fixing in position, shrinkage if any in any direction shall not impair the appearance and strength of the finished work.

HOLD FASTS:

Three holdfasts shall be fixed to each post of the door frame The M. S. holdfasts shall be of the size 35 cm/25 cm x 40 mm x 6 mm or as required at site and shall be fixed to the

frames by means of screws and not nails. The other end of the holdfast shall be fixed

into jambs with 1:2:4 P. C. C. with 10 mm down graded stone ships of dimensions as directed. Ends of holdfasts will be fish tailed.

Whenever asked for, metal fastener or bolts as directed shall be used for rough grounds, framing hangers, etc.

The rates quoted for woodwork and joinery shall exclude the cost for holdfasts for doors and windows and ventilators (Horns for frame shall be cut and shall not be used as holdfasts).

The item of holdfast, for doors windows and ventilators shall be paid as a separate item as described in Schedule of Quantities. The rate for holdfast shall include for cement grouting and fixing to framework with screws etc. The cost for other metal fasteners shall include for nuts etc. and should be inclusive in the rates of items of work required to be fixed (composite item).

WORKMANSHIP AND CONSTRUCTORS:

i. The workmanship shall be first class and to the approval of the PMC/ Employer. Scantlings and boarding shall be accurately sawn and shall be of required finished width and thickness. All carpenters' work shall be wrought except where otherwise described. The workmanship and joinery shall be accurately set out in strict conformity according with the drawings and shall be framed together and securely fixed in approved manner and with properly made joints. All work is to be properly tennoned, shouldered, wedged, pinned, braced, etc. and properly glued with approved quality glue to the satisfaction of the PMC/ Employer.

ii. Screws:
Unless otherwise specified all screws to be used in woodwork and joinery shall be G. I. and of approved quality and manufacture. The size (diameter and length) should conform to those specified in hardware schedule.

iii. Tolerance:
1.5 nun (1/16 ") tolerance will be allowed for each wrought face of sizes specified except where described as finished in which case they shall hold to the full dimensions.

iv. Protection:
All edges of timber frames etc. shall be protected from being damaged during construction by providing rough timber casing securely fixed and other adequate protective measures.

v. If it is decided by the Employer to provide anti-termite treatment, the building contractor shall co-ordinate his work suitably as directed by the PMC/Employer.

vi. Door/windows frames shall have cut rebate. Planted rebates shall not be permitted.

vii. Where door frames are fixed flush with plaster to wall teak wood cover mould 40 mm x 12 mm specified as per drawings shall be provided all round where the plaster is flush with the frame, painted or finished as in doors. (This will be paid as a separate item as described in Schedule of Quantites).

15. WOODEN FLUSH SHUTTERS: (Solid Core Type)

Solid core flush shutters shall be commercial or teak veneered type with a solid/cellular core and teak wood frame and fixed with approved quality of plywood as specified in the

schedule of quantities and as per list of approved manufacturers therein stated or other equivalent and approved quality. An approved sample shall be deposited in the office of the PMC/Employer at site for reference. The shutter will be provided with lipping wherever required and unless otherwise specified the finished thickness of the shutter shall not be less than 4 cm and or as mentioned in the item. Plywood faces should be glued on to the solid/cellular core with waterproof glue and should be hot pressed and phenol formaldehyde should be as glue. The construction of the shutters should be such that it will facilitate fitting and fixing of locking arrangements- hydraulic door closers, glass eye piece, push plate, kick plate and indicating bolts, without impairing the strength of the shutter.

16. TEAK WOOD PANELLED SHUTTERS:

Solid wood panels for shutter shall be of pattern, design, thickness and size as specified. Wherever possible each panel shall be of a single width piece. But where two pieces are used, width of each piece should not be less than 12.5 cm. When made from more than one piece, the pieces shall bi jointed with a continuous tongued and grooved joint and glued together and reinforced with metal-dowels. Such joints are to be got approved by the PMC/ Employer before actual manufacture is taken up. The grains of solid panel shall be framed into grooves to the full depth of the grooves heaving an air space of 1.6 mm and the faces shall be closely fitted to the sides of the grooves. Mouldings to the edge of panel openings shall ascribed at the joints. An approved sample shall be kept in the office of the PMC/ Employer at site for reference.

Unless otherwise specified the finished thickness of panels shall be 2 cm and 1.25 cm for 4 cm and 2.5 cm finished thick shutters respectively.

17. TEAK WOOD GLAZED SHUTTERS:

The general specifications for glazed shutter shall be similar to that for panelled shutter described above. Styles and rails in the glazed shutters shall be rebated 5/8" x 1/2" or (16 mm x 12 mm) to receive the glass unless otherwise specified.

Sash bars shall be of full thickness of the shutter and of width as shown in the drawings. These shall be moulded and rebated, mitred on side to receive the glass of approved quality, manufacture and thickness. Unless otherwise specified glass panels shall be fixed by means of moulded teak beads and suitable G. I. screws. Finished thickness of the shutter shall be as mentioned in the schedule of quantities. The rate shall be for the completed work, fitted and fixed in position. An approved sample should be kept in the

office of the PMC/ Employer at the site for reference. The glass shall conform to specification as described under the head, glazing. The glass shall be plain, ground or frosted of approved quality and manufacture and of thickness as mentioned in the schedule of quantities.

18. HARDWARE FITTINGS:

All hardware fittings for doors shall be of best quality and of approved manufacture, anodised iron/brass anodised aluminium, or as otherwise specified in the schedule of quantities. The samples for the fittings shall be submitted to the PMC/Employer for their approval. Hardware fittings for door shutters shall be paid as separate item as given in schedule of quantities. The rate for hardware fittings with necessary screws, washers, bolts, nuts etc. as required. All locks shall be provided with keys in duplicate and rate shall include for the same. All screws shall be of the same metal as specified. Approved samples of hardware fittings shall be deposited with PMC/Employer for reference.

RATES TO INCLUDE:

Apart from other factors mentioned elsewhere in this con- tract the rate for item of wood work and joinery shall include for the following:

A. Items of Scantling and Frame:

   i. All labour, materials and equipments for fixing frame work in position as per drawing, excluding the cost of holdfasts but including cost of rawl plug or other fasteners, screws and bolts, and easying, adjusting, cutting to the required size, shape and finish, and all by-works, at specified line and level with all lead and lift and all incidentals and wastages.

B. Items of shutters:

   i. All labour, materials, equipments, and consumables, for carrying out the work as per drawing and or as directed.

   ii. Labour for fixing the shutters in position (excluding the cost of fittings) as per drawing and including easying, adjusting, cutting to the required of size, shape and finish and all by-work, at specified line and level, with all lead and lift and all incidentals and wastage but excluding the gap between the shutter and the floor.

MODE OF MEASUREMENT:

All measurements shall be as per I. S. S. 1200 (Part XXI) 1973.

i. Scantling shall be measured in cum. The sectional area shall be the area of the least square, or rectangle, from which the scantling may be cut. The length shall be actual length of timber required for the purpose including the extra portion required for jointing.

ii. Shuttering shall be measured in square metre for closed-door shutter area i.e. rebate to rebate without extra measurement for rebates and/or splayed meeting styles of door.

19. SPECIFICATIONS FOR PVC/POLLYTHENE CONDUITS

i) PVC/ Polythene – Medium gauge pipes of reputed make having 3 mm wall thickness shall be used.

For roof slabs – These shall be pre laid during casting of floor/roof slab. No. of wires drawn through the same shall not exceed the number of specified I.S. Code.

For vertical drops in wall to switch boards – Minimum size shall be 13 mm bore through which not more 2 Nos. 1/1.40 and G.I. earth wire shall be drawn.

ii) Fish wire – 18 S.W.G. G.I. wire shall be used and it shall protrude the conduit ends by 9 inches.

iii) Conduit laying in floor/roof slabs before casting :

PVC/Polythene/G.I. conduit shall be laid straight as far as practicable and properly placed including binding with the steel reinforcement rods with 22 SWG G.I. wire so that proper positions of conduits are maintained.

While laying the conduits for concealed wiring in the ceiling or in the beams and columns and before casting, the contractor shall ensure that both ends of the conduit are plugged by means of dead-end socket or otherwise so that any foreign matter can not enter the conduit and choke them.

All precaution must be taken while laying the conduits on the slabs, R.C. walls, columns etc. and the contractor shall rectify at his own cost if any defects are found during process of drawing cables through the concealed pre laid conduits.

Each PVC polythene conduit shall be provided with protruding length of not less than 225mm for free end of the conduits.

There shall be no intermediate joints in one straight run of conduits.

There shall be no intermediate joints in one straight run of conduit.

All ceiling outlets shall be terminated in a round C.I./G.I. circular box to suit standard size ceiling rose or/and fan box, rectangular C.I./M.S. junction box as the case may be.

It will be mandatory for the contractor to get the layouts approved. When the conduits are laid and bound to steel reinforcement rods, before he can release the work for casting of floor/roof.

20. WHITE WASHING COLOUR WASHING & DISTEMPERING:

White washing:

a) Materials: White wash shall be prepared from 5 part of stone lime and 1 part of shall lime. The lime shall be dissolved in a tub with sufficient quantity of water (about 4/5 litros/kg of lime) and the whole thoroughly mixed and stirred until it attains the consistency of thin cream. The wash shall be taken out in small quantities and strained thorough a clean then be added in suitable proportion of 2kg of gum Arabic or synthetic resin as specified per cum of lime to prevent the whitewash coming off easily when rubbed. Indigo as necessary shall be mixed as per standard practice.

b) Scaffolding: This shall be strong & stout rigidly ties catering to the safety needs & shall be double or single according to requirement & as directed. If ladders are used, pieces of old

gunny bags or cloth rags shall be tied on their tops to avoid damage or scratches in the plastered surfaces, etc. proper stage scaffolding shall be erected when white washing the ceilings.

c) Preparation of surface: The surface shall be prepared by removing all mortar droppings & foreign matter & thoroughly cleaned with hair or fibre brush or to produce an approved clean & even surface. All loose pieces & scales shall be scrapped off and holes, cracks etc. stopped with mortar to match with the surrounding finish. The plaster should be cured sufficiently.

In case where the surface have been obviously white washed or colour washed, the old white or colour wash shall be entirely removed & surface broomed down before the new white wash is applied. In case the old white wash cannot be removed by brooming, the surfaces shall be cleaned by scrapping.

d) Application of White wash: On he other surface so prepared the white wash shall be laid on with a brush. The first stroke of the brush shall be from top downwards, another from bottom upwards over the first stroke, & similarly one stroke from the right & another from the left over the first brush before it dries. This will form on coat, each coat must be allowed to dry & shall be subject to inspection & approval before the next coat is applied, when dry, the surface shall show no signs of cracking. It shall present a smooth & uniform finish free from brush marks & it should come off easily when rubbed with a finger. Minimum 3 cots of white wash shall be applied.

No portions in the surface shall be left out initially to be patched up later on.

For new work, the whiter washed surface shall present a smooth & uniform finish.

For old work, patches, & repairs shall be white washed first. Thereafter, the whole surface shall be white washed with the required number of coats.

Doors, windows floors & other articles of furniture etc shall be protected from being splashed upon. Splashing & droppings, if any, shall be removed & the surface cleaned.

c) Rates to include: Apart from other factors mentioned elsewhere in this contract, the rates for white wash include for the following:

i) All labour, materials, equipment, consumables required for white washing.
ii) Strong & stout, catering to safety needs, double or single scaffolding including erection & removal.
iii) Providing & preparing the white wash..
iv) Preparing the surface for white wash including providing strong & stout catering to safety needs double or single scaffolding.
v) Applying the white wash in three coats minimum to the required finish line & level at all heights with all lead & lift & adopting all safety measures. If a proper even surface is not obtained to the satisfaction of the Employer/Architect in 3 coats contractors shall carry out additional coats of white wash to approval, at contractor’s expenses.
vi) Cleaning of floor, door & windows from droppings & splashes.

d) Mode of Measurement: The measurement shall be in square metre. The mode of measurement shall be as applicable to that for plaster.

21. COLOUR WASH

MATERIALS:

This shall be prepared by adding approved colouring matter to the white wash (prepared as for white washing) according to tint required. In all other respects the same conditions & specifications as applicable to white wash shall be applicable to colour wash.

22. DISTEMPERING:

PROVIDING DRY DISTEMPER:

a) Material: The powered dry distemper shall be of approved colour shade manufacture by M/s Blundel Eomite or other equivalent & approved manufacturers.

b) Scaffolding: This shall strong & stout rigidly tied catering to the safety needs & shall be double or single as required and / or directed.

c) Preparing the surface: The surface to be distempered shall be cleaned & all cracks, holes & surface defects shall be repaired with gypsum & allowed to set hard. All irregularities shall be sand papered smooth & wipped clean. The surface so prepared must be completely dry & free from dust before distempering is commenced. In the case of walls newly plastered surface special care shall be taken to see that it is completely dry before any treatment is attempted. For the old surface which had earlier been distempered, the surface shall be cleaned of grease, dust etc. The flakings of previous coating, if any, shall be taken off. All cracks holes & surface defects shall be taken off. All cracks, holes & surface defects shall be repaired with gypsum & allowed to set hard & then sand prepared & wipped clean. But in case the surface are coloured or white washed the wash must be removed thoroughly first.

d) Priming Coat: The priming coat shall be applied over the complete dry surface in the manner recommended by the makers in the case of patent distemper. When no priming coat is specified by the manufacturer, a finely powdered chalk mixed with a thin solution of glue shall be applied to prepare a good hard background the coating when dry being sand papered as close & smooth as possible.

e) Application of Distemper: The instruction of the makers shall be followed regarding the preparation of the surface & application of priming & finishing coats. Distemper shall not be mixed in a larger quantity than is actually required for a day's work. Hot water should be used to prepare the mixture. Distempers shall be applied in dry weather with broad stiff brush in long parallel strokes & to be finished with spongy roller. The treated surface shall be allowed to dry & harden .Second or succeeding coats shall not be applied until the preceding coat has been passed by the Employer/Architect. Two more coats of distemper shall be given in exactly the same manner as the first one but only after the earlier coat laid has thoroughly dried. The meaning of one coat shall be as described for white washing.

f) Rates to be included: The rates include all labourer, materials equipment & tools for carrying out the following operations:

i) Providing the primer & distemper & mixing the distemper.
ii) Scaffolding.
iii) Preparing the surface to receive the priming & finishing coats.
iv) Applying the priming coats.
v) Applying the distemper in 3 coats minimum to the required finish, line & level at all heights with all lead & lift adopting all safety measures. If a proper even

surface is not obtained to the satisfaction of the Employer/Architect in 3 coats, contractor shall carry out additional coats of distemper to approval, at contractor's expense.

vi) Cleaning the floor, doors & windows of droppings & splashes.

g) Mode of Measurements: Similar to that for whiter washing.

23. OIL BOUND DISTEMPERS / ACRYLIC DISTEMPER (INTERIOR)

The specifications & conditions for this shall be the same as that applicable for dry distemper, above, except that oil bound distemper of approved make, shade & colour shall be used after applying priming coat of petrifying liquid/water based liquid as per manufacturer's specifications or other primer as may be recommended by the manufacturers of distemper or as directed.

24. PLASTIC EMULSION PAINT:

a)Material: The emulsion paint & primers in general shall be of approved quality colour & shade as manufactured by M/s Goodlac Nerolac or other equal & approved manufacturers.

b) Scaffolding: This shall be strong & stout rigidly tied catering to the safety needs & shall be double or single as required & directed. If ladders are used, pieces of gunny bags or cloth bags shall be tied on their tops to avoid damage or scratches to the plastered surface etc. proper stage scaffolding shall be erected when painting the coiling.

c) Preparation of the surface:

a) New Surface: The surface to be painted shall be cleaned & all cracks, holes & surface defects shall be repaired with plaster of paris for spot fillings, & with filler prepared with whiting, water & a little quantity paint for filling & leveling the wider areas.
b) Old Surface:

i) The surfaces, which had been previously painted with emulsion paint, shall be lightly rubbed down & washed with clean water.

ii) The surface, which had been painted with oil bound distemper or oil paint, shall be cleaned, washed & sand prepared.

iii) The surface, finished with lime/cooler wash, powder distemper, shall be completely scrapped off to the bare surfaces.

iv) In case, after scrapping the surface any cracks. Holes or other surface defects are noted, the same shall be repaired before applying priming coat with plaster of paris for spot filling, & with filler prepared with whiting, water & a little quantity of paint for filling & leveling the wider areas.

d) Priming Coat:

The priming coat of the approved shade shall be applied over the completely dry surface in the manner as recommended by the paint manufacturers. The emulsion paint, in the priming coat may be thinned down with 20% water or as recommended by the paint manufacturer. Tarpentine or any other solvent shall not be used for thinning the paint.

e) Application of Emulsion Paint:

The recommendation of approved paint manufacturer, whose product is used, shall be followed regarding the preparation of the surface & the application of the priming & finishing coats. The contractor shall arrange for technical assistance & supervision from the paint manufacturer, during the execution of the painting work. After the priming coat has been applied & perfectly dried, all holes, scratches, if any, shall be repaired as mentioned in 'preparation of surface' & then the second coat of approved shade & manufacture shall be evenly applied & allowed to dry.
The third coat shall be carefully applied to achieve smooth & even surface after the previous coat has dried up. Minimum 3 coats of paint shall be applied inclusive of primer coat. All paint, to be applied with good quality of brush & finished with spongy roller so that no impression of hair line remains on the surface. This is to be approved by Employer/Architect. If a proper & even surface is not obtained to the satisfaction of the Employer/Architect. If a proper & even surface is not obtained to the satisfaction of the Employer/Architect in 3 coats, contractor shall carry out additional coats of painting to approval, at contractor's expenses. Care shall be taken that dust or other foreign materials do not settle or disfigure the various coats. The meaning of one coat shall be as described for white washing.

f) Rates to include:

Apart from other factors mentioned elsewhere in this contract the rates for the item of plastic emulsion paint shall include for the following:

i) All labour, materials, consumables & equipment necessary to carry out the work.
ii) Supplying the approved emulsion paint for priming & finishing coats.
iii) Preparing the surface for receiving the primer & finishing coats.
iv) Providing scaffolding/ladder/platform/staging including its erections & dismantling.
v) Application of one primer coat & minimum two coats of finishing. If a proper & even surface is not obtained to the satisfaction of the Employer/Architect in 3 coats, The contractor shall carry out additional coats of painting to approval at contractor's expenses.
vi) Protection to painted surface till dried & handed over.
vii) Expenses, if any for supervision & technical assistance supplied by the approved paint manufacturers.
viii) Cleaning the floor of droppings & splashes.

g) Mode of Measurement:

The measurement shall be in a square metre. The mode of measurement shall be as applicable to that for white washing.

25. <u>CEMENT PAINTING</u>:

a) Materials: External waterproofing cement paints shall be of approved colour, manufacturer- Snowcem, or other approved manufacturers.

b) Preparation of Surface: Before painting is commenced on surface, all dirt, oil, grease, efflorsence & organic materials shall be completely removed. The surface shall be wetted by sprinkling of water with fine spray. The surface shall be sprayed several times with a few minutes intervals between each spraying to allow the moisture to soak into the surface.

c) Application: Cement paint solution shall be applied to the surface with hair brush in a number of coats to get uniform finish. After the first coat of paint has dried it shall be cured

with water at least for 24 hours before the application of the second coat should be elapsed between the two coats. Similarly, third shall be given to get uniform colour. The meaning of one coat shall be as described for whiter washing.

d) Curing: Cement paint work shall be kept damp at least for 7 days.

e) Rates to include: Apart from other factors mentioned elsewhere in this contract, the rate of providing cement paint shall include for the following:

i) All labour, materials, consumables & equipment to provide cement paint.
ii) Providing strong & stout catering to safety needs double or single scaffolding, including erecting & removing.
iii) Preparing the surface for receiving the cement paint as stated above.
iv) Applying 3 coats of approved cement paint to the required finish, line & level at all heights with all lead & lift adopting all safety measures. If a proper even surface is not obtained to the satisfaction of the Employer/Architect in the coats applied, the contractor shall provide additional coats of painting to approval, at contractor's expense.
v) Curing as stated above.
vi) Cleaning of floor, doors & windows of droppings & splashes.

f) Mode of Measurement:

Measurement shall be in square metre & as applicable to white wash. Nothing extra shall be allowed for painting on rough surface, for example, external sand faced plaster rough cast plaster etc.

26. <u>CEMENT WASHING.</u>

Cement washing including cleaning and smoothening of surface shall be done as for cement paint for single coat 15kg of cement and for two coats 25 kg per sq.m shall be used. Mode of measurement and rates to be include as above.

27. <u>PAINTING, FRENCH POLISHING, WAX POLISHING</u>:

A. PAINTING:

a) Materials: Synthetic enamel paints & primers, in general shall be of approved quality, colour & of approved manufacturer. These materials shall be in sealed tins & shall be opened in the presence of the Employer/Architect at site.

b) Preparation of Surface:

i) Iron and Steel works: Surface to be painted shall be thoroughly cleaned, sand prepared &/or rubbed with emery cloth, if necessary, to remove grease, mortar or any other foreign materials. In case of rusted surface, it shall be first cleaned with wire brushes till the corroded rust is removed. The prepared surface shall be shinny & free from brush marks, patches, blisters & other irregularities. The surface thus finished shall be got approved for painting.
ii) Wood work: All surface to be painted shall be thoroughly cleaned sand papered & removed of all foreign materials. The knotting materials shall consist of pure shellac dissolved in methylated spirit. Stopping materials shall consist of putty. The surface thus treated shall be allowed to dry & then sand papered smooth (For veneered surface a surface film of French chalk/primer and whiting shall be

provided to give a smooth surface prior to application of primer.

c) Application: After preparing the surface, a primer coat shall be applied. The primer coat shall be ready mixed of approved make & manufacturer. After the primer coat is applied & perfectly dried, all holes. Cracks, etc is still remains, shall be filled in with putty & the surface sand papered smooth with putty as described above. Then a second coat of paint of approved shade & manufacturer shall be evenly applied & allowed to dry.

The third coat shall be carefully applied to achieve smooth & even surface after the previous coat has dried up. Minimum 3 coats of paint shall be applied inclusive of a primer coat. If a proper & even surface is not obtained to the satisfaction of the Employer/Architect in 3 coats, contractor shall carry out additional coats of painting to approval, at contractor's expenses. Care shall be taken that dust or other foreign materials do not settle or disfigure the various coats.

d) Rates to include:
Apart from other factors mentioned elsewhere in this contract the rates for the item of painting shall include for the following:

i) All labour, materials, consumables & equipment necessary to carry out the work.
ii) Supplying the approved paint for priming & finishing coats.
iii) Preparing the surface including knotting & stopping for receiving the priming & finishing coats.
iv) Providing strong & stout, catering to safety needs (wherever required), single or doubt scaffolding including its erection & dismantling.
v) Application of one primer coat & two coats of finishing, minimum, to the required finish line & level at all heights with all lead & lift & adopting all safety measures. If a proper & even surface is not obtained to the satisfaction of the Employer/Consultants in 3 coats, the contractor shall carry out additional coats of painting to approval at contractor's expenses.
vi) Protection to painted surface till dried & handed over.
vii) Cleaning the walls, floor etc. of droppings & splashes

e) Mode of measurement:

Painting to wood work, steel shall be measured separately, as per I.S 1200 (Part XV) 1968.

B. FRENCH POLISHING:

French polish to be used shall comply with I.S. 348-1962 in the requirements of quality & methods of test.

Before French polish is applied, the surface of wood works shall be prepared in the same manner as for painting. The wood to be polished should be first painted with a filter composed of 1 part of whiting mixed with 0.58 part of methylated spirit. After drying, it should be finely send papered.

On the woodwork thus treated a thin coat of French polish shall be applied & allowed to dry. After drying the surface shall be lightly rubbed with a fine sand paper prior to the second & the third coats. The French polishing should be finished in such a way, so that the natural grain lines of wood are visible. The surface hall show an even polished surface & be approved by the Employer/Architect.

i) Rates to Include: Similar to that of painting.

ii) Mode of Measurement: Similar to that of painting.

C. WAX POLISHING:
a) The polish shall be of approved manufactures (e.g. Mansion Brand) or shall be prepared as under:
A mixture of Bee's wax & turpentine in proportion of 2:1 by weight shall be used. The wax is melted & added to the turpentine, mixed well & allowed to cool.

b) The surface of wood work shall be prepared as for oil-painting before waxing. The wood work shall be smeared with the mixture & allowed to remain overnight so that the mixture may soak into the pores of the wood. In the morning the superfluous wax shall be wiped off & the surface rubbed up with a soft flannel to a fine polish.

c)Rates to Include: Similar to that of painting.
d)Mode of Measurement: Similar to that of painting.

28. EXTERIOR GRADE ACRYLIC EMULSION:

Surface shall be prepared as per specification for cement paint. Primer shall be one coat of approved primer or cement based paint as specified. Finishing shall be in two coats of exterior grade acrylic emulsion as per the manufacturer's specification. (shade and brand to be specified by Employer/Architect). Application of finish coats shall be on dry surface.

Rates to include all items as same as for cement paint. Mode of measurement shall also be the same.

29. PLASTER OF PARIS PUNING:

Rendering plastered surface of walls and ceilings with plaster of paris. Approved quality of plaster of paris shall be mixed with clean salt-free water to prepare a consistent paste. The paste shall be applied on wet surface with a trowel on steel plate and smoothened. Coat shall not be less than 1.5mm thick with additional thickness as required to give an even surface. After drying the surface shall be rubbed down with rough cloth.

GENERAL SPECIFICATIONS
(INCLUDING MODE OF MEASUREMENT)

(A)Materials

All materials used in the works shall be of the best kind and to the approval of the Engineer-In-Charge. All material shall comply with the relevant Bureau of Indian Standard specification.

A.1. Supply of Brick Materials:

The minimum compressive strength of burnt clay bricks when tested flat shall not be less 84 kg/cm2 for individual bricks and 105 kg/cm2 for average of 5(five) specimens and the size may be as mentioned below with a tolerance of +5 percent

a) Ist class bricks shall be manufactured with well plugged earth & must be box moulded The finished size of bricks shall be 24 cm x 12 cm x 7 cm. These shall be of uniform size & colour, thoroughly & evenly burnt & should ring clearly when struck, be well shaped, square & true with even surface & straight unbroken edges without cracks, rainspots flaws of any kind. These should not absorb more than $1/6^{th}$ of their weight of water when saturated.

b) Picked Jhama Bricks shall be manufactured as at (a) above except that those shall be slightly overburnt.The shape, size etc. shall conform as far as practicable to those of Ist class bricks.

c) Jhama bats shall be obtained from uniformly vitrified & heavy picked jhama bricks & the size should be ¼ to ¾ full bricks. The colour of bats shall be copper red to black & must not be spongy. All lump jhama shall be broken to ½ brick size before it can be accepted as bats.

d) Jhama metal for road works, jhama clips for concrete works shall be obtained by breaking good quality jhama bats, must not be spongy or with any coating of foreign material. The metal or chips shall be of more or less cubical in shape & correspond to the specified range of size.

A.2. Collection Supply of Hard Stone materials:

Stone materials for road works or aggregate for cement concrete (Plain or reinforced shall Be hard, of uniform & fine texture, free from faults or planes of weakness & free from weathered faces. These must also be free from loam, clay, or any surface coating, free from organic matter or other impurities. The materials shall be stacked at road side lands or other lands (as directed by the Engineer-In-Charge) in specified heights without causing inconvenience to traffic & in such a way as to afford maximum facilities of work. Aggregates for cement Concrete work should conform to IS:383. Physical requirements & gradings of aggregates for pavement course shall be as specified for particular type of work. Stones when immersed in water for 24 hours shall not absorb water by more than 5 percent of their dry weight when tested in accordance with IS:1124.

a) Road Metals shall be obtained by breaking large blocks conforming to above specification regarding hardness etc. must be more or less cubical in shape & shall be well graded within the range of size specified.

b) Stone chips shall be obtained by breaking large & hard blocks, must be cubical in shape & graded within specified size range. These shall be washed clean as directed by engineer-In-Charge.

c) Shingles shall be hard, must have clean surface & on being broken the fractured surface must indicate a uniform & fine texture free from laminations or planes of weakness. The size shall be within specified limits.

d) Gravels shall be as per shingles above, moreover these shall be washed clean before supply.

e) The stone aggregate shall be designated by their standard sizes & shall conform to the requirements set forth in the following table. The actual work of laying pavement course & concrete works shall however be governed by the respective specifications of differ works. The size & quantities of aggregates to be supplied shall be also selected such that the grading requirements for which the supply is intented are supplied.

Size Requirements for Stone aggregates.

Sl No	Standard size of aggregate	Designation of sieve through which the aggregate shall wholly pass.	Designation of sieve on which the aggregate shall wholly be retained.
i	75 mm	105 mm	63 mm
ii	63 mm	90 mm	53 mm
iii	45 mm	53 mm	26.5 mm
iv	26.5 mm	45 mm	22.4 mm
v	22.4 mm	26.5 mm	13.2 mm
vi	13.2 mm	22.4 mm	11.2 mm
vii	11.2 mm	13.2 mm	6.7 mm
viii	6.7 mm	11.2 mm	2.8 mm
ix	5.6 mm	9.5 mm	2.36 mm

A.3. Collection/Supply of laterite Stone materials:

Laterite shall be hard, compact, heavy & of dark colour. Light coloured sandy laterite & also those containing a good bit of ochreous clay shall not be used.

Laterite stone materials for road works shall be of good quality, free from dust, impurities & other foreign material. The hardness shall be the maximum that is possible in this type of stone.

a) Laterite boulders shall be as above regarding quality, of stone, shall be rough dressed & must be supplied in thickness (when laid as per natural bedding) as specified.

b) Laterite road metals shall be obtained by breaking good quality large laterite blocks, must be more or less cubical in shape & within the range of size specified.

c) Moorum shall be of the best quality free of clay & must not be too britle when dry nor too sticky when wet.

A.4. Sand : All sand shall be clean, sharp & free from clay, loam, organic or foreign matter & shall be obtained from approved source. The contractor shall get the samples of sand to be used in different kinds of work approved by the Engineer-In-Charge before using the same in work. Sand which in the opinion of the Engineer-In-Charge or his representative is dirty must be washed to his satisfaction at the cost & expenses of the contractor.

Sand may be classified as follows according to size :

i) Coarse sand: 4.75 mm to 2.00 mm I.S sieve.
ii) Medium sand : 2.00 mm to 425 micron I.S sieve.
iii) Fine Sand : 425 micron to 75 micron I.S sieve.
iv) Sand for all concrete works shall conform to provisions stipulated IS: 383. The fineness modulus of sand shall be greater than 2.0 & should be within 3.5.
v) Medium sand may be used in cement mortar for masonary, plaster etc & also bituminous works of road.

A4.Cement: Grade of cement to be used in the works shall have to comply with relevant I.S code.

A5.Steel: All steel shall be tested quality unless stipulated otherwise. These shall be free from oil, dirt & loose rust; any scale or loose rust shall be removed before use. Steel used must comply with relevant I.S code.

(B) General Specification for Execution

B. Earthwork

B-1 Roadway and Drainage excavation.

B-1.1 Description: Roadway & Drainage excavation shall consist of excavation, removal & satisfactory disposal of all materials necessary for the construction of roadway, site ditches & water Ways in accordance with the requirements of these specifications & the line grades & cross-sections shown in the drawings or indicated by the Engineer-In-Charge. This work shall include the hauling & stacking of or hauling to sites of embankment construction, of suitable cut materials are required, as also the disposal of unsuitable cut materials in specified manner, & the trimming & finishing of the roadway as per specified dimensions.

B 1.1.1. Classification: All materials involved in excavation shall be classified by the Engineer-in

The following manner:

a) Soil.

This shall comprise top soil, turf, sand, silt,loam,clay,mud,peat,black cotton soil, soft shale, loose moorum, a mixture of these & similar materials which yields to the ordinary application of pick, spade &/or shovel etc. of ordinary digging implement. Removal of gravel or any other nodular material having dimension in any direction not exceeding 75 mm occurring in such strata shall be deemed to be covered under this category.

b) Ordinary Rock (not requiring blasting) shall include:

i) Rock type such as laterites, shales & conglomerates, varieties of limestone & sandstone etc. which may be quarried or split with crow bars, also including any rock which in dry strata may be hard requiring blasting but which when wet becomes soft & manageable by means other than blasting.

ii) Macadam surfaces such as water bound & bitumen/ tar bounds soiling of roads, paths etc. & hard core, compact moorum or stabilized soil requiring grafting tool or pick or both & shovel, closely applied, gravel & cobble stone having maximum dimension in any one direction between 75 and 300 mm

iii) Lime concrete stone masonry & brick work below ground level, reinforced cement concrete which may be broken up with crow bar or picks.

c) Marshy soil.

This shall include soils like soft clays & peats excavation below the original ground level of marshy & swamps & soil excavated from areas requiring pumping or boiling out of water.

B-1.2 Authority for classification: The classification for excavation shall be decided by the Engineer-In-Charge & his decision shall be final binding on the contractor. Merely the use of explosives in excavation shall not be considered as a reason for higher classification unless blast on is clearly necessary in the opinion of the Engineer-In-Charge.

B1.3 Construction operation:

1.3.1 Setting out: After the site has been cleared, the limits of excavation shall be set out true to lines, curves, slopes, grades & sections, as shown on the drawings or as directed by the Engineer-In-Charge. The contractor shall provide all labour, survey instruments & materials such as strings, pegs, nails, bamboos, stones, lime, mortar, concrete etc. required in connection with the settiing of works & establishment of bench marks. The contractor shall be responsible for the maintenance of bench marks & other marks & stakes as long as they required for the work in the opinion of the Engineer-In-Charge.

1.3.2 Stripping and storing top soil : When so directed by the Engineer-In-Charge, the top soil existing over the sites of excavation shall be stripped to specified depths & stored at designated locations for re-use in covering embankment slopes, cut slopes, berns & other disturbed areas where re-vegetation is desired.

1.3.3 Excavation –General: All excavation shall be carried out in conformity with the directions laid herein under & in a manner approved by the Engineer-In-Charge. The work shall be so planned that the suitable materials available from excavation are satisfactory utilized as directed upon before head.

The excavation shall conform to the lines, grades, side slopes & levels shown on the drawings or directed by the Engineer-In-Charge. The contractor shall not excavate outside the slopes or below the established grades or loosen any material outside the limits of excavation. Subject to the permitted tolerances, any excess depth excavated below the specified levels on the roadway shall be made good at the cost of the contractor with suitable material of similar characteristics to that removed & compacted to the requirements of Clause B-4.

1.3.6. Slides: If slides occurs in cuttings during the process of construction, they shall be removed at the cost of the contractor as ordered by the Engineer-In-charge. If finished slopes slide into the roadway subsequently, such slides shall be removed & paid for at the contract rate for the class of excavation involved provided the slides are not due to any negligence on the part of the contractor. The classification of the debris material shall conform to its condition at the time of removal & payment made accordingly regardless of its condition earlier.

1.3.7. Dewatering: If water is met within the excavations due to springs, seepage, rain or other causes, it shall be removed by suitable diversion, pumping or bailing out, & the excavation kept dry whenever so required or directed by the Engineer-In-charge. Care shall be taken to discharge the drained water as not to cause damage to the works, crops or any other property.

1.3.8. Disposal of excavated materials: All the excavated materials shall be the property of the Government. Where the excavated material is directed to be used in the construction of the embankment, it shall be directly deposited at the required location complying with the requirements of Clause B-4. The operation shall be so arranged that the capacity of cutting, haulage & compaction is nearly the same.
All hard materials, such as hard moorum, rubble, etc. not intended for use in the bank, shall be stacked nearly for future use on Government land as directed by the Engineer-In-Charge within the lead specified for the item. Unsuitable & surplus materials not intended for use in any part of the road shall be disposed of as directed by the Engineer-in-charge.

1.4. Plying of construction traffic: Construction traffic shall not use the cut formation without the prior permission of the Engineer-in-charge. Any damage arising out of such use shall be made good by the contractor at his own expense.

1.5. Preservation Property: The contractor shall undertake all reasonable precautions for the protection & preservation of any or all existing roadside trees, drains, or other surface drains, pipes, conduits & any other structures under or above ground, which may be affected by construction operation & which in the opinion of the engineer-in-Charge shall be continuation use without any change. Safeguards taken by the contractor in this respect shall be got approved by him from the Engineer-In-Charge. However, if any of these objects is damaged by reason of the contractor's negligence, it shall be replaced or restored to the original condition at his expense.

1.6. Preparation of cut formation: The cut formation shall be prepared to receive the sub-base/base course as directed by the Engineer-in-charge.

Where the material is in a poor state of compaction that is densities less than 95 % of the maximum dry density determined according to IS: 2720-(Part VII) is met with at the sub-grade level, the same shall be loosened to a depth of 500 mm & compacted in 250 mm thick loose layers in accordance with the requirements of Clause B-4. Any unsuitable material encountered at the formation level shall be removed to a depth indicated by the Engineer-in-charge & replaced with suitable material compacted in accordance with Clause B-4.

In rocky formations, the surface irregularities shall be corrected & the levels brought up to the specified elevation with sub-base or base material as directed by the Engineer-in-charge, laid & compacted in accordance with the respective specifications for these materials.

1.7. Finishing operations: Finishing operations shall include the work of properly shaping & dressing all excavated surfaces.
When completed, no point on the slopes shall vary from the designated slopes by more than 150 mm Measured at right angles to the slope except where excavation is in rock (hard or soft) where no point shall vary more than 600 mm from the designated slope. In no case shall any portion of the slope croach on the roadway.
The finished cut formation shall conform with longitudinal cross-profile of the road shown on the drawings or as directed by the Engineer-in-charge. (+_ 25 mm).
Where directed, the top soil removed earlier & conserved shall be spread over the cut slopes, berms

& other disturbed areas. Slopes may be roughened & moistened slightly, prior to the application of top soil in order to provide satisfactory bond. The depth of top soil shall be sufficient to sustain plant growth, usual thickness being from 75 mm to 150 mm.

1.8. Mode of work and measurement for payment.

In the preparation of item of earthwork it has been envisaged that the following types of such works will be done.

Type-I: This type of earthwork will comprise of repair works of road embankment namely filling voids, local depression, depressions behind abutments, wingwalls etc. filling rain cuts on emergent basis & manually compacted earthwork in constructed portion of embankment where roller compaction is not possible. In this case borrow-pit measurements will be applicable.

Type-II: This type of work will comprise of earthwork in cutting to form road section/side drain in correct profile. Payment will be made on the basis of quantity arrived at after pre-work & post-work section measurements.

Type-III: this type of work will comprise of earthwork compacted or uncompacted in embankment in all types of soils desired profile & grade as per designated formation level.

Payment will be made on the basis of quantity arrived at after pre-work & post-work section measurement.

Type IV: This type of work will comprise dressing & chichaling of road flanks up to a depth of 150 mm. payment for dressing & chichalling road flanks will be made on square metre basis.

B-4.Embankment Construction.

Description: These specifications shall apply to the construction of embankments, shoulders, &miscellaneous back fills with approved material obtained either from excavation for road construction, borrow pits or other sources. All embankments shall be constructed in accordance with the requirements of these specifications & in conformity with the lines, grades & cross-sections shown on the drawings or as directed by the Engineer-in-charge.

Materials:
Physical requirements: The materials used in embankments shall be earth, moorum, gravel, a mixture of these or any other materials approved by the engineer-in-charge. Such materials shall be free of logs, stumps, roots, rubbish or any other ingredient likely to deteriorate or affect the stability of the embankment.

The size of the coarse material in the mixture of earth shall ordinarily not exceed 75 mm. However, the Engineer-in-charge may at his discretion permit the use of material coarser than this also if he is satisfied that the same will not present any difficulty as regards the placement of fill material & its compaction to the specification requirements.

Ordinarily, only the materials, satisfying the density requirement given in Table below shall be employed for embankment construction. The Engineer-in-charge may, however, relax these requirements at his discretion taking into account the availability of materials for construction & other relevant factors.

Sl. No	Type	Maximum laboratory dry density when tested as per IS:2720 (PartVII)
1.	Embankment up to 3 m height not subjected to extensive flooding.	Not less than 15.2 KN/cum
2.	Embankment exceeding 3 m height or embankments of any height subject to long periods of inundation.	Not less than 16.0 KN/cum.
3.	Sub-grade and shoulders (where earth shoulders are specified)	Not less than 17.5 KN/cum.

Highly expansive clays, exhibiting marked swell & shrinkage properties, shall be deposited at the bottom of the embankment just below the sub-grade level. The above table is not applicable for light-weight fill material e.g. cinder, fly ash etc.

Source of supply: The materials for embankment shall be obtained from approved sources with preference given to materials becoming available from nearby road excavation under the same Contract.

Where the materials are to be obtained from the approved borrow pits, the locations, size & shape of these pits shall be as indicated by the Engineer-in-charge & the same shall not be opened without his written permission.

Pit shall not be dug continuously. Ridges of not less than 8 m width should be left at intervals not exceeding 300m. Small drains shall be cut through the ridges to facilitate drainages. The depth of the pits shall be so regulated that their bottom does not cut an imaginary line having a slope of 1 in 4 projected from the edge of the final section of the bank the maximum depth in any case be limited to 1.5 m. Also, no pit shall be dug within 5.00 m of the toe of the final section of the road embankment.

Construction Operation:

Setting out: After the site has been cleared the work shall be set out true to lines, curve, slopes, grades& sections as shown on the drawings or as directed by the Engineer-in-charge .the contractor shall provide all labour, survey instruments & materials such as strings, pegs, nails, bamboos, stones, lime, mortar, concrete, etc. required in connection with the setting out of the works & the establishment of bench marks. The contractor shall be responsible for the maintenance of bench

marks & other marks & stakes as long as they are required for the work in the opinion of the Engineer-in-charge. The limits of embankment shall be marked by fixing better pegs on both sides at regular intervals as guides before commencing the earthwork. To ensure their safety, it is desirable to fix the pegs about 0.5 m back from the actual limits of the fill & paint them in a distinctive colour.

Stripping and storing top-soil: In localities where most of the available embankment materials are not conductive to plant growth, or when so directed by the Engineer-in-charge, the top soil existing over the embankment foundation shall be stripped to specified depths not exceeding 150 mm & stored for covering embankment slopes, cut slopes & other disturbed area where re-vegetation is desired.

Compacting original ground: In all cases, the original ground shall be consolidated by rolling, as directed by the Engineer-in-charge, but with a maximum of six passes of 8-10 tonne roller.

Where the height of the proposed embankment is less than 0.5 m & the original ground does not already have a relative compaction of at least 100 % the same shall be loosened to a depth of 0.5m watered & compacted in layers not exceeding 250 mm in loose thickness to the maximum dry density of the materials determined in accordance with IS: 2720 (PartVII). However, before relaying

& compacting the loosened material the surface below this level shall be suitably consolidated as directed by the Engineer-in-charge but with a maximum of six passes of 8-10 tonne roller.

Where so directed by the Engineer-in-charge, any unsuitable materials occurring in embankment foundation shall be removed & replaced by approved materials suitably compacted.

Embankment or sub-grade work shall not proceed until the foundation for embankment/sub-grade have been inspected by the Engineer-in-charge for satisfactory condition & approved.

SPREADING MATERIALS IN LAYERS AND BRINGING TO APPROPRIATE MOISTURE CONTENT:

The embankment materials shall be spread uniformly over the entire width of the embankment in layer not exceeding 250 mm in loose thickness. Successive layers of embankment shall not be placed until the layer under construction has been thoroughly compacted to the requirements set down here under.

Moisture content of the material shall be checked at the source of supply & if found less than that specified for compaction, the same shall be made good either at the source or after, spreading the soil in loose thickness for compaction. In the later case, water shall be sprinkled from a hose line and/or truck mounted water tank capable of applying water uniformly & at controlled quantities but without any flooding.

If the material delivered to the roadbed is too wet, it shall be dried, by aeration & exposure to the sun, till the moisture content is acceptable for compaction. Such circumstances arise, where owing to wet weather, the moisture content cannot be reduced to the required amount by the above procedure, work on compaction shall be suspended.

Moisture content of each layer of soil shall be so adjusted (making due allowance for evaporation losses) that at the time of compaction it is in the range of 1% above to 2% below the optimum moisture content determined in accordance with IS:2720 (PartVII). Highly expansive clays shall, however, be compacted at 2 to 4% above the optimum moisture content.

After adding the required amount of water, the soil shall be proceeded by means of harrows, rotary mixers or as otherwise approved until the layer is uniformly wet.

Clods or hard lumps of earth shall be broken to have maximum size of 75 mm when being placed in the lower layers of the embankments & a maximum size of 50 mm when being placed in the top of 0.5 m portion of the embankment below the sub-grade level.

Compaction: Only compaction equipment approved by the Engineer-in-charge shall be employed to compact the different materials encountered during construction. If directed by the Engineer-in-charge, the contractor shall demonstrate the efficacy of the plant be intended to use by carrying out compaction trials.

Each layer of the materials shall be thoroughly compacted to the densities specified in the table below:

Compaction Requirement for Embankment and sub-grade.

Sl No	Type of work/material	Field dry density as a percentage of maximum laboratory dry density as per IS: 2720 (PartVII)
1.	Sub-grade and earthen shoulders.	Not less than 97
2.	Other portion embankment.	Not less than 95
3.	Highly expansive clays in embankment only.	Not less than 90

Subsequent layers shall be placed only after the finished layer has been tested for the following & accepted by the Engineer-in-charge. A record for the same shall be maintained.

Tests on Earthwork for embankment sand sub-grade Construction with borrow material.

(a) Sand content: (IS.2720(Part IV)) One to two tests per 8000 m3 of soil.
(b) Plasticity Test: (IS.2720 (Part V)) Each type to be tested, 1-2 tests per 8000m3 of soil.
(c) Density test: (IS.2720 (Part VII)) Each soil type to be tested, 1-2 tests per 8000m3 of soil.
(d) Deleterious Content test: (IS. 2720 (Part XXVII)) As & when required by the Engineer-in-charge.
(e) Moisture content test: (IS. 2720 (Part II)) One test for every 250 m3 of soil.
(f) C.B.R. Test of materials to be incorporated in the sub-grade on soaked/un-soaked sample: (IS.2720 (PartXVI)) one test for every 3000 m3 at least or closer as & when required by the Engineer-in-charge.

When density measurements reveal any soft areas in the embankment further compaction shall be carried out as directed by the Engineer-in-charge. If in spite of that, the specified compaction is not achieved, the material in the soft areas shall be removed & replaced by approved material compacted to the density requirements & satisfaction of the engineer-in-charge.

Compaction Control: Control shall be exercised by taking at least one measurement of density for each 100 sq.m of compacted area or closer as required to yield the minimum number of test results for evaluating a day's work on statistical basis. The determination of density shall be in accordance with Is:2720(PartXXVII). Test location shall be chosen only through random sampling techniques. Control shall not be based on the result of any one test but on the mean value of a set of 5-10 density determinations. The number of tests in one set of measurement shall be 5 as long as it is felt that sufficient control over borrow materials & the method of compaction is being exercised. If considerable variations are observed between individual density results the minimum number of tests in one set of measurement shall be increased to 10. The acceptance of work shall be subject to the condition that the mean dry density equals or exceeds the specified density & the standard deviation for any set of results is below 0.08 gmc.c.

However, for earthwork in shoulder & in top 500 mm portion of the embankment below the sub-grade, at least one density measurement shall be taken for every 500 sq.m of the compacted area provided further that the number of tests in each set of measurement shall be at last 10.

Drainage: The surface of the embankment/sub-grade at all times during construction shall be maintained at such a cross fall as will shed water & prevent flooding.

Finishing Operations: Finishing operations shall include the work of shaping & dressing the shoulders, road bed& side slopes to conform to the alignment, levels, cross section & dimensions shown in the drawings or as directed by the Engineer-in-charge subject to surface tolerances as stated under "Control of Alignment and surface Regularity". Both the upper & lower ends of the side slopes shall be rounded off to improve appearance & to merge the embankment with the adjacent terrain.

As directed, the top soil, removed and conserved (as directed under stripping & storing top soil) shall be spread over the filled slopes to facilitate the growth of vegetation. Slopes shall be roughened & moistened slightly just prior to the application of the top soil, in order to provide satisfactory bond. The depth of the top soil shall be sufficient to sustain plant growth, the usual thickness being from 75 to 150 mm.

When earthwork operations have been substantially completed the roadway area shall be cleared of all debris & ugly scars in the construction area responsible for objectionable appearance eliminated.

Construction of embankment and Sub-grade under Special Conditions.

1. Embankment around structures: To avoid interference with the construction of abutments, wingwalls or return walls of culvert/bridge structures, the contractor shall, at point to be determined by the Engineer-in-charge suspend work on embankments forming approaches to such structures, until such time as the construction of latter is sufficiently advanced to permit the completion of approaches without the risk of interference or damage to the structure.

   Unless directed otherwise, the filling around culverts, bridges & other structures up to a distance of twice the height of the embankment from the back of the abutment shall be carried out independent of the work of the main embankment. The fill material shall not be placed against any abutment or wingwall unless permission has been given by the Engineer-in-charge but in any case nor until the concrete or masonary has been in position for 14 days. The embankment & sub-grade shall be brought up simultaneously in equal layers on each side of the structure to avoid displacement & unequal pressure. The sequence of work in this regard shall be got approved from the Engineer-in-charge.

   The material used for back filling shall not be organic soil or highly plastic clay having 'plasticity index' & 'liquid limit' more than 20 and 40 respectively when tested according to

IS: 2720 (PartV). The fill material shall be deposited in horizontal layers not exceeding 150 mm, in loose thickness & compacted thoroughly to the requirement.

2.Embankment construction under water.

Where filling is to be placed under water, only acceptable granular material or rock shall be used unless otherwise approved by the Engineer. Acceptable granular material shall consist of graded, hard durable particles with maximum particle size not exceeding 75 mm. The material shall be non-plastic having uniformity coefficient of not less than 10. The material placed in open water shall be deposited by end tipping without compaction.

3.Earthwork for high embankment.

In case of high embankment the agency should use the material from the specified borrow area where the properties of soil are already approved by the Engineer. In case different materials are intended to be used the soil should be tested & results approved by the Engineer before actual use. If necessary, stage construction of fills & any controlled rates of filling shall be carried out including the installation of instruments for its monitoring & control as per direction of the Engineer. Where required, the contractor shall arrange for surcharge embankment with approved material for the period as specified by the Engineer. Where surcharge material is to be kept for the specified period to monitor the settlement of the embankment, the surcharged material shall remain in place for the required settlement period before the further work. The duration of the settlement period shall be specified by the Engineer.

Plying of construction traffic.

Construction traffic shall not use the prepared surface of the embankment without the prior permission of the Engineer-in-charge. Any damage arising out of such use shall however, be made good by the contractor at his own cost.

Rolling: Immediately after spreading, grading & leveling of the mixed material, compaction shall be carried out with 8 to 10 tonne smooth wheel rollers or other approved plant, preceded by a few passes of lighter roller if necessary. Rolling shall commence at edges & progress forwards the centre, except at super elevated portions where it shall commence at the inner edge& progress towards the outer. During rolling the surface shall br frequently checked for grade & camber & any irregularities corrected by loosening the material & removing or adding fresh material. Compaction shall continue until the density achieved is at least 100 % of the maximum dry density for the material determined in accordance with IS: 2720 (PartVII).

The final surface shall be well closed, free from movement under compaction plant, & any compaction planes, ridges, cracks or loose material. All loose segregated or otherwise defective areas shall be made good to the full thickness of the layer & re-compacted.

Surface finish and quality control of work: The surface finish of the construction shall conform to the requirements for **"quality control" FOR ROAD WORKS.**

B-6 Shoulder Construction.

(i) Description: This work shall consist of constructing shoulders (earthen/hard) on either sides of the pavement, in accordance with the requirements of these specifications & in conformity with the lines, grades & cross sections shown on the drawings or as directed by the Engineer-in-charge.

(ii) Materials: Should on either side of the road may be of selected earth/granular material conforming to specification.

(iii) Size of shoulder: Shoulder (earthen/hard) dimensions shall be as per their functional requirements.

(iv) Construction operation: Except in the case of Bituminous constructions, shoulder shall be constructed in advance of the laying of pavement courses. The compacted thickness of each layer of shoulder shall correspond to the compacted layers of the pavements course to be laid adjacent to it. After compaction, the inside edges of shoulder shall be trimmed vertical & included area cleaned of all spilled material before proceeding with the construction of pavement layer.

In the case of bituminous courses, shouldering operation shall start only after the pavement course has been laid & compacted.

During all stages of shoulder (earthen/hard) construction required cross fall shall be maintained to drain off surface water. Regardless of the method of laying, all shoulder construction material shall be placed directly on the shoulder. Any spilled material dragged on to the pavement surface shall be immediately removed, without damage to the pavement, & the area so affected thoroughly cleaned.

(v) Measurement for payments: Shoulder construction shall be measured as finished work in position in square metres.

B-9.2 QUALITY CONTROL FOR ROAD WORKS.

Control of Alignment and surface regularity:
General: All works performed shall conform to the lines, grades, cross section & dimensions shown on the drawings or as directed by the Engineer-in-charge subject to the permitted tolerances described hereafter.
(a) Horizontal alignments: Horizontal alignments shall be reckoned with respect to the centre line of the carriage way as shown on the drawings. The edges of the carriage way as constructed shall be corrected within a tolerance of +_25 mm thereforth. The corresponding tolerance for edges of the road way & lower of pavement shall be +_40 mm.
(b) Longitudinal profile: The levels of the sub-grade & different pavement courses as constructed shall not vary from these calculated with reference to the longitudinal & cross-profile of the road

shown on the drawings or as directed by the Engineer-in-charge, beyond the tolerance mentioned below:

Sub-grade	+-25 mm
Sub-base	+-20 mm
Base Course	+-15 mm
Wearing Course	+-10 mm

Provided, however, that the negative tolerance for wearing course shall not be permitted in conjunction with the positive tolerance for base course if the thickness of the former is thereby reduced by more than 6 mm.

B-9.3 QUALITY CONTROL TESTS DURING CONSTRUCTION.

1.General: The materials supplied & the works carried out by the Contractor shall conform to the specifications prescribed Clauses.

For ensuring the requisite quality of construction, the materials & works shall be subjected to quality control tests, as described hereinafter, by the Engineer-in-charge. The testing frequencies set forth are the desirable minimum & the Engineer-in-charge shall have the full authority to carry out tests as frequently as he deem necessary to satisfy himself that the materials & works comply with the appropriate specifications.

Test procedures for the various quality control tests are indicated in the respective sections of specification or for certain tests within this section—

Where no specific testing procedure is mentioned for quality control, tests shall be carried out as per the prevalent accepted engineering practice to the direction of the Engineer-in-charge.

2. Tests of earth work for Embankment Construction:
2.1. Borrow material:

(a) Sand Content IS. 2720(Part IV)
two tests per 3000 cu.metres of soil.
(b) Plasticity Test IS 2720 (Part V)
Each type to be tested 2 tests per 3000 cu. metres of soil.
© Density test I.S 2720 (PartVII)
Each type of soil to be tested 2 tests per 3000 cu.metres of soil.
(d) Deleterious Content Test Is: 2720 (part XXVII)
As and when required by the Engineer-in-charge.
(e) Moisture Content Test IS: 2720 (Part I)
One test for every 250 cu. metres of soil.
(g) CBR Test on materials to be incorporated in the sub-grade on soaked/un-soaked samples IS. 2720(Part XVI) one test for every 3000 m3 at least or closure as & when required by the Engineer-in-charge.

2.2 Compaction control: Control shall be exercised by taking at least one measurement of density for each 1000 square metres of compacted area, or closer as required to yield the minimum number of test results for evaluating a day's work on statistical basis. The determination of density shall be in accordance with IS: 2720 (Part XXVII).Test location shall be chosen only through random sampling techniques. Control shall not be based on the result of any one test but on the mean value of a set of 5-10 density determinations. The number of tests in one set of measurements shall be 5 as long as long as it is felt the sufficient control over borrow material & the method of compaction is being exercised. If considerable variations are observed between individual density, results the minimum number of tests in one set of measurement shall be increased to 10. The acceptance criteria shall subject to the condition that the mean dry density is not less than the specified density plus.

(1.65 - 1.65
---------- 0.05) x standard deviation.
(no of samples)

However, for earthwork in shoulders (earthen) & in top 500 mm portion of the embankment below the sub-grade, at least one density measurement shall be taken for every 500 square metres of the compacted area provided further that the number of tests in each set of measurements shall be at least 10. In other respects the control shall be similar to that described earlier.

3.Tests on Sub-bases and Bases: (excluding bitumen bound bases).

The tests & their frequencies for the different types of bases & sub-bases shall be as given in the following Table. The evaluation of density results for compaction control shall be on lines similar to those set out in 2.2 above.

CONTROL TESTS AND THEIR FREQUENCY FOR SUB-BASES AND BASES (EXCLUDING BITUMEN BOUND BASES)

Sl No	Type of Construction	Test	Frequency
1.	**Granular and Mechanically Stabilised Soil Sub-bases**	i) Gradation	One test per 200m3.
		ii) Atterberg's limit.	-do-
		iii) Deleterious constituents.	As required.
		iv) CBR test on a set of 3 specimens.	As required.
		v) Moisture content prior to compaction.	One test per 250 m2.
		vi) Density of compacted layer.	One test per 500 m2.
2.	**Lime/Cement Stabilised soil Sub-base.**	i) Purity of lime (for lime soil stabilization).	One test for each signment subject to a minimum of one test

			per 5 tonnes of lime.
		ii) Lime/Cement content.	Regularly through procedural checks.
		iii) Degree of pulverization.	Periodically as considered necessary.
		iv) Moisture content prior to compaction.	One test per 250 m2.
		v) Density of compacted layer.	One test per 500 m2.
		vi) Deleterious constituents.	As required.
		vii) CBR test on a set of 3 specimens.	As required.
3.	**Water Bound Macadam and Wet Mix Macadam.**	i)Aggregate Impact Value.	One test per 200 m3 of aggregate.
		ii) Grading.	One test per 100 m3 of aggregate.
		iii) Flakiness Index.	One test per 200 m3 of aggregate
		iv) Atterberg's limits of binding material (for WBM only)	One test per 25 m3 of binding material.
		v) Atterberg's limit of portion of aggregate passing 425 micron sieve (For WMM only).	One test per 100 m3 of aggregate.
		vi) Density of compacted of layer (For WMM only)	One test per 500 m2 of aggregate.

B-10. SPECIFICATIONS OF BITUMINOUS BASES AND WEARING COURSES:

B-10.1 Preparation of Base for laying Bituminous base and wearing Courses.

(i)Scope: This work shall consist of preparing an existing water bound macadam, wet mix macadam or black-topped surface to specified lines, grade, & cross sections in advance of laying a bituminous course. The work shall be performed on such widths & lengths as may be directed by the Engineer-in-charge & may consist of scarifying & relaying the granular base course, filling of potholes &/or application of a profile corrective course (leveling course) as necessary.

(ii) Materials:

a) For Scarifying and relaying the granular base course:

The material used shall be course aggregate salvaged from scarification of the existing base course supplemented by fresh coarse aggregates & screening corresponding to water bound macadam or wet mix macadam as the case may be.

b) For patching Pot holes:

For patching potholes, the materials used shall be course aggregate, screenings, stone chippings, bitumen, Cationic bitumen emulsion or a combination thereof as specified, conforming to the quality requirements of these materials, depending upon the site requirements.

c) For profile corrective course:

A profile corrective course (leveling course) is essentially a pavement base material course for correcting the existing pavement profile which has either lost its shape or has to be given a new shape to meet the requirements of specified lines, grades & cross sections. It shall be differentiated from the strengthening course or other type of structural pavement course needs as a remedial measure against inherent deficient &/or distressed pavement. It is meant to remove the irregularity in the existing road profile only.

(iii) Types of profile corrective course material and their application:

The type of material for profile corrective course shall be decided based on its thickness & the type of pavement surface over which it is required to be placed for its suitability to work in conjunction with the existing pavement course material.

(iv) Profile corrective course is classified under the following broad categories of materials:

Type A: Premixed bituminous material corresponding to that explained under open graded premix carpet, excepting the seal coat.

Type B: Premixed bituminous material conforming

1.0. TECHNICAL SPECIFICATION FOR SANITARY & PLUMBING WORKS :

1.1. GENERAL :

All works shall be carried out as per standard engineering practices in proper workman like manner in general and as per Plumbing Services as laid down in the National Building Code of India 1970 and also according to the direction of the Engineer-in-charge. Unless otherwise specified in this section or in the description of item, the cost of all stages of works mentioned hereunder shall be deemed to have included in the rates of items provided in the schedule.

Rates appearing in the schedule of items are inclusive of cost of supplying, fitting, fixing of the respective materials and works involved in any floor, at any level and including all necessary joining materials and scaffolding to any height, tools & plants and all helping and all incidentals.

All rates include all carriages, handling and other incidentals, besides fitting, fixing and supply even though these may not be specifically/specially mentioned.

Items of works relating to building and road works, which may crop up, consequential to Sanitary and Plumbing works, shall be guided as per the rate for schedule & specification of items provided for road and building works and as per decision of the Engineer-in-Charge.

If in connection with Sanitary & Plumbing works etc. any item or items of work relating to building works or road works crop up, the Contractor shall, if so be directed, have to execute such items of work/works.

All cutting of holes, chases etc. at any place necessary in connection with work as per items in the schedule and subsequent mending damages as per original specification and as directed are included in the rates and shall not be paid extra, unless otherwise expressively specified.

The Contractor shall be responsible for the safeguard and proper maintenance to original good condition of all sanitary & plumbing works till all works are completed and formally handed over to the department.

All fittings shall conforms to standard laid down by the ISI and approved by the Engineer – in – Charge prior to their use.

The rates for Porcelain goods will be reduced by 25% for makes other than ISI specification. Brand of Porcelain goods will be approved by the Engineer –in – charge.

All the joints of plumbing and soil disposal system should be tested for leakage. The contractor will have to hire pumps, tanks and arrange for water or necessary materials and install temporary arrangements if necessary. The rate in the schedule are inclusive of these tests.

2.0. WATER SUPPLY :

2.1. Scope of Work

The work will generally refer to all items relating to water supply arrangements including supply of all materials, erection, testing and commissioning for business buildings/residential buildings/industrial buildings and similar type of structures, premises etc. at all level and location.

The work to be provided for by the Contractor shall include but not be limited to furnishing all labour, service, supervision, materials, tools and plants, equipment and execution of all transportation, handling, hoisting, preparation of layout, installation, erection, painting, treatment, testing, protection, maintenance, temporary works, approach and all other incidental works etc. for the use and purpose of the item of works under the scope of the contract.

The Contractor shall execute works by licensed plumbers where necessary and shall obtain all necessary sanctions, permission, certificates etc. from other related Authorities and shall also pay necessary charges for the same.

2.2. MATERIALS

Under the scope of this specification, pipes, pipe fittings, specials, etc. may be of any or combination of the following types; (i) Cast Iron pipes; (ii) Galvanized iron pipes;

All materials, fittings, fixtures, appliances used for permanent work shall be of best quality and of reputed manufacturers conforming to relevant, Indian Standard Codes. Samples and each and every type of item to be used in permanent works shall be produced to Engineer for approval soon after placement of work order and approved items shall be produced well ahead of their requirement to avoid non-availability of required type and quantity during actual execution. Any change in quality of materials from specified and approved types shall be

considered as unauthorized and shall have to be replaced by approved types at any stage of work prior to final acceptance of the total work.

All G.I. pipes are to be medium quality of 'TATA' or similar standard. If pipes are non 'TATA' manufactured, they must be got approved prior to their use by the Engineer-in-Charge.

All fittings shall conform to standard laid down by the ISI and be approved by the Engineer-in-Charge prior to their use.

The weight of different nominal bore GI pipes shall be as per details given below:-

Nominal bore	weight of pipe in Kg./rm		
	Light	Medium	Heavy
15 mm (1/2")	0.96	1.23	1.46
20 mm (3/4")	1.42	1.59	1.91
25 mm (1")	2.03	2.46	2.99
32 mm (1 ¼")	2.61	3.11	3.87
40 mm (1 ½")	3.29	3.65	4.47
50 mm (2")	4.18	5.17	6.24
65 mm (2 ½")	5.92	6.63	8.02
80 mm (3")	6.98	8.64	10.30
100 mm (4")	-	12.40	14.70

2.3 INSTALLATION

While basic layout may be available in the drawings provided by the Owner, the details shall have to be supplemented by the contractor for approval of the Engineer-in-Charge prior to execution. Fittings meant for operation shall be located and oriented to allow easy reach and smooth operation. Maintenance, repairs and replacements of pipes, fittings and fixtures must be conveniently possible.

All cast iron soil pipes, waste pipe and vent pipes should conform to ISI standard. Other fittings etc. should conform to the Indian Standard specifications.

2.4 LAYING OF PIPE LINES

2.4.1. Over ground Piping

In addition to fulfilling of the functional requirements all pipelines shall be laid true to line, plumb and level. Meticulous care shall be taken to avoid chances of air lock and water hammer. Pipes shall be laid on continuous unyielding surface or on reliable supports at least one near each joint or a spacing directed by the Engineer. The support must be strong, neat and shall have provisions for securing the pipes in every direction and easy maintenance. Pipes shall be encased or concealed in masonry or concrete if shown in drawings or as directed by the Engineer. The lay-out of pipe work should be such that there is no possibility of back flow towards the source of supply from any cistern or appliances, whether by siphonage or otherwise. All pipe works shall be so laid or fixed or maintained as to be and to remain completely water tight there by avoiding waste of water , damage of property and the risk of contamination of the water conveyed.

2.4.2. **UNDER GROUND PIPING**

Underground piping shall be laid at such a depth that it is not likely to be damaged by traffic and other loads. All excavation work necessary for the work shall be done in any type of soil upto required depth and width suitable for laying work, testing etc. including shoring, de-watering as necessary. The excavated material shall be kept for refilling trenches. Excavation for crossing roads, structures, pavements etc. shall be carefully done without imparing to stability of adjacent structures. The bottom of the trench excavated shall be carefully trimmed and prepared in such a manner so that the pipes when laid are well embeded for their entire length on a firm surface and are true to line and gradient. Back filling of the trenches shall be done with selected fine earth and unless otherwise permitted, in 150 mm layers and carefully consolidated, so as to prevent subsequent movements of pipes. When the excavation is in rock, the bottoms shall be cut deep enough to permit the pipes to be bedded on a layer of fine selected material or concrete to avoid local point support. After back filling the top surface shall be restored identical to adjacent surface including mending good all damages as necessary.

While there is a gradient, pipe laying shall proceed in an upward direction to facilitate joint making. Except in case of small pipes under low pressure, thrust blocks of concrete shall be formed at all bends to transmit the hydraulic thrust on to disturbed ground and spread it over a sufficient area. When the thrust is in upward direction, anchor blocks of sufficient weight shall be provided to which the pipes shall be secured with steel straps. (Thrust Blocks or Anchor Blocks will be separately paid).

2.4.3. **CONCEALED PIPING**

Where desired by the Engineer or shown on the drawings the pipes shall be concealed in masonry or concrete of the structure. The Contractor shall prepare chases, openings, ducts as necessary and will rectify and make good after laying and testing of the concealed pipelines.

3.0. **JOINING OF PIPES**

Joining of pipes shall be completely leak- proof and durable. Instruction of the manufacturer shall be followed. Usual recommended practices are stated below for guidance :

3.1. **CAST IRON PIPES**

Cast iron soil pipes and fittings with the joints to be done by either of the two methods as specified below :-

(a) The half of the depth of the annular space between the spigot and socket shall be packed with tarred gasket and the remain half will be filled up three quarter with valamoid or similar compound and the top quarter with cement – mortar (4:1) and shall be finished bevelled at 45 deg.

Or,

(b) The half of the depth of the annular space between the spigot and socket shall be packed with spun yarn or tarred gasket and remaining half to be filled with molten lead wool caulking with caulking tools, and finished upto the edge of socket. After completing the joint it shall not be allowed to move.

Approximate weight of lead and yarn required for joints of various sizes of C.I. pipes and specials shall be as under :

Dia of Pipes	Lead/Joint	Spun Yarn/Joint
80 mm	1.8 Kg.	0.10 Kg.
100 mm	2.2 Kg.	0.18 Kg.
150 mm	3.4 Kg.	0.20 Kg.
200 mm	5.0 Kg.	0.30 Kg.

3.2 G.I. PIPES

G.I. pipes, fittings, valves and cocks shall be jointed with jute and white lead paint of approved quality. Threads shall be cut with sharp tools and before jointing all scales shall be removed from pipes by suitable means. The screw threads of the pipes shall be cleaned and the joints made by screwing with fittings after treating the threads with approved pipe jointing compound.

3.3 RIGID (UNPLASTICISED) PVC PIPES:

Rigid PVC pipes are widely accepted for applications such as cold water services internal/external water supply systems, water mains, rain water system, soil waste piping system, underground(sewerage pipes), drainage piping system. Rigid PVC is three times as rigid as polyethylene. It is also much stronger and will withstand much higher pressure for a given wall thickness. Joints can easily be made in rigid PVC pipes by solvent welding and a whole range of injection moulded matching fittings and specials are available for these pipes.

Rigid PVC pipes are normally available in the following shades:
-White/Cream, - light to dark grey, - black.-blue

In general Rigid PVC is resistant to most inorganic acids, alkalines and salts, as well as many organic chemicals. It quite resistant to most effluents, salt water and plating solutions, corrosive fumes, soils and the like which leads to its application over a wide field. The material is also perfectly safe with potable water, whether hard or soft, and in the former cases it tends to retard the formation of scale. Those materials which do attack it include concentrated oxidizing acids, ester, ketones, aromatic and chlorinated hydrocarbons, organonitro compounds, organo-amino compounds, lacquer solvents and acetic anhydride.

The pipes shall be reasonably round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of the pipes shall be smooth and clean, free from groovings and other defects. The end shall be cleanly cut and square with the axis of the pipe. The pipe shall be designated by external diameter and shall conform to I.S. 4985 Revised in all respects.

Fittings used shall be of the same make as that of the PVC pipes, injection moulded or made in cast iron and shall conform to Indian Standard wherever available.

Laying and Jointing of Unplasticised PVC (external work)

For satisfactory service performance or plastic pipes under conditions of use, the following points must be kept in view while undertaking installations of plastic piping system:

i)The plastic materials are thermoplastic in nature and must not be used in contact with hot surface (or hot water)

ii) They must be supported at regular intervals for above ground installations.

iii) Allowance must be made, during installations for their expansion, particularly by using loose clips/clamps.
The trench bottom on which the pipes are laid, should be carefully examined for the presence of hard objects such as flints, rock projections or tree roots, etc. PVC pipes are bedded in sand or soft soil free from rock and gravel. The back-fill 15 cm above the pipe should also be of fine sand or soft soil. These pipes should not be painted. The width of trench should not be less than outside diameter of pipe plus 30cm in case of gravel soils. Pipes should be laid at least 90cm below the ground level(measured from surface of the ground to top of the pipe).

Where joining of PVC pipes is concerned, any one of the two methods can be employed:

i) Solvent welding joints
ii) Rubber ring joints

Solvent Welding Joints

It is non-heat application method. In this method, instead of forming a socket on one pipe, an injection moulded socket fitting or coupler is used. These sockets & couplets have provision to take in the pipes at both ends. The solvent cements are applied on the surfaces to be jointed & the joint is made at ambient temperatures.

Injection moulded fittings only should be used in preference to fabricated fittings. Full load on the joints should be applied only after 24 hr. The pipe is cut perpendicular to the axis of the pipe length, with a metal cutting saw or an ordinary hand saw with small teeth. Pipe ends have to be beveled slightly with a beveling tool (reamer) at an angle of about 30 degrees. The total length of insertion socket (injection moulded socket or coupler) should be marked on the pipe. Attempt should be made to push the pipe to the marked distance, if not possible it should at least be pushed for two-thirds of this distance.

Dust, oil, water, grease, etc. should be wiped out with a dry cloth from the surface. Further grease should be thoroughly removed with a suitable solvent, such as methylene

chloride; or as an alternative, the outside surface of the pipe & inside of the fitting may be roughened with emery paper.

Generous coatings of solvent cement should be evenly applied on the inside of the fitting all round the circumference for the full length of insertion & on outside of the pipe and up to the marked line with non-synthetic brush. The pipe end up to the marked line with non-synthetic brush. The pipe is pushed into the fitting socket & held for 1 or 2 minutes, as otherwise the pipe may come out of the fitting due to slippery quality of cement & the tapering inside the bore of the fitting. The surplus cement on the pipe surface is wiped out. If the solvent cement has dried up too much or the tapering of the socket is too steep, joining will not be proper & the pipe will come out of the fitting.

In summer months, the joint should be made preferably early in the morning or in the evening when it is cooler. This prevents the joint from pulling apart when the pipe cools off at night. Heat application method for jointing should not be adopted.

Rubber Ring Joints

They can provide a watertight seal but do not resist the pull. As such, these joints are used only as repairs collar & for jointing pipes larger than 110mm. Such joints may be provided on pipes which are buried in the ground & supported throughout on a bedding, so that they are not subject to movement & longitudinal pull.

The ring is housed in a groove formed in plastic or metallic housing. The rubber is compressed & forms a seal between the pipe & the housing. The shape of ring & the method of compressing the ring vary considerably in different type of joints.

Most joints often require the application of lubricating paste. The rubber ring joints can be either with spigot & socket or with separate collar pieces having two rubber rings, one at either end.

The ringtite pipes are specially designed with built-in rubber sealing ring where the pipe-line crosses a road or a drain, it should be through CI or RCC pipe. The valves & hydrant tees should be properly supported so that torque applied in operating a valve is not transmitted to the pipe-line.

Solvent welded pipe should not be pressure tested until at least 24 hours after the last solvent cemented joint has been done. All control valve should be positioned open for the duration of the test & open end closed with water tight fittings. The testing pressure on completion of the work should not be less than one and a half times the working pressure of the pipes .

Pressure should be applied either by hand pump or power driven pump. Pressure gauges, after being correctly positioned should be carefully observed to ensure that at no time, the test pressure exceeds. The system is slowly & carefully filled with water to avoid surge pressure or water hammer. Air vents should be open at all high points so that air may be expelled from the system during filling.

When the system has been fully charged with water & air displaced from the line, air vent should be closed. The pipe-line is initially inspected for seepage at joints 7 firmness of supports under load. Pressure may then be applied until the required test pressure is reached. In general, the test pressure should not fall more than 0.2kg/sq.cm at the end of one hour test duration.

4.0. PAINTING

All pipes (G.I., C.I., water main or soil) with fittings and specials shall have to be painted outside with two coats of paint of approved brand and shade of normal gloss. No separate payment shall be allowed on this account and rates of respective items shall be deemed to be inclusive of painting works. Painting shall be done only after inspection and testing of pipelines and receipt of formal order from the Competent Authority.

5.0 VALVES, COCKS, BIBS, TAPS :

All valves, stopcocks, taps etc. shall conform to relevant Indian Standard Specifications and shall be best quality from approved manufacturers. These shall be suitable for working mentioned in schedule. Nominal size and material shall be as indicated in the schedule.

6.0. TESTING

6.1. INSPECTION BEFORE INSTALLATION

All pipes, fittings, and appliances shall be inspected before use to see whether they conform to accepted standards. Defective items shall be clearly marked for rejection and forth with removed from the site.

6.2. TESTING OF MAINS AFTER LAYING

After laying and jointing, the mains shall be slowly and carefully filled with water so that all air is expelled from the main and allowed to stand water filled for a few days and then tested under pressure. The test pressure shall be 5 Kg./sq.cm. or double the maximum working pressure, which ever is greater. The

Pressure shall be applied by means of manually operated test pump, or in the case of long mains or mains of large diameter, by a power driven test pump. In either case due precaution shall be taken to ensure that the required test pressure is not exceeded. The test pressure shall be maintained for at least five minutes.

6.3. TESTING OF SERVICE PIPES AND FITTINGS :

The service pipes shall be slowly and carefully filled with water allowing air to escape and avoiding all shocks or water hammer. The service pipe shall then be inspected under working conditions of pressure and flow, when all draw off taps are closed, the service pipes shall be absolutely water tight. All pipings , fittings and appliances shall be checked for satisfactory support and protection from damage, erosion and frost.

7.0. MEASUREMENT FOR PAYMENT :

The pipes of different nominal bores shall be measured separately in fitted condition along the center line of pipe in length inclusive of sockets, special fittings etc. in position. Unless specifically indicated in the schedule of items supports, cutting, chases, holes and rectifications, painting two coats, testing and commissioning shall be deemed to be included in the contract, item shall not be separately paid for. Tanks, valves, specials, fittings, fixtures shall be separately measured and paid for in case these items are not included in complete assembled items of work.

8.0. **DRAINAGE AND SANITATION :**

8.1. SCOPE OF WORK

The work will generally refer to all items relating to laying and construction of drains and works relating to foul water, surface water and sewerage and including supply, erection, installation, testing of pipes, fixtures and associated works for buildings, structures, premises etc. at all level and location.

The work to be provided for by the contractor shall include but not be limited to furnishing all labour, service, supervision, materials, tools and plants, equipments and to execute all transportation, handling, hoisting, preparation of lay out, installation, construction, erection, painting & treatment as directed, testing, commissioning, protection, maintenance, temporary works, approach and other incidental works etc. for use and purpose of the item of works in the schedule under the scope of the contract.

8.2. MATERIALS

All materials necessary for construction related to this specification of works have been specified elsewhere under this section, other materials are specified hereunder in the respective item of work. In absence of details of materials under this specification or in the schedule of items, shall be available in relevant I.S.Code.

8.3. INSTALLATION :

SOIL AND DRAINAGE PIPES

8.3.1. LAYING :

Each separate pipe shall be individually set for line and for level, where lengths of sewer or drain pipes are laid in trench. Properly painted sight-rails shall be fixed across the trench at approved locations. The excavation shall be boned in at least 2m apart. Each pipe shall be separately and accurately boned between sight rails.

8.3.2. SUPPORTS :

All pipes shall be laid with sockets opposite to flow and shall preferably rest on solid and even foundation s for full length of the barrel. To achieve full and continuous support, concrete for bedding and packing shall be made. Where pipes are not bedded on concrete, the floor shall be left slightly high and carefully placed so that the pipe barrels rest on undisturbed ground. Where laid on rock or very hard ground which cannot be easily excavated to a smooth surface, the pipes shall be laid on a saddle of cement concrete or as desired by the Engineer-in-Charge.

When earth cover is less than 2 meters or pipes are unavoidably exposed above ground, laid in soft soil, the glazed stoneware pipes shall be completely encased or surrounded with concrete, unless otherwise directed in the schedule of item or by the Engineer. Vitrified clay pipes shall be laid on a bed of 150mm thick cement concrete (1:3:6) nominal mix. Cast iron pipes and concrete pipes shall be supported on suitable unyielding concrete or brick supports. At least one support shall be located close to the end. Spacing of intermediate supports shall be as decided by the Engineer-in-Charge. Pipes shall be secured to the supports by approved means.

8.3.3. ENTRY INTO STRUCTURES :

For entry of the pipelines into any building or structures suitable conduit or sleeve under the structures shall be used. The conduits and sleeves shall be such as to allow easy repairs and replacement of the pipes, when openings or chases are required to be made in the structure for entry of pipelines. Locations and sizes shall be marked and checked by the Engineer-in Charge. After laying of the pipe line the openings and chases shall be mended and finished identical to adjoining surface, at Contractor's cost.

8.3.4. DUCTS :

Where soil, waste and ventilating pipes are accommodated in ducts, access to cleaning areas shall be provided. Connection to drain shall be through a gully with sealed cover to guard against ingress of sewer gas, vermin or back flow.

8.3.5. TRAPS AND VENTILATING PIPES :

Pipes for carrying off the waste from the water closets and waste water and overflow water from the baths, wash basins, sinks to drains, shall be trapped immediately beneath such fixtures. Traps shall have minimum water seal of 50mm and shall be ventilated whenever such ventilation is necessary to maintain water seal of the trap.

Ventilating pipes shall be carried up vertically from the drain to a height of at least 600mm above the outer covering of the roof of the building or as shown in the drawings. All vertical ventilating, anti-syphonage and similar pipes shall be covered on top with a cowl. The cowl shall be made of cast iron unless desired otherwise by the Engineer.

8.3.6. MANHOLES AND INSPECTION CHAMBERS :

The maximum distance between manholes shall be 30 meters unless otherwise indicated. In addition, at every change of alignment of gradient or diameter there shall be one manhole or inspection chamber. The distance between manhole or inspection chamber and gully chamber shall not exceed 6 meters unless desired otherwise. Manhole shall be usually covered with C.I. watertight cover, sufficiently strong and of enough dead weight to withstand pressure and shock. The bottom of the chambers shall be plastered with 1:2 cement:sand mortar and finished smooth to the grade and connecting channels, drains shall be shaped and laid to provide smooth flow.

8.3.7. CUTTING OF PIPES :

Manufacturer's instructions shall be followed for cutting of pipes where necessary. Suitable and approved tools shall be used for the cutting so as to leave surface clean and square to the axis of the pipe.

8.3.8. JOINTING :

Jointing of laid pipes shall be planned as to avoid completely any movement or strain to the joints. All joints between pipes and fittings and manholes shall be gas tight when above ground and water tight when under ground.

Method of jointing shall be on following instructions of manufacturer's and usually as per details stated hereunder.

a) Cast Iron pipes :

Please refer 3.1.(a) jointing of cast iron pipes in the specification of water supply.

b) Glazed Stoneware Pipes :

Tarred gasket or hemp yarn soaked in thick cement slurry shall be first placed round the spigot of each pipe and the spigot shall ten be placed into the socket of the pipe previously laid. The pipes shall then be adjusted and fixed in the correct position and the gasket caulked tightly so as not to fill more than ¼ of the total depth of the socket. The remainder of the sockets shall be filled with stiff mixture of cement mortar 1:1 proportion and worked to form a fillet round the joints at an angle of 45 deg. with the barrel. The newly made joints shall be protected, until set, from sun and rain and shall be cured with damp jute pad or other suitable materials.

9.0. TRENCHES AND OTHER EXCAVATIONS :

Width of the trench at the bottom shall be such as to provide 200mm clearance of either side of the pipes for facility of laying and jointing. Excavated materials shall be stacked sufficiently away from the edge of the trench to avoid collapse of side earth in trench and will be used for back filling the trench.

Turf or other surface material shall be set aside carefully during excavation and re-installed after filling the trench properly matching with adjoining surface, when and where necessary effective and efficient arrangements for de-watering

and shoring shall be made to keep the excavation pit dry and trench protected.

Special care shall be taken to avoid damage of under ground services, cables etc. . These when exposed shall be kept adequately supported, till back-filling of the area.

The back-filling shall be done only after the pipelines has been tested and approved by the Engineer-in-Charge, special care shall be taken under and sides of the pipe during hand packing with selected materials. At least 300mm over the pipe shall also be filled with soft earth or sand. Consolidation shall be done in 150mm layers. The surface water shall be prevented from getting to the filled up trench. Heaping up unduly the back-filling material causing in-convenience to traffic & public shall not be made but all future settlements shall be made good regularly.

10.0. FIXTURES :

All fixtures and fittings shall be of approved quality and must bear identification mark of the type and manufacturer. All fixtures shall be adequately protected, covered and plugged till handed over.

All vitreous china fittings shall be manufactured by 'Neycer'/ G.M.B./ Khedyar/ 'Cera' bearing ISI Certificate mark.

10.1. WATER CLOSET

10.1.1. European Pattern Water Closet :

It shall include glazed stoneware basin with syphon, open front, Bestolite seat and cover, low level PVC cistern, supply, connection and with necessary fittings.

10.1.2. Squatting Type Indian Water Closet :

It shall include glazed stoneware pan with integrated foot rests and low level PVC Cistern, supply, connections and with necessary fittings.

10.2. URINALS :

It shall consists of flat back front lipped type glazed stoneware urinal, porcelain vitreous automatic flushing cistern complete with supply, connections, flush pipe, PVC pipes, gratings and all other necessary fittings, Automatic flushing shall be approximately once in every five minutes. A number of urinals located together

may be served by one cistern of adequate capacity. All fittings shall be chromium plated.

10.3. WASH BASIN :

It shall be made of glazed stoneware. The basin shall be flat back, wall hung by painted cast iron brackets and complete with C.P. over brass faucets, nylon washers, C.P. chain, rubber plug, waste, waste washer, PVC waste pipes with traps, with necessary fittings. All fittings including faucets shall be chromium plated, unless otherwise desired.

10.3. SINK :

It shall be made of glazed stoneware/mosaic/stain less steel. It shall be hung by Painted cast iron brackets and complete with one brass faucet with nylon washers, chain, waste, waste washers, PVC waste pipes, with traps and with necessary fittings. All fittings, including faucets shall be chromium plated, unless otherwise desired by the Engineer-in-Charge.

10.4. BATHROOM MIRROR :

Unless otherwise desired it shall be made of the best quality 6mm thick indigenous glass. It shall be wall mounted with adjustable revolving brackets. The brackets, screws and other fittings shall be chromium plated or as directed by the Engineer-in-Charge.

10.5. GLASS SHELVES :

Unless otherwise desired glass shelves shall consist of 6mm thick clear glass with guard rails and shall be wall mounted with brackets. All brackets, guard rails and screws shall be chromium plated.

10.6. TOWEL RAIL :

Unless otherwise desired towel rails shall be 20mm dia. chromium plated brass pipes wall mounted with concealed brackets. The brackets, screws etc. shall also be chromium plated.

10.7. SOAP TRAY

Unless otherwise desired it shall be of porcelain as per shape. The holder shall be wall mounted with chromium plated brackets and screws.

10.8. LIQUID SOAP DISPENSER :

Unless otherwise desired it shall be round and easily revolving with removable threaded nozzle. The body, bracket for wall mounting and screws shall be chromium plated.

11.0. TESTING :

11.1. INSPECTION BEFORE INSTALLATION :

The method of actual tests shall be as decided by the Engineer-in-Charge. All tests data shall be recorded and submitted to the Engineer-in-Charge, for review and instructions. The Engineer's decision regarding tolerance shall be final. General procedure of testing shall be as per details indicated below :

11.2. SMOKE TEST :

All soil pipes, waste pipes, and vent pipes and all other pipes when above ground shall be approved gas tight by a smoke test conducted under pressure of water and maintained for 15 minutes. All the traps are filled with water before starting the smoke test. A smoke testing machine consists of a length of flexible rubber tubing and below. The smoke is made by firing oily waste (brown paper or cotton waste soaked in creosote). Chemical smokes are not satisfactory. Smoke is pumped into drains and pipes through a gully outside the house or an inlet ventilator, or through a clay plug in an inspection chamber. In making a smoke test, the top of the soil and ventilating pipes are left open until smoke is seen to issue, when the openings are plugged securely with wet cloth or wet clay tied in a cloth, and the smoke is pumped in for some considerable time.

11.3. WATER TEST :

11.3.1. For Pipes Other Than Cast Iron :

Glazed stoneware and concrete pipes shall be subjected to a test pressure of at least 1.5m head of water at the highest point of the section under test. After the joints have properly dried (for at least seven days) and before filling the trenches, the pipes should be tested for water-tightness by filling the pipes with water to the level of 1.5m above the top of the highest pipe in the length to be tested, by closing the ends of the sections and maintaining this water level for one hour. Earthen ware pipes should not be subjected to a head of more than 3m of water. A plug is inserted at the lower end of each length and a right angled bed at the top and funnel fixed by a rubber tube or testing rubber plug is used. (A drain is a

cylindrical bag of rubber and canvas to which a tube and a tap/valve is fixed at one end. Air is pumped into the plug which is inflated and blocks the passage of water. If these plugs are not available use a wad of clay supported by a disc of wood). After air bubbles have escaped after the first filling and absorption has ceased, water is again added to completely fill the pipe.

A slight amount of sweating which is uniform may be overlooked and a small amount of subsidence not to be taken as implying bad workmanship or defects. Absorption is at a diminishing rate of subsidence till no further subsidence takes place.

A tolerance figure of two liters per cm. dia. per kilometer may be allowed during a water filled period of 10 minutes. It is considered satisfactory if the water level does not fall more than about 14mm in a length of 100m. The water placed in the pipe should not be drained out until the trenches have been filled in about 90cm. to detect if any joints have given away during the filling, or alternatively, the test should be repeated after back filling the trench. In case of leakage, the defective part of the work shall be cut out and made good.

11.3.2. FOR CAST IRON PIPES :

Cast Iron sewers and drains shall be tested as for glazed ware and concrete pipes. The drain plug shall be suitably strutted to prevent their being forced out of the pipe during the test.

11.3.3. FOR STRAIGHTNESS :

(a) By inserting at the high end of the sewer or drain a smooth ball of diameter 3mm less than the pipe bore. In the absence of obstruction, such as yarn or mortar projecting through the joints, the ball will roll down the invert of the pipe and emerge at the lower end;

(b) By means of a mirror at one end of the line and a lamp at the other end. The mirror will also indicate obstruction in the barrel if the pipe line is not straight.

11.3.4. FIXTURES ETC. :

All fixtures and fittings shall be connected by water tight joints. No dripping shall be accepted.

12.0. MEASUREMENT FOR PAYMENT :

For method of measurement regarding work under scope of this specification I.S. : 1200 (Part-XVI) shall be followed unless contrary to the following :

12.1. TRENCHES :

Item of lead, lift, de-watering, dressing, shoring, back-filling, consolidation, etc. that may be required in this section.

12.2. CONCRETE, MASONRY :

Unless included with the related items in the schedule, these items shall be separately measured and paid for under relevant items.

12.3. PIPE WORK :

The pipes of different nominal bores shall be measured separately in length inclusive of sockets, specials, fittings, etc. in position.

Unless specifically indicated in the schedule of items, specials, fixtures, supports, cuttings, chases, holes and rectification shall be deemed to be included in the completed item and will not be separately measured and paid for.

12.4. FITTINGS & FIXTURES :

Where applicable fittings and fixtures shall be measured for the complete item inclusive of anchors, brackets and fasteners as required and paid for in the relevant item.

12.5. CHASES AND HOLES :

Cutting chases, holes etc. and making good for any works shall be deemed to be included within the scope of relevant complete item and will not be separately measured for payment.

12.6. **PAINTING**:

Two coats of approved compatible paint as directed by the Engineer-in -Charge shall be deemed to be included within the scope of related complete item and will not be separately measured for payment.

DISINFECTION OF WATER TANKS

The storage tanks shall be filled with water and thoroughly flushed out; the tank shall then be filled with water again and disinfecting chemical containing chlorine added generally while the tanks are filled to ensure through mixing. Sufficient chemical shall be used to give water a dose of 50 parts of chlorine to one million parts of water. If ordinary bleaching powder is used the proportion will be 150 gms of powder to 1000 liters of water. The powder shall be mixed with water to a creamy consistency before being added to the water in the tank. When the tank is full, the supply shall be topped and all the taps on the disturbing pipes opened successfully working progressively away from the tank. Each tap shall be closed when the water discharge begins to smell of chlorine. The tank shall then be topped up with water from the supply pipeline and with more disinfecting chemical in the recommended proportions. The tank and pipes shall be thoroughly flushed out before any water is used for domestic purpose.

SPECIFICATION FOR SINKING OF TUBEWELL

GENERAL :

This specification comprises the supply of all materials, labour and all appliances etc. including tools and plants for sinking of the tube-well to the required depth and for testing the yield of the tube-wells on completion of all works as specified and detailed in the Schedule of Items and Quantities for the work After the satisfactory completion of the Tube-Wells including withdrawing drilling pipes, the Contractor shall remove surplus materials, tools and plants etc. and restore the site to the original good condition. All other works incidental to the above shall have to be executed by the contractor for which no extra payment will be made.

Indian Standard Specification IS 2800-1964 is to be followed strictly unless otherwise specified.

Tenderers are strongly advised to inspect the site/sites before tendering and get themselves acquinted with the condition, access, availability of water for sinking of the tube-well. No extra claim on ground of insufficient data and lack of knowledge of site conditions shall be entertained at a later date.

The contractor shall have to clean the site/sites from jungles, wood etc. and this shall be included in their unit rates. No separate payment will be made on this account. The raea of operation will be available for use to the contractor till the final Yield Test of the tube-wells is carried out. After completion of the work, the contractor shall remove all plants and machinery and all ancillary structures and shall make good any damage which might have caused to such land.

DRILLING :

Sinking of tube-well shall be done by direct rotary rig drill machine with required dia. drill. Rotary or Churn drills are frequently employed fro drilling wells in almost all formations encountered hard or soft rock strata. Power driven machines are used with tripod or four legged derrick. Drilling is accomplished by rapidly rotating a pipe fitted with a toothed cutting shoe at the lower end. The two types of drills in common use are diamond drills and shot-drills.

The drills used in boring vary much in shape, quality and hardness and range from soft steels to diamond drills, which will drill through the hardest rock formations. Rotary rigs perform the two operations of breaking, loosening, grinding and removal simultaneously.

Water is continuously pumped into the well under pressure through holes in the cutting shoe to rise to the surface between the side of the hole and carrying with it the loosened material, all formed into mud or slush. The mud or slush plays an important role in the drilling . The mud keeps the open hole from caving during the drilling process due to its weight and viscosity aided by plastering action of the rotary drill pipe.

If the contractor uses pipes for the purpose of casing or to have some security during the drilling operation, no additional claim under such circumstances shall be entertained.

Bentonite clay should not normally be used during drilling and approval of the Engineer-in- Charge must be obtained prior to use of the Bentonite clay.

The complete tube-well assembly shall be placed vertically inside the casing pipe and a deviation upto 10cm in 30m from the plumb will be permitted where submersible pumps are not to be installed. Incase the tube-wells, specially where submersible pumps are to be used, the tube-well must be strictly vertical to avoid hammering. Housing pipe should be erected in such a manner that it should be above 450mm above ground level with a 150mm tolerance. Blank pipe 3m long at the bottom of the slotted pipe shall have to be used.

SLOTTED PIPES :

For standard tube-wells, slotted pipes shall have vertical slots 75mm x 3mm providing for a total area of not less than 15% inside pipe surface of the slotted pipe. If in consideration of sub-stratum formation the Engineer desires that the slots should be 75mm x 1.5mm, the contractor shall have to provide 75mm x 1.5mm slots for which no extra payment will be made. The slots should be milled and not punched. Slotting with oxy-acetylene flame or any perforation shall not be allowed. If slotted pipes are to placed for more than one stratum, the same shall be allowed but not length of pipe less than 1.5m shall be allowed to be placed. The slotted pipe in a particular length of acquifier should be 600mm short on either end of the acquifier.

The section of the slots is trapezoidal, tapering with the wider end inside and narrow end outside and this wider opening inside prevents the sand from choking the perforations. The openings of a strainer should be less than the average diameter of the soil particles and small enough to prevent the entrance of any large quantity of sand.

SAMPLE OF UNDERGROUND FORMATION ;

Sample of underground formation shall have to be collected by the contractor from the drilled material at every 3m interval and at every change of layer. The collected samples must be placed in sample boxes with depth records and shall be constantly maintained at the site for inspection by the Engineer –in-Charge or his authorized representatives.

After completion of the tube-well, the contractor shall put the characteristic samples in glass tubes. This tube must be of uniform bore of 20mm dia. and the strata should be placed in the scale of 1/200. These are to be fixed on boards in suitable manner as per direction of the Engineer-in-Charge who will give instructions about the size of the boards, the fixtures, the denomination to be marked etc. and are to be handed over to the Engineer-in-Charge after completion of the tube-well. The tube must be given description symbols for the underground formations as per Indian Standards and the description of depth. No extra payment will be made for this and the cost on this account must be included in the overall cost quoted by the Tenderer.

If in course of sinking, suitable water bearing strata of inadequate depths are met with different layers, the strainers may be required to be placed in parts in different layers at the direction of the Engineer-in-Charge and his decision in this regard shall be final.

During drilling operation the Representative of the Engineer shall remain present at the site and take records of strata encountered and the final log chart shall bear the signature of the Representatives of the Contractor and the Engineer. After drilling the bore and examining the log chart the Contractor shall design the tube-well assembly and the design shall be submitted for approval to Engineer-in-Charge or to his authorized representative and in token of acceptance the design assembly chart shall bear the signature of the Engineer-in-Charge or his authorized representative as well as that of the representative of the Contractor. It is only, thereafter that the contractor shall start lowering the assembly inside the drilled bore. A representative of the Engineer shall always remain present during lowering of the tube-well assembly and he shall have to submit written document both signed by himself and by the contractor to the Engineer-in-Charge that the assembly as per design has been lowered in his presence. In case of any difference of opinion about the design of the tube-well assembly, the decision of the Engineer shall be final.

Depending on the sub-stratum formation, the tube-well assembly may have to be composed with non-standard length of pipes both for housing, tube-well pipes and for strainer portion. The contractor will be paid according to the actual length of pipe used in the assembly and lowered in the borehole. No extra claim for cutting pipes, making threads, jointing by welding etc. will be entertained. This should be included in relevant items of work.

GRAVEL FILLING :

After the tube-well assembly has been placed in position within the well bore, shrouding must be done with gravel of the correct size so that the finer particles of sand are not drawn into the interspaces. The packing of gravel should not be done with very coarse

gravel, but should be done with the size of gravel about 2.5 to 3 times the size of the sand of the strata. The shrouding should be graded to a uniform size and not a mixture.

The contractor shall arrange for gravel shrouding with best quality hard, well rounded quartzite gravel with uniformity co-efficient of 2 or less and in that context 90% gravel should be retained on a sieve of slot size to be used in the tube-well and then lowered in position after clearing and removal of all foreign materials.

The gravel filling should be started from the bottom of the borehole and should be continuously worked upto the level as may be decided by the Engineer-in-Charge or his authorized representative and thereafter annular space shall be packed with puddle clay upto ground level with good quality local earth as per direction of the Engineer-in-Charge.

The contractor shall be paid for gravel packing on the basis of the quantity of gravel with sinkage or shrinkage allowance in the stocks consumed in the work.

WATER REQUIRED FOR SINKING OF TUBE-WELL :

It will be the contractor's responsibility to procure water for drilling operations and drinking and other purposes of his working personnel by sinking tube-wells and installing temporary pipe lines at his own cost.

DEVELOPMENT OF TUBE-WELL ;

The object of well development is the removal of silt, fine sand and other such materials from a zone immediately around the well screen thereby creating larger passes in the formation through which water can flow more freely towards the well and the development process continued until the stabilization of sand and gravel pack is fully assured.

The well shall be developed either by surging, including washing and agitating or by over-pumping and back washing with airlift. Any other acceptable method, deemed fit by the Engineer-in-Charge, may also be adopted for development. The capacity of the pump emplyed for development should be capable of discharging fifty percent more than the rated yield of the tube-well so that the pump can be suitably utilized for developing the tube-well properly to give a clear and reasonably sand free discharge. The contractor shall finally overdevelop the tube-well to the extent of 20% (twenty percent) of the expected discharge or yield out in such over development draw down should not be allowed to exceed beyond 6 meters.

The development shall be considered complete if the final discharge water, when the tube-well is delivering rated discharge plus twenty percent extra due to over development is free from sand during the test run with a maximum tolerance of 5 (five) parts of sand in one million parts of water by volume after 20 (twenty) minutes of starting the pump, but the same content should, at no stage exceed 10 (ten)parts of sand per million parts of water by volume.

DISPOSAL OF PUMP WATER :

The water pumped from a borehole shall be disposed off in such a way as to ensure that no recharge of the acquifier can take place during the period of the pumping test. The contractor shall make his own arrangements for disposal or storage of the pumped water and these arrangements shall be subjected to the approval of the Engineer-in-Charge.

The water from an acidised borehole shall not be discharged to an area where there is a possibility of contamination of agricultural or domestic supplies unless the pH value is greater than 6.0 and the suspended solid concentration less than 100 ppm.

YIELD TEST :

The well shall be pumped at discharges of 25,30,40,50 litres/sec. In successive periods of two hours at each pumping rate. The well shall then be allowed to recover for a period of four hours. The contractor's attention is drawn to the need for maintenance of a steady discharge and for rapid change from one discharge value to another at each step. Water level shall be measured at intervals of time of one minute for the first ten minutes of pumping at a given rate, at five minutes intervals during the next fifty minutes and at half hour intervals thereafter. Particularly for the early measurements when water level is still varying rapidly care must be exercised to ensure that measurements are taken at the precise instant specified. On completion of the above the whole step test shall be repeated for another twelve hours.

On completion of the above a constant discharge pump test will be carried out for a period of twenty four hours.

In general this will be at a discharge of 25 litres/sec.(20,000 GPH) but the Engineer –in-charge may revise this figure in the light of the results of the step pumping tests. Measurements will be taken at the same time intervals as specified above.

On the completion of the above, pumping shall be stopped and the well allowed to recover a period of twelve hours. Measurements of draw-down shall be taken at the same time intervals after cession of pumping as were specified above.

In the event of a break-down in pumping during a test during a test, or a failure to maintain pumping at a sufficiently constant rate which failure would be in the opinion of the Engineer-in-Charge may render the results of the pump test invalid, the test shall be discontinued and the well will be allowed to recover for a period of time which will be determined by the Engineer –in-Charge. The section of the test (i.e. step test continuous pumping test) deeming which conditions became unsatisfactory shall then be repeated.

If the wells with poor yields are encountered, which are incapable of supporting the discharge and pumping regimes specified above, then the Engineer may decide to revise the specification to such lesser discharge.

MEASUREMENT OF DISCHARGE FROM TUBE-WELL :

The contractor shall provide a means of continuous measurement of flow through a pumping well. This may be an orifice plate, a measuring tank, or other method approved by the Engineer-in-Charge.

An orifice plate, if, installed ain the pipe line shall confirm in all respects with I. S. Specifivation and IS: 2952 “Methods of Measurement of Fluid in Pipes”.

The measuring tank shall have suitable baffles and be equipped with a sharp edged weir of a 90 degree Vee-Notch. The tank shall be as such proportions that the velocity of approach to the measurement point is negligible.

In addition to the measuring and recording equipment referred to above the contractor shall provide and install in the test pumping pipeline, a suitable integrating flow meter of the helix type to record the total volume of water pumped from the commencement of the test.

MEASUREMENT OF WATER LEVEL :

The contractor shall make available during test pumping such apparatus as may be approved by the Engineer-in-Charge for the purpose of measuring water level in the borehole under test. This apparatus shall include a dip tube which will run from the well head to a point 3m below the pump suction intake. It will be attached to the rising main or casing at intervals of 3m and will be installed straight and vertical and must not rotate around the casing more than 180 degree. The dipped tube material will be 32mm dia. PVC schedule 40 in 4 to 5m. lengths. Each length will be solvent welded or thread coupled to form a continuous tube.

In the event of a water level measurement device failing to function satisfactorily during a test, the test shall be discontinued and the well allowed to recover. The test shall be restarted from the beginning as described in the Yield Test.

VERTICALNESS :

The housing pipes should necessarily be to the plumb. The maximum tolerable limit of deviation of the housing pipe from strict verticalness is 10cm in 30m. in one direction and one plane only. A greater deviation beyond the limit of tolerances, necessitates rectification by the contractor free of cost and the tube-well may be altogether rejected, if the contractor fails to rectify. The contractor shall provide necessary tools and implements (at his own cost) for showing test of verticalness, for tube-wells.

VERTICALITY TEST :

The verticality test should be carried out most carefully as per IS 2800 (Part-II) and a test report submitted in original for scrutiny of the Engineer-in-Charge. Unsatisfactory results may necessitate rejection of the entire work.

SUCCESSFUL TUBE-WELL :

A tube-well shall be considered successful by the Engineer-in-Charge if during operational Yield Test the expected varying between maximum quantity of water per hour to minimum quantity of water per hour (depending on the slotted pipe actually provided for) has been made available within 5 meters draw down and the water is free from sand (within tolerable limits).

UNSUCCESSFUL TUBE-WELL :

The tube-well shall be considered unsuccessful by the Engineer-in-Charge, during the operational Yield Test if the expected discharge as mentioned in the Yield Test could not be made available.

Also by boring upto 250m. depth if no suitable water bearing formation is available, the contractor shall be asked by the Engineer-in-Charge in writing to abandon the tube-well. Under such circumstances, the Engineer-in-Charge shall prepare full details of the work actually done by the contractor upto the point of order or abandoning the tube-well.

The details of work done on such abandoned tube-well should be jointly signed by both the contractor and by the Engineer-in-Charge. For making payment of work of such abandoned tube-well should be worked out after due analysis as per accepted Schedule

fair rates. Where the items of work are outside the accepted Schedule of rates, such works should be treated as supplementary items and rates shall be worked out by the Engineer-in-Charge.

TIME OF COMPLETION :

Time period is the essence of the contract and the work is to be completed in all respects within the construction time schedule to be projected by the contractor.

GUARANTEE :

For a period of 12 (twelve) months after completion and acceptance of the work, the contractor shall be responsible for any defect which may under proper use, develop from faulty construction, and workmanship of the work including defects in materials supplied by the contractor, erection and installation, and the contractor shall remedy all such defects at his own cost when call upon to do so. If during this period the tube-well discharges water containing sand beyond the specified limit the contractor shall have to arrange for resurging the tube-well at his own cost till the sand free (as per specified limit) water is obtained.

BACTERIOLOGICAL TEST :

Water from deep tube-well is generally bacteriologcally safe. After development of the tube-well and successful Yield Test water from the tube-well should be collected in approved sterilized bottle and the collected sample of water should be tested for chemical and bacteriological examination in an approved Public Health Laboratory as decided by the Engineer-in-Charge. In case of unsatisfactory report regarding the bacteria content of the water it will be the responsibility of the contractor to properly wash and disinfect the tube-well as per advice of the Public Health Engineering Experts so that a satisfactory result is obtained.

The entire cost of testing the water from an approved laboratory as mentioned above and subsequent washing and disinfecting the tube-well in case of unsatisfactory test report will have to be borne by the contractor. No extra payment shall be made to the contractor for the subsequent work as mentioned above.

GENERAL SPECIFICATION AND TECHNICAL DETAILS

1.0 INTENT OF SPECIFICATION:

This specification is Intended to cover the supply, erection, testing and commissioning of the complete electrical installation including supply, fabrication and erection of lighting fixtures and accessories, mounting arrangement, supply and installation of main and sub-distribution boards wiring system and control arrangement, grounding materials and accessories and other sundry consumable Items and to do all other works relevant to the "Scope of Work" stipulated herein after.

The work under this specification shall have to be performed with great care and skill and the Contractor tendering for the work must have sufficient experience in the installation indoor and outdoor in modern big building industries, commercial houses educational institute.

2.0. DESIGN CONDITIONS:

The lighting fixtures and fittings must be suitable for operation in tropical and humid climate, For the purpose of design the following data shall be used :-

Ambient Air Temperature : 4O°C.
Relative Humidity (AV.) : 85%
Maximum Wind Velocity : 100 km, P.H.

3.0. COMPLETENESS:

The items of supply offered by the Tendered shall be completed in all respects and any item of supply or additional work not covered by this specification but essential for proper design coordination, operation and maintenance shall be included by the tenderer without any extra cost to the purchaser.

4.0. ALTERATION/DEVIATION:

The successful tenderer shall supply all items of supply and accessories listed in this specification with such modifications and alterations as are agreed upon in writing after mutual consultation without any financial commitment on the part of the Employer. The offer for the supply of lighting fixtures and supply and erection of fittings shall include anchor bolts, holding down bolts etc. for all mechanical and electrical items. All wiring, fittings, control devices, hangers and supports for the Tenderer's plant. Which are part of individual equipment are required for tying up all the equipment to the employer system shall be supplied.

5.0. INTERCHAKGEABILITY:

All similar materials and removable parts shall be interchangeable with one another.

6.0. SAMPLES:

The samples of all the fittings like lighting fixtures, conduits, junction boxes, tap-off boxes, cables, switches, cable LUGS, clamps, numbering ferrules, cable markers, etc, shall be submitted by the Tenderer for inspection and approval of the Engineer-in-charge, free of cost and without any obligation.

The employer reserves the right to call for sample of any other item if considered necessary and the same shall be submitted by the Tenderer free of cost and without obligations.

7.0. STANDARDS:

The lighting fixtures & fittings to be furnished under this specification shall be designed, constructed and tested in accordance with the latest revisions of the relevant Indian Standards(IS),British Standards(BS)and International Electro Technical Commission(IEC) publication unless otherwise stated.

The surface of all the contact materials shall have bright smooth finish, free from "below holes, enamel and other castings or manufacturing defects. All materials shall be either inherently resistant to atmospheric corrosion or suitably treated or protect against corrosion or oxidation both during storage and in service.

The electrical installation shall meet the requirements of Indian Electricity Act 1910, and Indian Electricity Rules 1956 as amended upto date and also applicable sections of the latest revision of relevant IS code of practice, and the rules and bylaws of the local electric supply authorities.

The addition any statutory rule or regulation applicable to the work shall be followed. In case of any discrepancy, the decision of the Engineer-in-charge shall be final.

8.0. SCOPE OF ELECTRICAL INSTALLATION WORK :

The specifications schedule of quantities and the accompanying drawings are intended to provide for the complete installation as follows:

i) Main and Sub-distribution Boards

ii) Grounding System

iii) Feeder Cables

iv) Mains, Sub-mains and point wiring

v) Lighting fixtures, fans, sockets outlets etc.

vi) Pre-commissioning checks and teats of the complete electrical Installation.

vii) Submission of test results in the prescribed proforma for, the approval of the chief Electrical Inspector, of state Govt. of West Bengal.

viii) Alteration/modification if any, required by the Chief Electrical Inspector, Govt. of West Bengal.

ix) Obtaining written approval from the Chief Electrical Inspector to commission the whole installation.

x) Commissioning of the whole installation and trial run.

9.0.

a) All work shall be installed 1n a first class, neat and workmanlike manner by technicians skilled in the trade involved shall be supervised by competent, supervisors holding supervisory license from the Government. All details on installation shall be electrically & mechanically corrected and shall not be carried out in such a manner so as to prevent access to other equipment installed.

b) Evidence in support of qualifications and experience and the certificate of competency, all in original shall be submitted to the Employer or the Consulting Engineer for his approval before assigning any engineer/supervisor on the job.

c) The Employer may arrange for manufacturer's supervision for some plant & equipment. When the manufacturer's supervisor is present the contractor shall have to carry out the work under his guidance and direction. No work shall be deemed to have been completed until approved by him.

10.0. ERECTION,INSPECTION, START UP & TRAIL OPERATION, INITIAL OPERATION AND TAKING OVER :

a) Erection :

The erection work will be carried out in the manner and sequence as may be directed by the Engineer-in-charge.

As erection proceeds, each completed part before being permanently covered up or sealed shall be placed for inspection by the Engineer-in-charge for approval and should any defect be discovered during such inspection the contractor shall make it good as desired by the Engineer-in-charge.

b) Inspection :

After completion of erection and/or installation and before start up each unit and all its apparatus shall be thoroughly cleaned and then inspected in the presence of the Engineer-in-charge for correctness and completeness of installation and acceptability for start-up. The inspection and checking of individual pieces of equipment upon receipt of instructions of the Engineer-in-charge will be done at any time during the erection and installation period. A checklist, in triplicate, will be furnished by the Engineer-in-charge wherein all items to be checked and necessary instructions therefore shall be listed. Inspection and checking will strictly follow this checklist. On completion of the Inspection and checking two (2) copies of the check, lists will have to be handed over to the Engineer-in-charge. The checklists after checking will have to be jointly signed by the contractor's supervisor and the Engineer-in-charge to ensure that all inspection and checking have been properly carried out. However, such endorsement will not relieve the contractor from the responsibility in ensuring proper erection and cleaning. After the inspection has been completed to the satisfaction of the Engineer-in-charge, if so required, the paintings and markings shall be removed and shall be repainted and remarked as per Engineer-in-charge instructions.

During inspection all clearness, alignment and important measurements and adjustments as may be directed by the Engineer-in-charge will be noted by the contractor for future reference and guidance. Two copies of such notes shall
be delivered to the Engineer-in-charge.

c) Start-up and Trial Operation:

Following the inspection and checking of the installation the contractor will make shutdown wherever necessary to carry out adjustments and repairs. On completion of satisfactory trail operation, the installation will be placed under initial operation by the Employer. All labour for repairs and adjustments will be supplied by the Contractor.

d) Initial Operation :

On successful completion of Trial Operation the illumination installation of each unit will be placed on initial operation for a period of fourteen (14)days during which time all lights will glow, fans will run continuously. Should any defect develop in any item of the installation during the initial operation necessary repair works will be carried out by the Contractor to remove such defects either on running plant or during shut-down of the plant, after which the rectified portion of the installation will again be placed on initial operation for a period of fourteen days.

e) Taking over :

On successful completion of the initial operation and the contractor having completed all the contract work under the scope of the contract, each unit will be taken over by the Employer.

11.0. SAFETY MEASURES :

All safety rules and codes as applicable to work shall be followed without exception.

All safety appliances and protective devices including safety belts, hand gloves, aprons, helmets, shields, goggles etc. shall be provided by the contractor for his personnel. The Contractor shall arrange to provide guards and prominently display caution notices if access to any equipment /area is considered unsafe and hazardous.

12.0. MATERIALS & WASTAGE :

After completion of works, the contractor shall submit a complete detailed account of the equipment and materials issued to him, if any.

The contractor shall make every effort to minimize wastage during erection.
In any case, the wastage shall not exceed the following limits :

Sl.No.	Item	% wastage on erected quantity
1.	Steel Material	1.5%
2.	Cables	1%

13.0. CONTRACT LICENSE :

The Contractor(or the sub-contractor of the contractor if approved by the Employer on receipt or request from the contractor) shall have valid contractor license issued/endorsed by the Chief Electrical Inspector, of State Govt.

14.0. SCHEME :

Supply shall be received at the main distribution board and will be sub-distributed from there to different sub-distribution boards located at different load centres. The final sub-circuits and points wiring to light, fan socket,outlets etc. shall follow from the sub-distribution board.

The sub-main and point wiring shall be carried out in concealed M.S. conduit with single core polythene insulated PVC sheathed cable along with earth continuity conductor.

15.0.CONCEALED CONDUIT LAYOUT AND ERECTION :

The Contractor on award of the letter of intent shall prepare the layout of the concealed conduit for the whole installation on the basis of the illumination layout drawing and submit the same for the approval of the Engineer-in-charge or the Consulting Engineer. The routing of the conduit pipes shall be done in such a way as to traverse the shortest possible distance.

The programmed for conduit laying work with Earth Continuity Conductor particularly for the pipes and accessories which the are to be laid in floor/roof slab shall have to be strictly co-ordinate with the program of floor/slab casting by the civil contractor in consultation with the Engineer-in-charge.

16.1.CONDUIT SYSTEM :

All conduit pipes shall be solid drawn or welded finished with black stove enameled surface and of gauges not less than 18 SWG for sizes upto 32 mm. diameter and not less than 16 SWG for sizes above 32 mm. diameter.

Only screwed conduits shall be used. The conduit shall be free from all burrs and internal roughness. All conduit accessories shall (be of threaded type and under no circumstances pin grip type or clamp type accessories to be used.

No conduit less than 10mm in diameter shall be used.

The conduit shall be proper earthed. The conduit pipe shall be joined by means of screwed couples and screwed accessories only. In long distance straight runs of conduit inspection type couplers at

a reasonable intervals shall be provided or running threads with couplers and jam-nuts, shall be provided. Thread on conduit pipes in all cases be between 13mm. to 27 mm. long sufficient to accommodate pipes to full threaded portion of couplers or accessories. Cut ends of conduit pipes shall have no sharp edges nor any burrs left to avoid damage to installation of conductors while pulling them through such pipes, insulation.

All necessary bends in the system including diversion shall be done by bending the pipes, or by inserting suitable inspection type bends, elbows or similar fittings or by fixing cast iron inspection boxes whichever is most suitable and approved by the Engineer-in-Charge.

All outlets for fittings, switches etc, shall be fixed on boxes of suitable metal for flush mounting system. In case of cast iron boxes the wall thickness shall be at least 3mm. and in case of welded mild steel box the wall thickness shall not be less than 16 gauge for boxes upto a size of 20cm x 30cm. and above this size 14 gauge M.S. box shall be used. Except where otherwise stated 3mm. thick insulated laminated sheets shall be fixed on the front with screws. Where conduits are terminated special care shall be taken in employing double jam-nuts for securely fixing conduits to outlets and to provide insulated bushes inside conduit ends so as to prevent any possibility of damage to cables when drawn.

The chase in the wall shall be neatly made and be of sample dimensions to permit the conduit to be fixed in the manner desired. The conduit pipes shall be fixed by means of staples or by means of saddles not more than 60cm.apart. Fixing of standard bends or elbows shall be avoided as far as practicable and all curves should be done by bending conduit pipes with a long radius which will permit easy drawing in of conductors. All threaded joints of conduits shall be treated with some approved preservative to secure protection against rust. Suitable inspection boxes shall be provided to permit periodical inspection and to facilitate removal of wires, when necessary. These shall be mounted flush with wall, All outlets such as switches, socket outlets shall be flush mounting type with cast iron or M.S. boxes with a cover of approved insulating - materials. The switches and other outside shall be mounted inside such boxes as would be approved. The metal box shall be efficiently earthed with conduit by means of earthing attachment with No. 16 SWG G.I. wires.

The entire conduit system including outlet boxes shall be thoroughly cleaned after completion of erection of conduit but before drawing of cable.

16.2. BATTENING SYSTEM

The battens -shall be of required width and of thickness 12mm. and made from first class teak wood free from knots. Two coats of varnish shall be applied to the battens, as well as to the accessories like corners and bends etc.

The battens shall be neatly and properly aligned. The battens shall be fixed to the wall/ceiling by means of wood screws and rawl plugs. The link clips shall be of brass, aluminium of suitable gauge and size and fixed to the batten by means of brass pins.

On completion of the wiring the battens and wires shall have a final coat of varnish.

17.0. CABLES FOR WIRING:

Only single core polythene insulated and PVC seathed cables of approved manufacturers shall be used for wiring in conduit system. The number of single core cables in one conduit shall be such that it permits easy drawing' in of the cables. Under no circumstances number of cables drawn in one conduit shall be greater than the maximum setout in Table- II of Indian Standard (I.S. 732 - 1963)code of practice(revised) for electrical wiring installation (system voltage not exceeding 650 Volts).

Distribution wiring in conduit to light, fan, plug points etc. shall be done in looping-in system. In this system no joints or connections shall be made any where of the system except at terminating points such as at terminals of switches ceiling roses, etc. and in case of socket outlets at the socket terminals and at approved terminal blocks in the junction boxes.

18.0. WIRES AND CABLES:

a) All light duty cables/wires shall be of 660/1100 volts. Grade and manufactured in accordance with the specification of IS : 694 (Part I) 1964, and must bear the ISI certified markings.

b) All heavy duty cables (armoured and un-armoured, cables) shall be of 650/1100 volts grade and aluminium/copper conducted conforming to IS : 1554 Part -I.

c) Twin flexible cords used for pendants and other fixture should not be less than 0.001 sq. inch (equivalent to 23/0.0076") sectional area.

19.0. EARTH CONTINUITY CONDUCTOR (ECC) :

All three pin 6 Amps. plug points should be provided with earthing attachment by No. 16 SWG, G.I. wires.

Three pin 16 Amps power plug point should be provided with earthing attachment by No. 14 SWG G.I. wire.

All conduits and accessories for point wiring should be provided with earthing attachment by No. 16 SWG G.I. Wires.

The main and sub-main shall have earth continuity conductor as specified. All 240 V. lines shall have one run of ECC, whereas 415 V. lines shall have two runs of E.C.C.

20.0. POINT WIRING :

The term means whole run of wiring between one outlet point such as' ceiling rose or socket outlet or wall bracket as the case may be and the controlling switch in the switch board including the circuit wiring from distribution board for the group of points which include the particular outlet point.

It Includes supply and "fixing of all conduit lengths, bends, junction boxes, lock nuts and other accessories, wires/cables, connectors etc. to complete the wiring in all respects and conforming to the relevant Indian Standard Code of Practice. It also shall include supply & fixing of the ceiling rose or socket outlet with plug top and the switch board with the controlling switch.

21.0. TERMINATION OF CONDUCTORS IN JUNCTION BOXES :

In the Junction boxes suitable size and number of terminal blocks shall be used and the conductor shall be terminated in the terminal blocks by means of lugs criped on the conductor. In no case, conductors shall be twisted and
tapped.

Terminal blocks for junction boxes/junction box cum tap off boxes (straight through, 3-way, 4-way, or as required) shall be of adequate capacity to accommodate all the wires in addition to two or three spares. Stud type terminal blocks may be used in junction boxes. All materials used shall be of correct type of prevent corrosion as well as distortion.

22.0. SWITCH BOARDS

22.1 . FOR CONDUIT WIRING

The switch boards shall be made out of not less than 16 gauge M.S. sheet upto 20cm. size and of Iron for sizes above 20cm x 30cm. The size of the board shall be determined according to the number of controlling switches, 6 amps. Socket outlets and fan regulators to be accommodated in the board and as approved by the Engineer-in-charge. Transparent acrylic sheets shall be used for the cover, which shall ultimately be painted to match with the wall colour. All switches, socket outlets and fan regulators shall be flush mounted. The control switches
shall be piano key type.

22.2. FOR BATTEN WIRING

Switch 'Boards shall be of double teak wood with hinged cover and double coating of varnish. The junction boxes and round blocks shall also be of double teak wood.

22.3. ANCILLARY MATERIALS

All ancillary materials like conduit saddles, cleats, clamps screws, bolts, nuts, PVC tape Empire tape, jointing materials or any other material required to complete the installation for satisfactory and efficient operation shall be of approved standard quality and supplied without any extra cost to the purchaser.

23.0 . LIGHTING FITTINGS AND OTHER FIXTURES

The lighting fixtures ceiling fans, socket outlets shall be designed for use in 240± 5% volts, 50 Cycles A.C. System.

The temperature rise of different components shall be limited to the specified value as per relevant standard over and average ambient temperature of 40°C.

All fittings and accessories specified in this standard shall be suitable for continuous operation.

All lighting fixtures and fittings shall be completely wired with PVC insulated "fixture wire" copper conductor upto the in-built supply termination connection chamber which shall be suitable for inspection and testing without interference of the other components of the fitting. The internal wiring shall be terminated by crimping type lugs.

All lighting fixtures and fittings shall be provided with suitable conduit entry and terminating of two single core cables (minimum size of all conductor 1.5mm2). One terminal stud shall be provided complete with necessary nut, plain and spring washers for termination of 14/16 SWG G.I. wire close to the conduit entry point.

All nuts, bolts, washers hangers, screws etc, shall be electro galvanised or passivated.

Adequate quantity of touch-up paint shall be supplied with each lot of fixtures free of cost.

The bidder shall submit leaflets, data, polar curves, etc, for each type of fitting they will quote for, without which the tender shall be considered incomplete and shall be liable for rejection.

i) Lamps - Incandescent
All incandescent lamps shall be with clear glass coiled filament, B.C.,S.C, T.P.Cap(ref. IS : 418-1963) suitable for ± 5% 240 volt A.C.

ii) Fluorescent Tubes
The fluorescent tubes, either cool daylight or white as indicated in the schedule, shall be of bi-pin type suitable for spring loaded **rotor** type lamp holders.

iii) Mercury Vapour Lamps
The inner side of the glass built of the high pressure mercury vapour lamp shall be coated with fluorescent powder, The lamp shall be of bayonet cap suitable for 3 pin B.C. lamp holder.

24.0 . MAIN DISTRIBUTION BOARD :

The main distribution board shall be floor mounted with sheet steel clad bus bar chamber and suitable for 415/240V, 3phase 4 wire supply system. The bus bars shall be of aluminium/copper and have a fault rating of minimum 35 KA. The incoming switch shall be one combination fuse switch (CFS) unit with HRC fuses. The outgoing fuse switch units shall have rewire able type fuses or as directed.

25.0 . FUSE DISTRIBUTION BOARDS :

These shall be iron clad and flush mounted in walls. The boards shall have miniature circuit breaker in the incoming and re-wireable type fuses on the outgoing circuits or as directed.

26.0. NAME PLATE & CIRCUIT NUMBER

Approved name plates shall be fitted on all distribution equipment. Distribution circuits in the fuse distribution boards shall be properly numbered and identified.

27.0. PVC casing capping, wood casing wiring, load cover wiring, cleat wiring, catenary wiring will have to be carried out as directed by the engineer-in-charge.

MOULDED CASE CIRCUIT BREAKERS:

1. GENERAL

Moulded case circuit breakers shall be incorporated in the Main Distribution Board and sub Distribution Board wherever specified .MCCBS shall be suitable either for singal phase AC 230 volts or three phase 415 volts and to be capable with adjustable protection (magnetic/overload) setting at site.

2. FRAME SIZES:

The MCCBS shall have the following frame sizes subject to meeting the fault level:

a) Upto 100 A rating - 100 A frame
b) From 125 to 225A - 225 A frame
c) From 250 to 400A - 400 A frame
d) From 400 to 600 A - 600 A frame
e) Above 600 A - 800 A frame

3. CONSTRUCTIONS:

The MCCB cover & case shall be made of high strength heat treatment & flame retardant thermo setting insulating material. Operating handle shall be quick make/quick break, trip free type. The operating handle shall have suitable “ON” “OFF” and “TRIPPED” indicator. Three phase MCCBS shall have operating handle for simultaneous operation and tripping of all the three phases.

Suitable for extinguishing device shall be provided for each contact. Tripping unit shall be of thermal magnetic or static type provided in each pole and connected by a common trip bar such that tripping of any one pole operates all three poles to open simultaneously. Thermal magnetic or static tripping device shall have IDMT characteristics for sustained over loads and short circuits.

Contacts trips shall be made of suitable are resistant, sintered alloy for long electrical life. Terminals shall be of liberal design with adequate clearance.

4. TESTING:

a) Original test certificate of the MCCB as per Indian Standard (IS) 315-C-8370 shall be furnished.
b) Pre-commissioning test on the MV panel incorporating the MCCB shall be done as per standard.

APPROVED MAKES

BUILDING & CIVIL WORKS

1. Ply & Block Board	: National Plywood Industries Ltd/ Samrat Plywood Ltd/ Mangalam Timber Products Ltd/Greenply Industries Ltd/Kitply/Century Ply.
2. Plain of veneered particle board	: Anchor/ Novateak Super/ Sudarshan
3. Timber treatments Seasoning	: Asco/ Hickson
4. Door closers	: Garnish/ Everite/ Ranjan
5. Locks	: Godrej/ Acme / Golden
6. Hinges	
a) Steel	: Moujee/ Hafele / Golden
b) Anodised Aluminium	: Juhi
7. Acrylic Emulsion Paint	: Luxol Silk of Berger Paints/ Apcolite of AsianPaints/Nerolac
8. Synthetic Enamel	: Luxol Silk of Berger Paints/ Apcolite of Asian Paints/Nerolac.
9. Decorative Laminators	: Forrnica/ Neolux satin finish/ Century Laminates Co/ Greenlam.
10. Pre-laminated particle board	: Novapan/ Nuchem Ltd/ Bhutan Board.
11. Bitumen Emulsion Paint	: Allied Bitumen.
12. Aluminium Section	: Indal/ Jindal/ Century
13. Glazed Tiles	: Spartek/ Kajaria/ Nitco/ Johnson/ Orient.
14. Non-skid Ceramic tiles	: Spartek/ Kajaria/ Nitco/ Johnson/ Orient.
15. Vitrified tiles	: Naveen/ Orient/ Regent.
16. Cement based paint	: Super Snowcem of Killick Nixon.

17. Floor Springs	: Ranjan/ Everite/ Garnish
18. Water proofing compound	: Dr. Fixit Pidiproof LW/ Fosroc/ Sika.
19. Other construction Chemicals	: Pidilite/ Fosroc/ Sika.
20. Polymersided textured paints	: Spectrum, Vibgior.
21. Hardware for aluminium doors/ windows	: Ebco (Earl Bihari Pvt Ltd)
22. Glass	: Pilkington/Modi/ Indo-Asahi / Sejal
23. Fastners	: Hilti India Pvt Ltd/ Fisher India.
24. Cement (Portland Pozlana or Portland Slag)	: Lafarge / Ultratech / Ambuja / Grasim / Concast Cement should conform to the applicable IS code.
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25. Steel	: SAIL, TATA, Elegant, Concast and equivalent primary rollers or authorized re-rollers. Reinforcement steel should also conform to the applicable IS code..
26. Glass Mosaic tiles	:Bisaza
27. Ceramic Mosaic tiles	: Shon.
28. White cement	: Birla White / J.K cement
29. White cement putty	: Birla White
30. Structural Steel	: Tata.
31. Aluminium sheeting	: Hindalco
32. False ceiling tiles	: AMF / Insula
33. PVC panels	: Sintex
34. Chain link fencing	: Tuflex
35. Geo- synthetics	: Tuflex

APPROVED MAKES OF THIS SCHEDULE OF ITEMS FOR SANITARY & PLUMBING WORKS

1. S.W Pipe and Fittings	: HIND's Product, Orissa or Perfect Brand.
2. Sanitary Wares	: Parryware, Cera, Hindware.
3. H.C.I Pipes and Fittings	: Note/ Approved manufacturer & conforming IS 1729-1979
4. a) G.I. Pipes b) G.I. Fittings	: Tata / Jindal medium quality. : R/KS/AA Brand.
5. C.I Man-Hole Covers with Frame & G.I gully Pit Cover	: NECO/ Any local approved manufacturers of approved weight.
6. Paints	: I.C.I./ Berger/ Asian / Nerolac
7. Gunmetal cocks and valves	: Leader, Annapurna or approved.
8. C.P Cocks	: Essco, Jaquar, Marc / Hindware
9. Polythene Pipes and Fittings	: Emco brand, Normal gauge.
10. Mirror	: Twin Bird, Atul, Golden Fish or similar approved brand.
11. Flushing Cisten C.I	: a) C.I. high level type Nomos or similar approved. b) C.I. automatic Cistern Rellance / Hindware or approved equivalent.
12. Flushing Cistern PVC	: Parryware – Johnson Peddar/ Sleek (Hindware)
13. P.V.C Pipes & Fittings	: Oriplast/ Supreme for water supplylines Supreme/ Oriplast for waste water lines./ Kisar.
14. Composite Pipes	: Flow Guard / Kitec / Kisar
15. Pumps	: Calama / KSB / Kirlosker
16. Commode seat cover	: Commander

APPROVED ELECTRICAL MAKE OF MATERIALS

A	LT CABLES	
1	1 CORE UNSHEADED COPPER CABLE 1100 VOLT GRADE PVC/FRLS	1 FINOLEX 2 HAVELS 3 RR CABLES 4 BONTON
2	ARMOURED LT CABLES IS 7098 (PART-I) XLPE AA	1 FINOLEX 2 HAVELS 3 TORRENT 4 KEI
3	ARMOURED LT CABLES IS1554 (PART-I)PVC AA	1 FINOLEX 2 HAVELS 3 TORENT 4 KEI
4	ARMOURED HT CABLES IS 7098 (PART-II) XLPE AA	1 UNISTAR 2 HAVELS 3 TORRENT 4 KEI
5	TELEPHONE CABLES	1 FINOLEX 2 HAVELS 3 DELTON
6	DATA CABLES (CAT . VI)	1 LUCENT 2 IBM 3 AMP

B	CABLE ACCESSORIES	
1	COPPER LUG	1 DOWELL 2 FORWARD
2	BRASS GLANDS	1 COMET 2 ELECTROMAC
3	HT TERMINATION (HEAT SHRINK)	1 RAYCHEM 2 MAHINDRA 3 DENSION 4 3M

C	HT EQUIPMENT	
1	TRANSFORMER(DRY TYPE)	1 CROMPTON GREAVES 2 KIRLOSKAR 3 VOLTAMP
2	11 KV BREAKER & PANEL	1 SIEMENS 2 AREVA 3 ABB

D	ELECTRICAL EQUIPMENT	
1	PUSH BUTTON/INDIC ATING LIGHT ETC	1 L&T 2 SIEMENS 3 VAISHNOW 4 BINAI
2	CT & PT	1 KAPPA 2 PRAGATI 3 AE
3	INDICATING METERS	1 AE 2 MECO 3 RISHAB
4	RELAYS	1 ALOSTOM 2 ABB 3 SIEMENS
5	DIGITAL METERS & KWH METERS	1 SECURE 2 SOCOMAC 3 DUCATI 4 SIEMENS
6	ENERGY METERS MAGNETIC	1 GE 2 BHEL 3 UNIVERSAL
7	LIGHTING FITTINGS	1 PHILIPS 2 WIPRO 3 BAJAJ
8	LAMPS	1 PHILIPS 2 OSRAM 3 BAJAJ 4 KLITE

9	EXHAUST FAN	1 GE 2 CROMPTON 3 BAJAJ
10	CEILING FAN	1 ORIENT 2 CROMPTON 3 BAJAJ 4 POLAR

E LT SWITCHGEAR

1	MCCBs	1 LEGRAND 2 L&T 3 SCHNEIDER 4 SIEMENS
2	HRC FUSES & FUSE LINK	1 L&T 2 ALOSTOM 3 SIEMENS
3	MCBs & MCB DBs	1 LEGRAND 2 L&T 3 SCHNEIDER
4	POWER FACTOR RELAY	1 SIGMA 2 L&T 3 DUCATI
5	LT PANELS	1 L&T 2 PRAYASS AUTOMATION 3 STERLING
6	ACB	1 L&T 2 SCHNEIDER 3 SIEMENS
7	CHANGEOVER SWITCH	1 CONTROL & SWGR 2 HPL
8	MS POLE WITH RECESSED CABLE BOX	1 BAJAJ

F DIESEL GENERATOR SET

1	DG SET	1 KIRLOSKAR 2 HONDA 2 JACKSON 3 SUDHIR

F	ELECTRICAL ACCESSORIES

1	SWITCH , FAN REGULATOR & SOCKET	1 LEGRAND 2 CPL HARMONEY 3 SCHNEIDER 4 ANCHOR

2	PVC CONDUIT	1 BEC 2 AKG 3 WIMCO 4 HARSH

3	TELEPHONE TAG BLOCK	1 CRONE 2 POUTS

4	20/32 AMP METAL CLAD PLUG & SOCKET UNITS	1 LEGRAND 2 L&T 3 ANCHOR