

# GENERAL TECHNICAL SPECIFICATIONS FOR BUILDING WORKS

Construction of "1 Class room" at village Sadadun Primary School  
Ta.Songadh Dist.Tapi.

**PANCHAYAT (R&B) CIRCLE, SURAT Circle, Surat**

**PANCHAYAT (R&B) DIVISION, TAPI Division,**

**PANCHAYAT (R&B) SUB-DIVISION Department, .**

## **ITEM WISE SPECIFICATION**

**Item No 1**      ' Excavation for foundation upto 1.5 m depth including sorting out and stacking of useful materials and disposing off the excavated stuff upto 50 Meter lead.(C) Hard Murrum

**1.0. General**

**1.1.** Any soil which generally yields to the application of pickaxes and shovels, phawaras rakes or any such ordinary excavating implement or organic soil, gravel silt, sand turf loam, clay, peat etc., fall under this category

**2.0. Clearing the site**

**2.1.** The site on which the structure is to be built shall be cleared, and all obstructions loose stone, materials and rubbish of all kind bush wood and trees shall be remove! as directed The materials so obtained shall be property of the Government and shall be conveyed und stacked as directed within 50 m lead. The roots of the trees coming in the sides shall be cut and coated with a hot asphalt

**2.2.** The rate of side clearance is deemed to be included in the rate of earth work for which no extra will be paid.

**3.0. Setting out**

After clearing the site the centre lines will be given, by the Engineer-in-charge. The contractor shall assume full responsibility for alignment, elevation and dimension of each and all 'parts of the work. Contractor shall supply labours materials, etc. required for setting out the reference marks and bench 'marks and shall maintain them as long as required and directed.

**4.0. Excavation**

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown in the drawings or as directed. The contractor shall do the necessary shoring and shutting or providing necessary slopes to a safe angle, at his own cost. The payment for such precautionary measures shall be paid separately if not specified. The bottom of the excavated area shall be leveled both longitudinally and transversely as directed by removing and watering as required No. earth filling will be allowed for brining it to level If by mistake or any excavation is made deeper or wider than, that shown on the plan or directed. The extra depth or width shall be made up with concrete of same proportion as specified for the foundation concrete at the cost of the contractor. The excavation up to 1.5 m depth shall be measured under this item.

**5.0. Disposal of the excavated stuff**

**5.1.** The excavated stuff of the selected type shall be used in filling the trenches and plinth or leveling the ground in layers including ramming and watering etc.

**5.2.** The balance of the excavated quantity shall be removed by the contractor from the site of work to a place as directed with lead up to 50 M. and all lift.

**6.0. Mode of measurements & payment**

**6.1.** The measurement of excavation in trenches for foundation shall be made according to the sections of trenches shown on the drawing or as per sections given by the Engineer-m-charge. No payment shall be made for surplus excavation made in excess of above requirements or due to stopping and sloping back as found necessary on account of conditions of soil and requirements of safety.

**6.2.** The rate shall be for a unit of one cubic meter.

**Item No 2      Excavation for foundation for depth from 1.5 m to 3.0 m including sorting out and stacking of useful materials and disposing off the excavated stuff upto 50 Meter lead. (D) Soft rock not requiring Blasting**

The work shall Excavation for foundation for depth from 1.5 m to 3.0 m including sorting out and stacking of useful materials and disposing off the excavated stuff upto 50 Meter lead. (D) Soft rock not requiring Blasting to be carried out as per relevant specification of **Item No. 1** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 3      Filling available excavated earth (Including rock in trenches plinth, sides of foundations etc. in layers not exceeding 20 cm. in depth consolidating each deposited layer by ramming and watering)**

**1.0.      Workmanship**

**1.1.**      The earth to be used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken.

**1.2.**      As soon as the work in foundation has been completed and measured the site of foundation shall be cleared of all debris, brick bats: mortar dropping etc., and filled with earth in layers not exceeding 20 cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid The earth shall be rammed with iron rammers where feasible and with the but ends of crow-bars, where rammer cannot be used.

**1.3.**      The plinth shall be similarly filled with earth in layers not exceeding 20 cms. adequately watered and consolidated by ramming with iron or wooden rammers. When filling reaches finished level the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated.

**1.4.**      The finished level of filling shall be kept to shape intended to be given to floor.

**1.5.**      In case off large heavy duty flooring like factory flooring, the consolidation may be done by power rollers, where so specified. The extent of consolidation required, shall also be as specified.

**1.6.**      The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth. Under no circumstances black cotton soil be used for filling the plinth.

**2.0.      Mode of Measurements & Payment**

**2.1.**      The payment shall be made for filling in plinth and trenches. No deduction shall be made for shrinkage or voids, if consolidated as instructed above.

**2.2.**      The rate shall be for a unit of one cubic meter.

**Item No 4      Providing & filling in plinth with murrum or yellow soil or selected soil in layers of 20 cm. Thickness. Incl. watering, ramming & consolidation etc. complete.**

**1.0.      Materials**

**1.1.**      Murrum shall conform to M 6

**2.0.      Workmanship**

The relevant specifications of item No. 4.12 shall be followed except that sand shall be filled in under floors,

including watering, ramming, consolidating and dressing etc , complete.

**3.0.      Mode of Measurements & Payment**

**3.1.**      The relevant specifications of item No. 4.12 shall be followed.

**3.2.**      The rate includes cost of collecting, carting sand with all lead and labour for filling the same in plinth under floors.

**3.3.**      The rate shall be for a unit of one cubic meter.

**Item No 5 Providing and laying cement concrete 1:2:4 (1- Cement :2- Coarse sand : 4- graded stone aggregates 20 mm nominal size) and curing complete including cost of formwork in (A) Foundation and Plinth (A) PCC**

1701. The work shall consist of furnishing and placing structural concrete and incidental construction in accordance with these specifications and in conformity with the lines, grades and dimensions, as shown -on the drawings or as directed by the Engineer.

**1702. MATERIALS**

All materials shall conform to Section 1000 of MORT&H Specifications.

**1703 GRADES OF CONCRETE**

The grades of concrete shall be designated by the characteristic strength as given in Table 1700-1, where the characteristic strength is defined as the strength of concrete below which not more than 5 per cent of the test results are expected to fall.

**TABLE 1700-1.**

Grade Designation	Specified characteristic Compressive strength of 150 mm cubes at 28 days, In MPa
M 15	15
M 20	20
M 25	25
M 30	30
M 35	35
M 40	40
M 45	45
M 50	50
M 55	55

**1704. PROPORTIONING OF CONCRETE**

Prior to the start of construction, the Contractor shall design the mix in case and submit to the Engineer for approval, the proportions of materials, including admixtures to be used. Water-reducing admixtures (including plasticisers or super-plasticisers) may be used at the Contractor's option, subject to the approval of the Engineer. Other types of admixtures shall be prohibited, unless specifically permitted by the Engineer.

1704.1. Requirements of Consistency :-The mix shall have the consistency which will allow proper placement and consolidation in the required position. Every attempt shall be made to obtain uniform consistency.

The optimum consistency for various types of structures shall be as indicated in Table 1700-4. or as directed by the Engineer. The slump of concrete shall be checked as per IS:516.

**TABLE 1700-4.**

TYPE	SLUMP (mm)
1 (a) Structures with exposed inclined surface requiring low slump concrete to allow proper compaction	25
(b) plain cement concrete	25
2. RCC structures with widely spaced reinforcements; e.g. solid columns, piers, abutments, footings, well iteming	40 - 50
3. RCC structures with fair degree of congestion of reinforcement; e.g. pier and abutment caps, box culverts well curb, well cap, walls with thickness greater than 300 mm	50 - 75
4. RCC and PSC structures with highly congested reinforcements e.g. deck slab girder:, box girders, walls with thickness less than 300 mm	75 - 125
5. Underwater concreting through tremie200 e.g. bottom plug, cast-	100 - 200

in-situ piling.	
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#### 1704.2. Requirements for Designed Mixes

##### 1704.2.1. Target mean strength

The target mean strength of specimen shall exceed the specified characteristic compressive strength by at least the “current margin”.

The current margin for a concrete mix shall be determined by the Contractor and shall be taken as 1.64 times the standard deviation of sample test results taken from at least 40 separate batches of concrete of nominally similar proportions produced at site by the same plant under similar supervision, over a period exceeding 5 days, but not exceeding 6 months.

Where there is insufficient data to satisfy the above, the current margin for the initial design mix shall be taken as given in Table 1700-5 :

**TABLE 1700-5.**

Concrete Grade	Current Margin (MPa)	Target Mean Strength (MPa)
M 15	10	25
M 20	10	30
M 25	11	36
M 30	12	42
M 35	12	47
M 40	12	52
M 45	13	58
M 50	13	63
M 55	14	69

The initial current margin given in the Table 1700-5 shall be used till sufficient data is available to determine the current margin as per sub-clause (i) above

##### 1704.2.2. Trial mixes

The Contractor shall give notice to enable the Engineer to be present at the making of trial mixes and preliminary testing of the cubes. The Contractor shall prepare trial mixes, using samples of approved materials typical of those he proposes to use in the works, for all grades to the Engineer’s satisfaction prior to commencement of concreting. The initial trial mixes shall generally be carried out in an established laboratory approved by the Engineer. In exceptional cases, the Engineer may permit the initial trial mixes to be prepared at the site laboratory of the Contractor, if a full fledged concrete laboratory has been established well before the start of construction, to his entire satisfaction. In all cases\* complete testing of materials forming the constituents of proposed Design Mix shall have been carried out prior to making trial mixes.

Sampling and testing procedures shall be in accordance with these specifications.

When the site laboratory is utilised for preparing initial mix design, the concreting plant and means of transport employed to make the trial mixes shall be similar to that proposed to be used in the works.

Test cubes shall be taken from trial mixes as follows. For each mix, set of six cubes shall be made from each of three consecutive batches. Three cubes from each set of six shall be tested at an age of 28 days and three at an earlier age approved by the Engineer. The cubes shall be made, cured, stored, transported and tested in accordance with these specifications. The average strength of the nine cubes at 28 days shall exceed the specified characteristic strength by the current margin minus 3.5 MPa.

##### 1704.2.3. Control of strength of design mixes

###### Adjustment to Mix Proportions

Adjustments to mix proportions arrived at in the trial mixes shall be made subject to the Engineer’s approval, in order to minimise the variability of strength and to maintain the target mean strength. Such adjustments shall not be taken to imply any change in the current margin.

#### Change of Current Margin

When required by the Engineer, the Contractor shall recalculate the current margin in accordance with Clause 1704.2.1. The recalculated value shall be adopted as directed by the Engineer, and it shall become the current margin for concrete produced subsequently.

#### Additional Trial Mixes

During production, the Contractor shall carry out trial mixes and tests, if required by the Engineer, before substantial changes are made in the material or in the proportions of the materials to be used, except when adjustments to the mix proportions are carried out in accordance with sub-clause (a) above.

#### 1704.4. Additional Requirements

Concrete shall meet with any other requirements as specified on the drawing or as directed by the Engineer. Additional requirements shall also consist of the following overall limits of deleterious substances in concrete:

The total chloride content of all constituents of concrete as a percentage of mass of cement in mix shall be limited to values given below:

Prestressed Concrete : 0.1 per cent

Reinforced concrete exposed to chlorides in service: 0.2 per cent (e.g. structures located near sea coast)

Other reinforced concrete construction : 0.3 per cent

The total sulphuric anhydride (SO<sub>2</sub>) content of all the constituents of concrete as a percentage of mass cement in the mix shall be limited to 4 per cent.

#### 1704.5. Suitability of Proposed Mix Proportions

The Contractor shall submit the following information for the Engineer's approval Nature and source of each material Quantities of each material per cubic metre of fully compacted concrete Either of the following :

appropriate existing data as evidence of satisfactory previous performance for the target mean strength, current margin, consistency and water/cement ratio and any other additional requirements) as specified full details of tests on trial mixes.

Statement giving the proposed mix proportions for nominal mix concrete.

Any change in the source of material or in the mix proportions shall be subject to the Engineer's prior approval.

#### 1705. ADMIXTURES

Use of admixtures such as super plasticizers for concrete may be made with the approval of the Engineer.

As the selection of an appropriate concrete admixture is an integral part of the mix design, the manufacturer shall recommend the use of any one of his products only after obtaining complete knowledge of all the actual constituents of concrete as well as methodologies of manufacture, transportation and compaction of concrete proposed to be used in the project

#### 1706. SIZE OF COURSE AGGREGATE

The size (maximum nominal) of coarse aggregates for concrete to be used in various components shall be given as Table 1700-7.

**TABLE 1700-7.**

<b>Components</b>	<b>Maximum Nominal Size of Coarse Aggregate (mm)</b>
RCC well curb	20
RCC/PCC well staining	40
Well cap or Pile Cap Solid type piers and abutments	40
RCC work in girders slabs, wearing coat, kerb, approach slab, hollow piers and abutments, pier/abutment caps, piles	20
PSC work	

Any other item	20 As specified by Engineer
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Maximum nominal size of aggregates shall also be restricted to the smaller of the following values :

10 mm less than the minimum lateral clear distance between main reinforcements

10 mm less than the minimum clear cover to the reinforcements

The proportions of the various individual sizes of aggregates shall be so adjusted that the grading produces densest mix and the grading curve corresponds to the maximum nominal size adopted for the concrete mix.

#### 1707. EQUIPMENT

Unless specified otherwise, equipment for production, transportation and compaction of concrete shall be as under:

##### For Production of Concrete:

Concrete batching and mixing plant fully automatic with minimum capacity of 15 cu.m. per hour.

All measuring devices of the equipment shall be maintained in a clean and serviceable condition. Its accuracy shall be checked over the range in use, when set up at each site and thereafter periodically as directed by the Engineer.

The accuracy of the measuring devices shall fall within the following limits:

Measurement of Cement	± 3 per cent of the quantity of cement in each batch
Measurement of Water	± 3 per cent of the quantity of water in each batch
Measurement of Aggregate	± 3 per cent of the quantity of aggregate in each batch
Measurement of Admixture	± 5 per cent of the quantity of admixture in each batch

For Concrete Transportation Concrete dumpers Powered hoists Chutes Buckets handled by cranes Transit truck mixer Concrete pump Concrete distributor booms Belt-conveyor Cranes with skips Tremies	: depending upon actual requirement minimum 2 tonnes capacity minimum O.S tonne capacity
For Compaction of Concrete : i)Internal vibrators ii)Form vibrators iii)Screed vibrators	size 25 mm to 70 mm minimum 500 watts full width of carriageway (upto two lanes)

#### 1708. MIXING CONCRETE

Concrete shall be mixed in a concrete batching and mixing plant, as per these specifications. Hand mixing shall not be permitted. The mixer or the plant shall be at an approved location considering the properties of the mixes and the transportation arrangements available with the Contractor. The mixer or the plant shall be approved by the Engineer.

Mixing shall be continued till materials are uniformly distributed and a uniform colour of the entire mass is obtained, and each individual particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement. In no case shall mixing be done for less than 2 minutes.

Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to by the Engineer, the first batch of concrete

from the mixer shall contain only two thirds of the normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

#### 1709. TRANSPORTING, PLACING AND COMPACTION OF CONCRETE

The method of transporting and placing concrete shall be approved by the Engineer. Concrete shall be transported and placed as near as practicable to its final position, so that no contamination, segregation or loss of its constituent materials takes place. Concrete shall not be freely (bopped into place from a height exceeding 1.5 metres.

When concrete is conveyed by chute, the plant shall be of such size and design as to ensure practically continuous flow. Slope of the chute shall be so adjusted that the concrete flows without the use of excessive quantity of water and without any segregation of its ingredients. The delivery end of the chute shall be as close as possible to the point of deposit. The chute shall be thoroughly flushed with water before and after each working period and the water used for this purpose shall be discharged outside the formwork.

All formwork and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete.

No concrete shall be placed in any part of the structure until the approval of the Engineer has been obtained.

If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer. Concreting then shall proceed continuously over the area between the construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed.

Except where otherwise agreed to by the Engineer, concrete shall be deposited in horizontal layers to a compacted depth of not more than 450 mm when internal vibrators are used and not exceeding 300 mm in all other cases.

Concrete when deposited shall have a temperature of not less than 5 degrees Celsius, and not more than 40 degrees Celsius. It shall be compacted in its final position within 30 minutes of its discharge from the mixer, unless carried in properly designed agitators, operating continuously, when this time shall be within 1 hour of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. It may be necessary to add retarding admixtures to concrete if trials show that the periods indicated above are unacceptable. In all such matters, the Engineer's decision shall be final.

Concrete shall be thoroughly compacted by vibration or other means during placing and worked around the reinforcement, tendons or duct formers, embedded fixtures and into corners of the formwork to produce a dense homogeneous void-free mass having the required surface finish. When vibrators are used, vibration shall be done continuously during the placing of each batch of concrete until the expulsion of air has practically ceased and in a manner that does not promote segregation. Over vibration shall be avoided to minimise the risk of forming a weak surface layer. When external vibrators are used, the design of formwork and disposition of vibrator shall be such as to ensure efficient compaction and to avoid surface blemishes. Vibrations shall not be applied through reinforcement and where vibrators of immersion type are used, contact with reinforcement and all inserts like ducts etc, shall be avoided. The internal vibrators shall be inserted in an orderly manner and the distance between insertions should be about one and a half times the radius of the area visibly affected by vibration. Additional vibrators in serviceable condition shall be kept at site so that they can be used in the event of breakdowns.

Mechanical vibrators used shall comply with IS: 2502, IS: 2506, IS:2514 and IS:4656.

#### 1710. CONSTRUCTION JOINTS

Construction joints shall be avoided as far as possible and in no case the locations of such joints shall be changed or increased from those shown on the drawings, except with express approval of the Engineer. The joints shall be provided in a direction perpendicular to the member axis.

Location, preparation of surface and concreting of construction joints shall conform to the additional specifications given in Appendix 170011 of MORT&H



#### 1711. CONCRETING UNDER WATER

When it is necessary to deposit concrete under water, the methods, equipment, materials and proportions of mix to be used shall be got approved from the Engineer before any work is started. Concrete shall contain 10 per cent more cement than that required for the same, mix placed in the dry.

Concrete shall not be placed in water having temperature below 5 degrees Celsius. The temperature of the concrete, when deposited, shall not be less than 16 degrees Celsius, nor more than 40 degrees Celsius.

Coffer dams or forms shall be sufficiently tight to ensure still water conditions, if practicable, and in any case to reduce the flow of water to less than 3 metres per minute through the space into which concrete is to be deposited. Coffer dams or forms in still water shall be sufficiently tight to prevent loss of mortar through the joints in the walls. Pumping shall not be done while concrete is being placed, or until 24 hours thereafter. To minimise the formation of laitance, great care shall be exercised not to disturb the concrete as far as possible while it is being deposited.

All under water concreting shall be carried out by trismic method only, using trammie of appropriate diameter. The number and spacing of the trammies should be worked out to ensure proper concreting. The trammie concreting when started should continue without interruption for the full height of the member being concreted. The concrete production and placement equipment should be sufficient to enable the underwater concrete to be completed uninterrupted within the stipulated time. Necessary stand-by equipment should be available for emergency situation.

The top section of the trammie shall have a hopper large enough to hold one full batch of the mix or the entire contents of the transporting bucket as the case may be. The trammie pipe shall not be less than 200 mm in diameter and shall be large enough to allow a free flow of concrete and strong enough to withstand the external pressure of the water in which it is suspended, even if a partial vacuum develops inside the pipe. Preferably, flanged steel pipe of adequate strength for the job shall be used. A separate lifting device shall be provided for each trammie pipe with its hopper at the upper end. Unless the lower end of the pipe is equipped with an approved automatic check valve, the upper end of the pipe shall be plugged with a wadding of gunny sacking or other approved material before delivering the concrete to the trammie pipe through the hopper, so that when the concrete is forced down from the hopper to the pipe, it will force the plug (and along with it any water in the pipe) down the pipe and out of the bottom end, thus establishing a continuous stream of concrete. It will be necessary to raise slowly the trammie order to allow a uniform flow of concrete, but it shall not be emptied so that water is not allowed to enter above the concrete in the pipe. At all times after placing of concrete is started and until all the required quantity has been placed, the lower end of the trammie pipe shall be kept below the surface of the plastic concrete. This will cause the concrete to build up from below instead of flowing out over the surface and thus avoid formation of layers of laitance. If the charge in the trammie is lost while depositing, the trammie shall be raised above the concrete surface and unless sealed by a check valve, it shall be replunged at the top end, as at the beginning, before refilling for depositing further concrete.

#### 1712. ADVERSE WEATHER CONDITIONS

##### 1712.1. Cold Weather Concreting

Where concrete is to be deposited at or near freezing temperature, precautions shall be taken to ensure that at the time of placing, it has a temperature of not less than 5 degrees Celsius and that the temperature of the concrete shall be maintained above 4 degrees Celsius until it has thoroughly hardened. When necessary, concrete ingredients shall be heated before mixing but cement shall not be heated artificially other than by the heat transmitted to it from other ingredients of the concrete. Stock-piled aggregate may be heated by the use of dry heat or steam. Aggregates shall not be heated directly by gas or on sheet metal over fire. In general, the temperature of aggregates or water shall not exceed 65 degrees Celsius. Salt or other chemicals

shall not be used for the prevention of freezing. No frozen material or materials containing ice shall be used. All concrete damaged by frost shall be removed. It is recommended that concrete exposed to freezing weather shall have entrained air and the water content of the mix shall not exceed 30 litres per 50 kg of cement.

#### 1712.2. Hot Weather Conditions

When depositing concrete in very hot weather, precautions shall be taken so that the temperature of wet concrete does not exceed 40 degrees Celsius while placing. This shall be achieved by stacking aggregate under the shade and keeping them moist, using cold water, reducing the time between mixing and placing to the minimum, cooling form work by sprinkling water, starting curing before concrete dries out and restricting concreting as far as possible to early mornings and late evenings. When ice is used to cool mixing water, it will be considered a part of the water in design mix. Under no circumstances shall the mixing operation be considered complete until all ice in the mixing drum has melted.

The Contractor will be required to state his methodology for the Engineer's approval when temperatures of concrete are likely to exceed 40 degrees Celsius during the work.

#### 1713. PROTECTION AND CURING

Concreting operations shall not commence until adequate arrangements for concrete curing have been made by the Contractor.

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

Premature drying out particularly by solar radiation and wind

High internal thermal gradients

Leaching out by rain and flowing water

Rapid cooling during the first few days after placing

Low temperature or frost

Vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement

Where members are of considerable size and length, with high cement content, accelerated curing methods may be applied, as approved by the Engineer.

#### 1713.1. Water Curing

Water for curing shall be as specified in Section 1000.

Sea water shall not be used for curing. Sea water shall not come into contact with concrete members unless it has attained adequate strength.

Exposed surfaces of concrete shall be kept continuously in a damp or wet condition by ponding or by covering with a layer of sacks, canvas, Hessian or similar materials and shall be kept constantly wet for a period of not less than 14 days from the date of placing of concrete.

#### 1713.2. Steam Curing

Where steam curing is adopted, it shall be ensured that it is done in a suitable enclosure to contain the live steam in order to minimise moisture and heat losses. The initial application of the steam shall be after about four hours of placement of concrete to allow the initial set of the concrete to take place.

Where retarders are used, the waiting period before application of the steam shall be increased to about six hours.

The steam shall be at 100 per cent relative humidity to prevent loss of moisture and to provide excess moisture for proper hydration of the cement. The application of steam shall not be directly on the concrete and the ambient air temperature shall increase at a rate not exceeding 5 degrees Celsius per hour until a maximum temperature of 60 degrees Celsius to 70 degrees Celsius is reached. The maximum temperature shall be maintained until the concrete has reached the desired strength.

When steam curing is discontinued, the ambient air temperature shall not drop at a rate exceeding 5 degrees Celsius per hour until a temperature of about 10 degrees Celsius above the temperature of the air to which the concrete will be exposed, has been reached.

The concrete shall not be exposed to temperatures below freezing for at least six days after curing.

#### 1713.3. Curing Compounds

Curing compounds shall only be permitted in special circumstances and will require specific approval of the Engineer. Curing compounds shall not be used on any surface which requires further finishing to be applied. All construction joints shall be moist, cured and no curing compound will be permitted in locations where concrete surfaces are required to be bonded together.

Curing compounds shall be continuously agitated during use. All concrete cured by this method shall receive two applications of the curing compound. The first coat shall be applied immediately after acceptance of concrete finish. If the surface is dry, the concrete shall be saturated with water and curing compound applied as soon as the surface film of water disappears. The second application shall be made after the first application has set. Placement in more than two coats may be required to prevent streaking.

#### 1714. FINISHING

Immediately after the removal of forms, exposed bars or bolts, if any, shall be cut inside the concrete member to a depth of at least 50 mm below the surface of the concrete and the resulting holes filled with cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners, and other defects, shall be thoroughly cleaned, saturated with water, and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry a consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. Special pre-packaged proprietary mortars shall be used where appropriate or where specified in the drawing.

All construction and expansion joints in the completed work shall be left carefully tooled and free from any mortar and concrete. Expansion joint filler shall be left exposed for its full length with clean and true edges.

Immediately on removal of forms, the concrete work shall be examined by the Engineer before any defects are made good.

The work that has sagged or contains honeycombing to an extent detrimental to structural safety or architectural appearance shall be rejected

Surface defect of a minor nature may be accepted. On acceptance of such work by the Engineer, the same shall be rectified as directed by the Engineer.

#### 1715. TOLERANCES

Tolerances for dimensions/shape of various components shall be as indicated in these specifications or shown on the drawings or as directed by the Engineer.

#### 1716. TESTS AND STANDARDS OF ACCEPTANCE

1716.1. Concrete shall conform to the surface finish and tolerance as prescribed in these specifications for respective components.

1716.2. Random sampling and lot by lot of acceptance inspection shall be made for the 28 days cube strength of concrete.

1716.2.1. Concrete under acceptance shall be notionally divided into lots for the purpose of sampling, before commencement of work. The delimitation of lots shall be determined by the following:  
No individual lot shall be more than 30 cu.m. in volume

At least one cube forming an item of the sample representing the lot shall be taken from concrete of the same grade and mix proportions cast on any day.

Different grades of mixes of concrete shall be divided into separate lots

Concrete of a lot shall be used in the same identifiable component of the bridge

#### 1716.2.2. Sampling and testing

Concrete for making 3 test cubes shall be taken from a batch of concrete at point of delivery into

construction, according to procedure laid down in IS: 1199.

A random sampling procedure to ensure that each of the concrete batches forming the lot under acceptance inspection has equal chance of being chosen for taking cubes shall be adopted.

ISO mm cubes shall be made, cured and tested at the age of 28 days for compressive strength in accordance with IS:516. The 28-day test strength result for each cube shall form an item of the sample.

1716.2.3. Test specimen and sample strength :

Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or for any other purpose.

The test strength of the sample shall be the average of the strength of 3 cubes. The individual variation should not be more than  $\pm 15$  per cent of the average.

1716.2.4. Frequency: The minimum frequency of sampling of concrete of each grade shall be in accordance with Table 1700-8

TABLE 1700-8

Quantity of Concrete In work, m3	No. of samples
1 - 5	1
6 - 15	2
16 - 30	3
31-50	4
51 and above	4 plus one additional sample for each additional 50 m1 or part thereof

At least one sample shall be taken from each shift of work.

1716.2.5. Acceptance criteria

Compressive Strength

When both the following conditions are met, the concrete complies with the specified compressive strength:

The mean strength determined from any group of four consecutive samples should exceed the specified characteristic compressive strength.

Strength of any sample is not less than the specified characteristic compressive strength minus 3 MPa.

The quantity of concrete represented by the test results include the batches from which the first and last samples were taken, together with all intervening batches.

Chloride and Sulphate Content

The total chloride and sulphuric anhydride (SO<sub>3</sub>) content of all the constituents of concrete as a percentage of mass of cement in the mix shall not exceed the values given in this section of the specifications.

1716.3. Density of Fresh Concrete

Where minimum density of fresh concrete is specified, the mean of any four consecutive samples shall not be less than the specified value and any individual sample result shall not be less than 97.5 per cent of the specified value.

1716.4. Density of Hardened Concrete: - Where minimum density of hardened concrete is specified, the mean of any four consecutive samples shall not be less than the specified value and any individual sample result shall not be less than 97.5 per cent of the specified value.

1716.5. Permeability Test

The concrete should pass the following test if it is properly compacted and is not considered permeable.

Prepare a cylindrical test specimen 150 mm dia and 160 mm high

After 28 days of curing, the test specimen is fitted in a machine such that the specimen can be placed in water under pressure up to 7 bars. A typical machine is shown in Appendix 1700III.

At first a pressure of one bar is applied for 48 hours, followed by 3 bars for 24 hours and 7 bars for next 24 hours.

After the passage of the above period, the specimen is taken out and split in the middle by compression applied on two round bars on opposite sides above and below.

The water penetration in the broken core is to be measured with a scale and the depth of penetration assessed in mm (max. permissible limit 25 mm).

- 1716.6. If the concrete is not able to meet any of the standards of acceptance as prescribed, the effect of such deficiency on the structure shall be investigated by the Contractor as directed by the Engineer. The Engineer may accept the concrete as sub-standard work. Any additional work required by the Engineer for such acceptance shall be carried out by the Contractor at his cost. In case the concrete is not found to be acceptable after investigation, the Contractor shall remove the rejected concrete forthwith.

1501. Form work

Formwork shall include all temporary or permanent forms required for forming the concrete of the shape, dimensions and surface finish as shown on the drawing or as directed by the Engineer, together with all props, staging, centering, scaffolding and temporary construction required for their support. The design, erection and removal of formwork shall conform to IRC:87 "Guidelines for Design and Erection of False work for Road Bridges" and these specifications.

1502. MATERIALS FOR FORM WORK

All materials shall comply with the requirements of IRC:87. Materials and components used for formwork shall be examined for damage or excessive deterioration before use / re-use and shall be used only if found suitable after necessary repairs. In case of timber formwork, the inspection shall not only cover physical damages but also signs of attacks by decay, rot or insect attack or the development of splits.

Forms shall be constructed with metal or timber. The metal used for forms shall be of such thickness that the forms remain true to shape. All bolts should be countersunk. The use of approved internal steel ties or steel or plastic spacers shall be permitted. Structural steel tubes used as support for forms shall have a minimum wall thickness of 4 mm. Other materials conforming to the requirements of IRC:87 may also be used if approved by the Engineer.

1503. DESIGN OF FORMWORK

- 1503.1. The Contractor shall furnish the design and drawing of complete formwork (i.e. the forms as well as their supports) for approval of the Engineer before any erection is taken up. If proprietary system of formwork is used, the Contractor shall furnish detailed information as per Appendix 150011 to the Engineer for approval.

Notwithstanding any approval or review of drawing and design by the Engineer, the Contractor shall be entirely responsible for the adequacy and safety for formwork.

- 1503.2. The design of the formwork shall conform 10 provisions of IRC:87. It shall ensure that the forms can be conveniently removed without disturbing the concrete. The design shall facilitate proper and safe access to all parts of formwork for inspection.

- 1503.3. In the case of prestressed concrete superstructure, careful consideration shall be given to redistribution of loads on props due to prestressing.

1504. WORKMANSHIP

- 1504.1. The formwork shall be robust and strong and the joints shall be leak-proof.

Bali shall not be used as staging. Staging must have cross bracings and diagonal bracings in both directions. Staging shall be provided with an appropriately designed base plate resting on firm strata.

- 1504.2. The number of joints in the formwork shall be kept to a minimum by using large size panels. The design shall provide for proper "soldiers" to facilitate alignment. All joints shall be leak proof and must be properly sealed. Use of PVC JOINT sealing tapes, foam rubber or PVC T-section is essential to prevent leakage of grout.

- 1504.3. As far as practicable, clamps shall be used to hold the forms together. Where use of nails is

- unavoidable minimum number of nails shall be used and these shall be left projecting so that they can be withdrawn easily. Use of double headed nails shall be preferred.
- 1504.4. Use of ties shall be restricted, as far as practicable. Wherever ties are used they shall be used with HDPE sheathing so that the ties can easily be removed. No parts prone to corrosion shall be left projecting or near the surface. The sheathing shall be grouted with cement mortar of the same strength as that of the structure.
  - 1504.5. Unless otherwise specified, or directed, chamfers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of the formwork to avoid sharp corners. The chamfers, bevelled edges and mouldings shall be made in the formwork itself. Opening for fixtures and other fittings shall be provided in the shuttering as directed by the Engineer.
  - 1504.6. Shuttering for walls, sloping members and thin sections of considerable height shall be provided with temporary openings to permit inspection and cleaning out before placing of concrete.
  - 1504.7. The formwork shall be constructed with pre-camber to the soffit to allow for deflection of the formwork. Pre-camber 10 allow for deflection of formwork shall be in addition to that indicated for the permanent structure in the drawings.
  - 1504.8. Where centering trusses or launching trusses are adopted for casting of superstructure, the joints of the centring trusses, whether welded, riveted or bolted should be thoroughly checked periodically. Also, various members of the centring trusses should be periodically examined for proper alignment and unintended deformation before proceeding with the concreting. They shall also be periodically checked for any deterioration in quality due to steel corrosion.
  - 1504.9. The formwork shall be so made as to produce a finished concrete true to shape, line and levels and dimensions as shown on the drawings, subject to the tolerances specified in respective sections of these specifications, or as directed by the Engineer.
  - 1504.10. Where metal forms are used, all bolts and rivets shall be countersunk and well ground to provide a smooth, plane surface. Where timber is used it shall be well seasoned, free from loose knots, projecting nails, splits or other defects that may mar the surface of concrete.
  - 1504.11. Forms shall be made sufficiently rigid by the use of ties and bracings to prevent any displacement or sagging between supports. They shall be strong enough to withstand all pressure, ramming and vibration during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete.
  - 1504.12. The formwork shall take due account of the calculated amount of positive or negative camber so as to ensure the correct final shape of the structures, having regard to the deformation of false work, scaffolding or propping and the instantaneous or deferred deformation due to various causes affecting prestressed structures.
  - 1504.13. Suitable camber shall be provided to horizontal members of structure, specially in long spans to counteract the effects of deflection. The formwork shall be so fixed as to provide for such camber.
  - 1504.14. The formwork shall be coated with an approved release agent that will effectively prevent sticking and will not stain the concrete surface. Lubricating (machine oils) shall be prohibited for use as coating.
  1505. FORMED SURFACE AND FINISH  
The formwork shall be lined with material approved by the Engineer so as to provide a smooth finish of uniform texture and appearance. This material shall leave no stain on the concrete and so fixed to its backing as not to impart any blemishes. It shall be of the same type and obtained from only one source throughout for the construction of any one structure. The contractor shall make good any imperfections in the resulting finish as required by the Engineer. Internal ties and -embedded metal pans shall be carefully detailed and their use shall be subject to the approval of the Engineer.
  1506. PRECAUTIONS  
Special measures in the design of formwork shall be taken to ensure that it does not hinder the

shrinkage of concrete. The soffit of the formwork shall be so designed as to ensure that the formwork does not restrain the shortening and/or hogging of beams during prestressing. The forms may be removed at the earliest opportunity subject to the minimum time for removal of forms with props retained in position.

Where necessary, formwork shall be so arranged that the soffit form, properly supported on props only can be retained in position for such period as may be required by maturing conditions

Any cut-outs or openings provided in any structural member to facilitate erection of formwork shall be closed with the same grade of concrete as the adjoining structure immediately after removal of formwork ensuring watertight joints.

Provision shall be made for safe access on, to and about the formwork at the levels as required.

Close watch shall be maintained to check for settlement of formwork during concreting. Any settlement of formwork during concreting shall be promptly rectified.

Water used for curing should not be allowed to stagnate near the base plates supporting the staging and should be properly drained.

#### 1507. PREPARATION OF FORMWORK BEFORE CONCRETING

The inside surfaces of forms shall, except in the case of permanent form work or where otherwise agreed to by the Engineer be coated with a release agent supplied by approved manufacturer or of an approved material to prevent adhesion of concrete to the formwork. Release agents shall be applied strictly in accordance with the manufacturer's instructions and shall not be allowed to come into contact with any reinforcement or prestressing tendons and anchorages. Different release agents shall not be used in formwork for exposed concrete.

Before re-use of forms, the following actions shall be taken :

The contact surfaces of the forms shall be cleaned carefully and dried before applying a release agent.

It should be ensured that the release agent is appropriate to the surface to be coated. The same type and make of release agent shall be used throughout on similar formwork materials and different types should not be mixed.

The form surfaces shall be evenly and thinly coated with release agent The vertical surface shall be treated before horizontal surface and any excess wiped out.

The release agent shall not come in contact with reinforcement or the hardened concrete.

All forms shall be thoroughly cleaned immediately before concreting.

The Contractor shall give the Engineer due notice before placing any concrete in the forms to permit him to inspect and approve the formwork, but such inspection shall not relieve the contractor of his responsibility for safety of formwork, men, machinery, materials and finish or tolerances of concrete.

#### 1508. REMOVAL OF FORMWORK

The scheme for removal of formwork (i.e. de-shuttering and de-centering) shall be planned in advance and furnished to the Engineer for scrutiny and approval. No formwork or any part thereof shall be removed without prior approval of the Engineer.

The formwork shall be so removed as not to cause any damage to concrete. Centring shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stresses due to its own weight uniformly and gradually to avoid any shock or vibration.

Where not specifically approved, the time of removal of formwork (when ordinary Portland Cement is used without any admixtures at an ambient temperatures exceeding 10 degrees Celsius) shall be as under :

Walls, piers, abutments, columns and vertical faces of structural members	12 to 48 hours as may be decided by the Engineer
Soffits of Slabs (with props left under)	3 days
Props (left under slabs)	14 days
Soffit of Girders (with props left under)	7 days
Props (left under girders)	21 days

Where there are re-entrant/angles in the concrete sections, the formwork should be removed at these sections as soon as possible after the concrete has set, in order to avoid cracking due to shrinkage of concrete.

1509. RE-USE OF FORMWORK

When formwork is dismantled, its individual components shall be examined for damage and damaged pieces shall be removed for rectification. Such examination shall always be carried out before being used again. Before re-use all components shall be cleaned of deposits of soil, concrete or other unwanted materials. Threaded parts shall be oiled after cleaning.

All bent steel props shall be straightened before re-use. The maximum deviation from straightness is 1/600 of the length. The maximum permissible axial loads in used props shall be suitably reduced depending upon their condition. The condition of the timber components, plywood and steel shuttering plates shall be examined closely for distortion and defects before re-use.

1510. SPECIALISED FORMWORK

Specialized formwork may be required in the case of slip form work, underwater concreting, segmental construction etc. Such specialized form-work shall be designed and detailed by competent agencies and a set of complete working drawings and installation instructions shall be supplied to the Engineer. The site personnel shall be trained in the erection and dismantling as well as operation of such specialised formwork. In case proprietary equipment is used, the supplier shall supply drawings, details, installation instructions, etc., in the form of manuals along with the formwork. Where specialised formwork is used, close co-ordination with the design of permanent structure is necessary.

For slip form the rate of slipping the formwork shall be designed for each individual case taking into account various parameters including the grade of concrete, concrete strength, concrete temperature, ambient temperature, concrete admixtures, etc. In the case of segmental construction, the concrete mix shall be normally designed for developing high early strength so that the formwork is released as early as possible.

In order to verify the time and sequence of striking/removal of specialised formwork, routine field tests for the consistency of concrete and strength development are mandatory and shall be carried out before adoption.

For specialised formwork, the form lining material may be either plywood or steel sheet of appropriate thickness. Plywood is preferred where superior quality of surface is desired, whereas steel sheeting is normally used where large number of repetitions is involved.

1717. MEASUREMENTS FOR PAYMENT

Structural concrete shall be measured in cubic metres. In reinforced or prestressed concrete, the volume occupied by reinforcement or prestressing cables and sheathing shall not be deducted.

1718. RATE

The contract unit rate for structural concrete shall cover costs of all materials, labour, tools, plant and equipment required for mixing, transporting and placing in position, vibrating and compacting, finishing and curing as per this Section or as directed by the Engineer, including all incidental expenses, sampling and testing, quality assurance and supervision. The contract unit rate for concrete shall also include the cost of providing, fixing and removing formwork required for concrete work as per Section 1500 of MORT& H specification.

Where concrete is found to be acceptable as sub-standard work, the Contractor shall pay a discount over the contract unit rate, as decided by the Engineer. For deficiency in compressive strength of concrete when accepted by the Engineer, the reduction in rate may be applied as under:

$$\text{Per cent reduction} = \frac{\text{Design Strength} - \text{Observed Strength}}{\text{Design Strength}} \times 100$$



**Item No 6      Providing and laying controlled cement concrete M.250 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (A) Foundations, footings, Base of columns and Mass concrete. (more than 10 ton)**

The work shall ' Providing and laying controlled cement concrete M.250 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (A) Foundations, footings, Base of columns and Mass concrete. (more than 10 ton) to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 7      Providing and laying controlled cement concrete M-250 and curing complete including the cost of form work but excluding cost of reinforcement for reinforced concrete work for Column upto plinth level.**

The work Providing and laying controlled cement concrete M-250 and curing complete including the cost of form work but excluding cost of reinforcement for reinforced concrete work for Column upto plinth level. to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 8      Providing and laying controlled cement concrete M.250 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (D) Columns, Pillars posts and struts, upto floor two level. (more than 10 ton)**

The work shall Providing and laying controlled cement concrete M.250 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (D) Columns, Pillars posts and struts, upto floor two level. (more than 10 ton to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 9      Brick work using common burnt clay building brick having crushing strength not less than 35 kg/sq. cm. in foundation and plinth in cement mortar 1:6 ( 1 Cement: 6 fine sand) (B) Conventional**

**1.0.      Materials**

Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Brick shall conform to M-15. Cement mortar shall conform to M-11.

**2.0.      Workmanship**

**2.1.      Proportion:**

**2.1.1.** The proportion of the cement mortar shall be 1:6 (1 cement: 6 fine sand) by volume.

**2.2.      Wetting of bricks:**

**2.2.1.** The bricks required for masonry shall be thoroughly wetted with clean water for about two hours before use or as directed. The cessation of bubbles, when the bricks are wetted with water is as indication of through wetting of bricks.

**2.3.      Laying:**

**2.3.1.** Bricks shall be laid in English bond unless directed otherwise. Half or cut bricks shall not be used except when necessary to complete to bond; closures in such case shall be cut to required size and used near the ends of walls.

**2.3.2.** A layer of mortar shall be spread on full width for suitable length of the lower course. Each brick shall first be property bedded and set home by gently tapping with handle of trowel or wooden mallet. Its inside face shall be flushed with mortar before the next brick is laid and pressed against it. On completion of course, the vertical joints shall be fully filled from the top with mortar.

- 2.3.3. The walls shall be taken up truly in plumb. All courses shall be laid truly horizontal and all vertical joint shall be truly vertical. Vertical joints in alternate course shall generally be directly one over the other. The thickness of brick course shall be kept uniform.
- 2.3.4. The brick shall be laid with frog up wards. A set of tools comprising of wooden straight edges, man son's spirit level, square half meter rub, and pins, string and plumb shall be kept on the site of work for frequent checking during the progress of work.
- 2.3.5. Both the faces of walls of thickness greater than 23 cms. shall be kept in proper place. All the connected brick work shall be kept not more than one meter over the rest of the work. Where this is not possible, the work shall be raked back according to bond (and not left toothed) at an angle not steeper than 45 degrees.
- 2.3.6. All futures, pipes, outlets of water, hold fasts of doors and windows etc. which are required to be built in wall shall be embedded in cement mortar
- 2.4. **Joints:**
- 2.4.1. Bricks shall be so laid that all joints are quite flush with mortar. Thickness of joints shall not exposed 12 mm. The face joints shall be raked out as directed by raking tools daily during the progress of work, when the mortar is still green so as to provide key for plaster or pointing to done.
- 2.4.2. The face of brick shall be cleaned the very day on which the work is laid and all mortar dropping removed.
- 2.5. **Curing:**
- 2.5.1. Green work shall be protected from rain suitably. Masonry work shall be kept moist on all the faces for a period of seven days. The top of masonry work shall be kept well wetted at the close of the day.
- 2.6. **Preparation of foundation bed:**
- 2.6.1. If the foundation is to be laid directly on the excavated bed, the shall be leveled, cleared of all loose materials, cleaned and wetted before stating masonry, If masonry is to be laid on concrete footing, the top of concrete shall be cleaned and moistened. The contractor shall obtain the engineer's approval for the foundation bed before foundation masonry is started. When pucca flooring is to be provided flush with the top to plinth, the inside plinth offset shall be kept lower than the outside plinth top by the thickness of the flooring.
- 3.0. **Mode measurements & payment**
- 3.1. The measurements of this item shall be taken for the brick masonry fully completed in foundation up to plinth. The limiting dimensions not exceeding those shown on the plinths or as directed shall be final. Battered tapered and curved portions shall be measured net.
- 3.2. No deduction shall be made from the quantity of brick work, for any extra payment made for embedding in masonry or making holes in respect of following items:
  - (1) Ends of joists, beams, posts, girders, purlins, trusses, corbel, steps etc. where cross sectional area does not exceed 500 Sq.Cm.
  - (2) Openings not exceeding 1000 Sq.Cm.
  - (3) Wall plates and bed plates, bearing of slabs, chajjas and the like whose thickness does not exceed 10 Cms. and the bearing does not extend to the full thickness of wall.
  - (4) Drainage holes, and recesses for cement concrete blocks to embed hold fasts for doors, windows etc.
  - (5) Iron fixtures, pipes up to 300 mm. dia hold fasts, and doors and windows built into masonry and pipes etc. for concealed wiring.
  - (6) Forming chases of section not exceeding 350 -Sq. Cm. in masonry.
- 3.3. Apertures for fire places shall not be deducted nor shall be paid for separately.
- 3.4. The rate shall be for a unit of one cubic meter.

work. The work shall conform strictly to the drawings or as directed by the Engineer

**Item No 10 Providing and laying cement concrete 1:2:4 (1- Cement : 2- Coarse sand : 4- graded stone aggregates 20 mm nominal size) and curing complete excluding cost of formwork in (A) Foundation and Plinth**

The work shall Providing and laying cement concrete 1:2:4 (1- Cement : 2- Coarse sand : 4- graded stone aggregates 20 mm nominal size) and curing complete excluding cost of formwork in (A) Foundation and Plinth to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No. 11 Providng TMT bars reinforcement of FE 500/500D for R.C.C. work including bending binding and placing in position complete for all floor.**

**1601. Description**

This work shall consist of furnishing and placing coated high strength deformed reinforcement bars TMT Fe-500D grade(untensioned) of the shape and dimensions shown on the drawings and conforming to these Specifications or as approved by the Engineer.

**1602. General**

Steel for reinforcement shall meet with the requirements of Section 1000.

**1603. Protection of Reinforcement**

Uncoated reinforcing steel shall be protected from rusting or chloride contamination. Reinforcements shall be free from rust, mortar, loose mill scale, grease, oil or paints. This may be ensured either by using reinforcement fresh from the factory or thoroughly cleaning all reinforcement to remove rust using any suitable method such as sand blasting, mechanical wire brushing, etc. as directed by the Engineer. Reinforcements shall be stored on blocks, racks or platforms and above the ground in a clean and dry condition and shall be suitably marked to facilitate inspection and identification.

Portions of uncoated reinforcing steel and dowels projecting from concrete, shall be protected within one week after initial placing of concrete with a brush coat of neat cement mixed with water to a consistency of thick paint This coating shall be removed by lightly tapping with a hammer or other tool not more than one week before placing of the adjacent pour of concrete. Coated reinforcing steel shall be protected against damage to the coating. If the coating on the bars is damaged during transportation or handling and cannot be repaired, the same shall be rejected.

**1604. Bending of Reinforcement**

Bar bending schedule shall be furnished by the Contractor and got approved by the Engineer before start of work.

Reinforcing steel shall conform to the dimensions and shapes given in the approved Bar Bending Schedules.

Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer using a proper bar bender, operated by hand or power to obtain the correct radii of bends and shape.

Bars shall not be bent or straightened in a manner that will damage the parent material or the coating.

Bars bent during transport or handling shall be straightened before being used on work and shall not be heated to facilitate straightening.

**1605. Placing of Reinforcement**

The reinforcement cage should generally be fabricated in the yard at ground level and then shifted and placed in position. The reinforcement shall be placed strictly in accordance with the drawings and shall be assembled in position only when the structure is otherwise ready for

placing of concrete. Prolonged time gap between assembling of reinforcements and casting of concrete, which may remit in rust formation on the surface, shall not be permitted.

Reinforcement bar shall be placed accurately in position as shown on the drawings. The bars, crossing one another shall be tied together at every intersection with binding wire (annealed), conforming to IS:280 to make the skeleton of the reinforcement rigid such that the reinforcement does not get displaced during placing of concrete, or any other operation. The diameter of binding wire shall not be less than 1 mm.

Bars shall be kept in position usually by the following methods:

In case of beam and slab construction, industrially produced polymer cover blocks of thickness equal to the specified cover shall be placed between the bar and formwork subject to satisfactory evidence that the polymer composition is not harmful to concrete and reinforcement. Cover blocks made of concrete may be permitted by the Engineer, provided they have the same strength and specification as those of the member.

In case of dowels for columns and walls, the vertical reinforcement shall be kept in position by means of timber templates with slots cut in them accurately, or with cover blocks tied to the reinforcement. Timber templates shall be removed after the concreting has progressed up to a level just below their location.

Layers of reinforcements shall be separated by spacer bar at approximately one metre intervals. The minimum diameter of spacer bar shall be 12 mm or equal to maximum size of main reinforcement or maximum size of coarse aggregate, whichever is greater. Horizontal reinforcement shall not be allowed to sag between supports.

Necessary stays, blocks, metal chain, spacers, metal hangers, supporting wires etc., or other subsidiary reinforcement shall be provided to fix the reinforcements firmly in its correct position.

Use of pebbles broken stone, metal pipe, brick, mortar, or wooden blocks etc., as devices for positioning reinforcement shall not be permitted.

Bar coated with epoxy or any other approved protective coating shall be placed on supports that do not damage the coating. Supports shall be installed in manner such that point of weakness and not created in hardened concrete. The coated reinforcing bar shall be held in place by use of plastic or plastic coated binding wires especially manufactured for the purpose. Reference shall be made to Section 1000 for other requirements.

Placing and fixing of reinforcement shall be inspected and approved by the Engineer before concrete is deposited.

## **1606. Bar Splices**

### **1606.1.Lapping**

All reinforcement shall be furnished in full lengths as indicated on the drawing. No splicing of bars, except where shown on the drawing, will be permitted without approval of the Engineer. The lengths of the splice shall be as indicated on drawing or as approved by the Engineer. Where practicable, overlapping bars shall not touch each other, and shall be kept apart by 25 mm or  $1\frac{1}{4}$  times the maximum size of coarse aggregate, whichever is greater. If this is not feasible, overlapping bars shall be bound with annealed steel binding wire, not less than 1 mm diameter and twisted tight in such a manner as to maintain minimum clear cover to the reinforcement from the concrete surface. Lapped splices shall be staggered or located at points, along the span where stresses are low.

### **1606.2.Welding**

**1606.2.1.** Splicing by welding of reinforcement will be permitted only if detailed on the drawing or approved by the Engineer. Weld shall develop an ultimate strength equal to or greater than that of the bars connected.

**1606.2.2.** While welding may be permitted for mild steel reinforcing bars conforming to IS:432,

welding of deformed bars conforming to IS:1786 shall in general be prohibited. Welding may be permitted in case of bars of other than S 240 grade including special welding grade of S 41S grade bars conforming to IS: 1786, for which necessary chemical analysis has been secured and the carbon equivalent (CE) calculated from the chemical composition using the formula :

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mg + V}{5} + \frac{Ni + Cu}{15} \text{ is 0.4 or less}$$

**1606.2.3.** The method of welding shall conform to IS:2751 and 15:9417 and to any supplemental specifications to the satisfaction of the Engineer.

Welding may be carried out by metal arc welding process. Oxy-acetelene welding shall not be permissible. Any other process may be used subject to the approval of the Engineer and necessary additional requirements to ensure satisfactory joint performance. Precautions on overheating, choice of electrode, selection of correct current in arc welding etc., should be strictly observed.

All bars shall be butt welded except for smaller diameter bars (diameter of less than 20 mm) which may be lap welded. Single-V or Double-V joints may generally be used. For vertical bars single bevel or double bevel joints may be used.

Welded joints shall be located well away from bends and not less than twice the bar diameter away from a bend.

Generally, shop welding in controlled conditions is to be preferred, where feasible. Site welding where necessary shall, however, be permitted when the facilities, equipment, process, consumables, operators, welding procedure are adequate to produce and maintain uniform quality at par with that attainable in shop welding to the satisfaction of the Engineer.

Joint welding procedures which are to be employed shall invariably be established by a procedure specification. All welders and welding operators to be employed shall have to be qualified by tests prescribed in IS:2751. Inspection of welds shall conform to IS:822 and destructive or non-destructive testing may be undertaken when deemed necessary. Joints with weld defects detected by visual inspection or dimensional check inspection shall not be accepted.

Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding. When welding is done in 2 or 3 stages, previous surface shall be cleaned properly. Bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before carrying out welding. Only competent and experienced welders shall be employed on the work with the approval of the Engineer. No welding shall be done on coated bars.

M.S. electrodes used for welding shall conform to IS:814.

**1606.2.4.** Welded joints shall preferably be located at points where steel will not be subject to more than 75 per cent of the maximum permissible stresses and welds so staggered that at any one section, not more than 20 per cent of the bars are welded.

**1606.2.5.** Welded pieces of reinforcement shall be 'tested. Specimens shall be taken from the site and the number and frequency of tests shall be as directed by the Engineer.

### **1606.3. Mechanical Coupling of Bars**

Bars may be joined with approved patented mechanical devices as indicated on the drawing or as approved by the Engineer e.g. by special grade steel sleeves swagged on to bars in end to end contact or by screwed couplers. In case such devices are permitted by the Engineer, they shall develop at least 125 per cent of the characteristic strength of the reinforcement bar.

## **1607. Testing and Acceptance**

The material shall be tested in accordance with relevant IS specifications and necessary test certificates shall be furnished. The fabrication, furnishing and placing of reinforcement shall be in accordance with these specifications and shall be checked and accepted, by the Engineer.

**1608. Measurements for Payment**

Reinforcement shall be measured in length including hooks, if any, separately for different diameters as actually used in work, excluding overlaps. From the length so measured, the weight of reinforcement shall be calculated in tonnes on the basis of 15:1732. Wastage, overlaps, couplings, welded joints, spacer bars, chairs, stays, hangers and annealed steel wire or other methods for binding and placing shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement

**1609. Rate**

The contract unit rate for coated reinforcement shall cover the cost of material, epoxy coating, fabricating, transporting\* storing, bending, placing, binding and fixing in position as shown on the drawings as per these specifications and as directed by the Engineer, including all labour, equipment, supplies, incidentals, sampling, testing and supervision.

**Item No 12 Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (D) Columns, Pillars posts and struts, upto floor two level. (more than 10 ton)**

The work shall Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (D) Columns, Pillars posts and struts, upto floor two level. (more than 10 ton) to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 13 Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (D) Columns, Pillars posts and struts, upto floor two level. (more than 10 ton)**

The work shall Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (D) Columns, Pillars posts and struts, upto floor two level. (more than 10 ton) to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 14 Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (C) Slabs,landing,shelves,Balconies, Lintels, Beams, Girders and Cantilever upto floor two level. (more than 10 ton)**

The work shall Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (C) Slabs,landing,shelves,Balconies, Lintels, Beams, Girders and Cantilever upto floor two level. (more than 10 ton). to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 15 Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (C) Slabs,landing,shelves,Balconies, Lintels, Beams, Girders and Cantilever upto floor two level. (more than 10 ton)**

The work shall Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (C) Slabs,landing,shelves,Balconies, Lintels, Beams, Girders and Cantilever upto floor two level. (more than 10 ton). to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 16 Providing laying controlled cement concrete M 200 R.C.C lintel including finishing smooth with,curing etc. complete including the cost of formwork but excluding the cost of reinforcement**

The work shall Providing laying controlled cement concrete M 200 R.C.C lintel including finishing smooth with,curing etc. complete including the cost of formwork but excluding the cost of reinforcement to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 17 Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (C) Slabs,landing,shelves,Balconies, Lintels, Beams, Girders and Cantilever upto floor two level. (more than 10 ton)**

The work shall Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (C) Slabs,landing,shelves,Balconies, Lintels, Beams, Girders and Cantilever upto floor two level. (more than 10 ton) to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 18 Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (C) Slabs,landing,shelves,Balconies, Lintels, Beams, Girders and Cantilever upto floor two level. (more than 10 ton)**

The work shall Providing and laying controlled cement concrete M.200 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (C) Slabs,landing,shelves,Balconies, Lintels, Beams, Girders and Cantilever upto floor two level. (more than 10 ton) to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 19 Providing and laying Controlled Cement Concrete M 200 and curing complete including the cost of formwork but excluding the cost of reinforcement for reinforced concrete work in R.C.C. Stair Cases**

The work shall Providing and laying Controlled Cement Concrete M 200 and curing complete including the cost of formwork but excluding the cost of reinforcement for reinforced concrete work in R.C.C. Stair Cases to be carried out as per relevant specification of **Item No. 5** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 20 Brick work using hydraulically pressed common burnt clay building brick having crushing strength not less than 35 kg/sq. cm. in super structure above plinth level up to floor two level in cement mortar 1:6 ( 1 Cement: 6 fine sand) (B) Convention for G.F**

The work shall Brick work using hydraulically pressed common burnt clay building brick having crushing

strength not less than 35 kg/sq. cm. in super structure above plinth level up to floor two level in cement mortar 1:6 ( 1 Cement: 6 fine sand) (B) Convention for G.F.. to be carried out as per relevant specification of **Item No. 9** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 21** **Brick work using hydraulically pressed common burnt clay building brick having crushing strength not less than 35 kg/sq. cm. in super structure above plinth level up to floor two level in cement mortar 1:6 ( 1 Cement: 6 fine sand) (B) Convention for F.F**

The work shall Brick work using hydraulically pressed common burnt clay building brick having crushing strength not less than 35 kg/sq. cm. in super structure above plinth level up to floor two level in cement mortar 1:6 ( 1 Cement: 6 fine sand) (B) Convention for F.F.. to be carried out as per relevant specification of **Item No. 9** of this contract. The Payment will be made on cum basis of the finished work. The work shall conform strictly to the drawings or as directed by the Engineer.

**Item No 22** **Providing and fixing Machine cut, free edges, Machine polished Marble slab 18mm to 20mm thick (Single place not more than 150 cm) for Door/ window cill and Jambs cladding as per design including full moulded round front edge both side and 1cm nosing and laid on 20 mm thick cement mortar 1:6 (1 cement, 6 coarse sand) jointed with grey cement slurry including rubbing and polishing finishing etc complete.**

M-51. Granite Slab

51.1. Marble slab shall be white or of other and of best quality as approved by the Engineer-in-charge

51.2. Slabs shall be hard, close, uniform and homogeneous in texture. They shall have even crystalline grain and free from defects and cracks. The surface shall be machine polished to an even and perfect plane surface and edges machine cut true and square. The rear face shall be rough to provide key for the mortar

51.3. Marble slabs with natural veins, if selected shall have to be laid as per the pattern given by the Engineer-in-charge. Size of the slab shall be minimum 460 mm x 450 mm and preferably 600 mm x 600 mm. However, smaller sizes will be allowed to be used of the extent of maintaining required pattern.

51.4. The slab shall not be thinner than the specified thickness at its thinnest part. A few specimen of finished slab to be used shall be deposited by the Contractor in the office for reference

51.5. Except as above the marble slabs shall conform to I.S. 1130-1969

M-52. Granite Stone slab

52.1. Granite shall be of approved colour and quality. The stone shall be hard, even sound and regular in shape and generally uniform in colour. It shall be without any soft veins, cracks or flaws

52.2. The thickness of the stone shall be specified in items

52.3. All exposed faces shall be double polished to tender truly smooth and even reflecting surface. exposed edges and corners shall be rounded off as directed The exposed edges shall be machine cut and shall have uniform thickness.

**Item No. 23** **Providing and fixing 35mm thick factory made moulded door shutter consisting of solid core single/two leaf flush door of 30mm thickness, lipped with 15mm (5mm x 3) thick x 30mm width on one stiles and top rail and 10mm (5mm x 2) thick x 30mm width on the other stiles and bottom rails. The inner panel laminated with 2mm thick termite proof, water proof and fire resistant moulded PVC sheet with 2,4,6 raised panel design in different plain and/or prelim colours on one side after routing the moulded design on flush door and 2mm plain and/or prelim PVC sheet on other side using rubber adhesive on flush door and solvent cement adhesive on the PVC lipping etc. complete as per direction of Engineer in charge, manufacture's specification and drawing.**

**1.0. Materials.**



- 1.1. Wood for shutter shall conform to M-29. 2. Glass shall conform to M-38. 3. Anodised aluminium butt hinges shall conform to M-43.
- 2.0. **Workmanship**
- 2.1. The item covers the requirement of preparation of shutters for doors, windows, clerestory windows, their supply and fixing.
- 2.2. **Shutters:**
- 2.2.1. Panelled shutters shall be constructed in the form of timber frame work of styles and rails with panel inserted of type as specified in the detailed drawings. Panel shall be fixed by providing grooves in the style and rails. The styles and rails shall be joined to each other by mortise and tenon joints at right angles.
- 2.2.2. All members of the shutters shall be straight without any warp or bow and shall have smooth, well planed faces at right angles to each other.
- 2.2.3. The size of styles and rails shall be as per drawings or as directed. Styles and rails of shutters shall be made of one piece only.
- 2.3. **Timber panelling:**
- 2.3.1. Thickness of the panel shall be as specified in the item as shown in the drawing or as directed. If the panel is made from more than one piece the pieces shall be finished as shown in the detailed drawings and shall be joined with continuous groove with specified size. The end pieces of the panel and the top and bottom of the panel shall be provided with continuous tongue to frame into groove of the frame shutter. An air space of 1.5 mm. shall be left in the groove of frame of shutter while framing the panels in it.
- 2.3.2. The faces of the panel as well as various pieces of the panel shall be- closely fitted to the sizes of the grooves.
- 2.3.3. Finishing of the corners of raised panel edges shall be done as shown in drawings or as directed.
- 2.3.4. The thickness specified shall be finished thickness and no tolerance will be permitted.
- 2.5. **Fixtures and Fastenings:**
- 2.5.1. The rate shall include anodised butt hinges including fixing with iron screws. The size and number of hinges shall be as per table given in annexure-1.
- 3.0. **Mode of measurement and payment**
- 3.1. The rate for shutter includes cost of providing block and cleat for keeping the shutter in open position if directed.
- 3.2. The dimension of the shutter shall be measured clear size of the shutter in close position between the grooves of the frame.
- 3.3. The rate shall be for a unit of one sq. meter

**Item No 25 Providing & fixing M.S. grill / M.S. door of required pattern to wooden frames of windows/ brick masonry with necessary M.S. angle, M.S. pipe, M.S. flats and other structural steel at required spacing and frame around square or round bars with round headed bolts and nuts or by screws (Plain Grills) Including primer coat of approved quality and two coats of oil paintings etc. complete as directed.**

**1.0 Materials & Workmanship**

- 1.1. The relevant specification of item No. 11.2 (A) shall be followed except that the steel work shall be done by welding.
- 1.2. Welding shall generally be done by electric process. Gas welding shall be resorted to, using oxyacetylene flame with specific prior approval. Gas welding shall not be permitted for structural steel work.
- 1.3. The work shall be done as shown in the shop drawings which should clearly indicate various details of the joints to be welded, shop and site welded as well as type of electrodes to be used, symbol for welding on plans and shop drawings shall be according to I.S. 813-1961. As far as possible every effort shall be made to limit the welding that must be done after improper welding that is likely to be done due to heights and difficult positions on scaffoldings etc. The welding work shall conform to I.S. 816-1969.
- 1.4. Preparation of surfaces : Surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter. A coating of boiled linseed oil shall be

- permitted.
- 1.5. Assembly for welding : Before welding is commenced, the plates shall first be brought together and firmly clamped or spot welded at specified distance. This temporary connection has to be strong enough to hold the plates accurately in place without displacement.
  - 1.6. Precautions : All operations connected with welding and cutting equipment shall conform to safety requirement given in I.S. 818-1968.  
The following points shall be borne in mind during the process of welding:
    - (b) Arc length, voltage and amperage shall be suited to the thickness of material type of groove and other circumstances of the work.
    - (c) The segments of welding shall be such that where possible the members which offer the greatest resistance to compression are welded first.
  - 1.7. The defective welds which shall be considered harmful to the structural strength shall cut out and reworked.
  - 1.8. Finished welds and adjacent parts shall be protected with clean boiled linseed oil and after all slag has been removed. Welds and adjacent parts shall be painted after the same are approved.
  - 1.9. All the members shall be thoroughly cleaned of rust-scales, dust etc. and given a priming coat of red lead paint before fixing them in position.  
Testing of welding to be added in the specification I.N. 12.2.2.12-(i) to (viii)
  - 2.0. **Mode of measurements & payment**
  - 2.1. The relevant, specification of item No. 11.2 (I) shall be followed.
  - 2.2. The rate shall be for unit of one quintal.
- Item No 26 Providing 15mm thick cement plaster in Single coat on brick/concrete wall for interior plastering finished even and smooth (ii) cement mortar 1:4(1 cement:4 sand) and mala proved finished etc. complete for GF**
- AND**
- Item No 27 Providing 10mm thick cement plaster in single coat on brick/concrete wall for interior plastering upto floor two level and finished even and smooth in (i) cement mortar 1:3(1 cement:3 sand)**
- 1.0. **Materials**
  - 1.1. Water shall conform to M-1. The cement mortar of proportion 1:4 shall conform to M-14.
  - 2.0. **Workmanship**
  - 2.1. **Scaffolding:**  
Wooden bullocks, bamboos, planks, trestles and other scaffolding shall be sound. These shall be properly examined before erection and use. Stage scaffolding shall be provided for ceiling plaster which shall be independent of the walls.
  - 2.2. **Preparation of back-ground :**
  - 2.2.1. The surface shall be cleaned of all dust, loose mortar droppings, traces of algae, efflorescence and other foreign matter by water or by brushing. Smooth surface shall be toughened by wire brushing if it is not hard and by hacking if it is hard. In case of concrete surface, if a chemical retarder has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the residues are left on the surface. Trimming of projections on brick/concrete surfaces where necessary shall be carried out to get an even surface.
  - 2.2.2. Raking of joints in case of masonry where necessary shall be allowed to dry out for sufficient period before carrying out the plaster work.
  - 2.2.3. The work shall not be soaked but only damped evenly before applying the plaster. If the surface becomes dry, such area shall be moistened again.
  - 2.2.4. For external plaster, the plastering operation shall be started from top floor and carried downwards. For internal plaster, the plastering operations may be started wherever the building frame and cladding work are ready and the temporary supports of the ceiling resting on the wall of the floor have been removed. Ceiling plaster shall be completed before starting

plaster to walls.

**2.3. Application of plaster:**

- 2.3.1.** The plaster about 15x15 cms. shall be first applied horizontally and vertically at not more than 2 meters intervals over the entire surface to serve as gauge. The surfaces of these gauges shall be truly in plane of the finished plastered surface. The mortar shall then be applied in uniform surface slightly more than the specified thickness, then brought to a true surface by working a wooden straight edge reaching across the gauges with small upward and sideways movements at a time. Finally, the surface shall be finished off true with a trowel or wooden float according as a smooth or a smooth or a sandy granular texture is required. Excessive troweling or overworking the float shall be avoided. All corners, arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Hounding or chamfering, corners, arises junctions etc. shall be carried out with proper templates to be size required.
- 2.3.2.** Cement plaster shall be used within half an hour after addition of water. And mortar or plaster which is partially set shall be rejected and removed forthwith from the site.
- 2.3.3.** In suspending the work at the end of the day, the plaster shall be left out clean to the line both horizontally and vertically, when recommencing the plaster, the edges of the old work shall be scraped clean and wetted with cement putty before plaster is applied to the adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of the wall and nearer than 15 cm. to any corners or arises. It shall not be closed on the body of features such as plaster bands and cornices not at the corners or arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakage. No portion of the surface shall be left out initially to be packed up later on.
- 2.3.4.** Each coat shall be kept damp continuously till the next coat is applied or for a minimum period of 7 days. Moistening shall commence as soon as plaster is hardened sufficiently. Soaking of walls shall be avoided and only as much water as can be readily absorbed shall be used, excessive evaporation on the sunny or windward side of building in hot air or dry weather shall be prevented by hanging matting or gunny bags on the outside of the plaster and keeping them wet.

**3.0. Mode of measurements & payment**

- 3.1.** The rate shall include the cost of all materials, labour and scaffolding etc. involved in the operations described under workmanship.
- 3.2.** All plastering shall be measured in square meters unless otherwise specified. Length breadth or height shall be measured correct to a centimeter.
- 3.3.** Thickness of the plaster shall be exclusive of the thickness of the key i.e. grooves or open joints in brick work, stone work etc. or space between laths. Thickness of plaster shall be average thickness with minimum 10 mm. at any point on this surface.
- 3.4.** This item includes plastering up to floor two level.
- 3.5.** The measurement of wall plastering shall be taken between the walls or partition (dimensions before plastering being taken) for length and from the top of floor or skirting to ceiling for height. Depth of cover of cornices if any shall be deducted.
- 3.6.** Soffits of stairs shall be measured as plastering on ceilings, following soffits shall be measured separately.
- 3.7.** For jambs, soffits, sills etc. for openings not exceeding 0.5 sq. met each in area for ends of joints beams, posts, girders, steps etc. not exceeding 0.5 sq. mt each in area and for openings exceeding 0.5 sq. mt and not exceeding 3.00 sq. mt. in each area deductions and additions shall be made in the following manners.
- (a) No deductions shall be made for ends of joints, beams, posts etc. and openings not exceeding 0.5 sq. mt each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings, for finish to plaster around ends of joints, beams posts etc.
- (b) Deduction for openings exceeding 0.5 sq. mt but not exceeding 3 sq.mt. each shall be made as follows and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings, (i)

When both faces of all wall are plastered with same plaster, deduction shall be made for one face only, (ii) When two faces of wall are plastered with different types of plasters or if one face is plastered and the other pointed, deductions shall be made from the plaster or pointing on the side of frame for door, window etc. on which width of reveals is less than that on the other side but no deductions shall be made on the other side. Where width of reveals on both faces of all are equal, deductions of 50% of area of opening on each face shall be made from areas of plaster and / or pointing as the case may be.

- 3.8. For openings having door frames equal to or projecting beyond the thickness of wall, full deduction for opening shall be made from each plastered face of the wall.
- 3.9. In case of openings of area above 3 sq. mt. each, deduction shall be made for openings but jambs, soffits and sills shall be measured.
- 3.10. The rate shall be for a unit of One sq. meter.

**Item No 28**      **20 mm thick sand faced cement plaster with on wall upto all height above ground level consisting 12 mm thick backing coat of c.m. 1:3 (1 cement : 3 sand ) and 8 mm thick finishing coat of cm 1:1 (1 cement : 1 sand) etc. complete.all height etc. complete**

**1.0. Materials**

**1.1.** Water shall conform to M-1. Cement mortar shall conform to M-11.

**2.0. Workmanship**

**2.1.** The work shall be carried out in the coats. The backing coat (base coat) shall be 12 mm. thick in C.M. 1:3. The relevant specifications of item No. 38 shall be followed except that the thickness of back coat shall be 12 mm. average. Before the first coat hardens its surface shall be beaten up by edges of wooden tapers and close dents shall be made on the surface. The subsequent coat shall be applied after this coat has been allowed to set for 3 to 5 days, depending upon the weather conditions. The surface shall not be allowed to dry during this period.

**2.2.** The second coat shall be completed to 8 mm. thickness in C.M. 1:1 as described above, including raising sand facing by bushing. The sample of sand face shall be got approved before the work is started. The whole work shall be carried out uniformly as per sample approved.

**2.3. Curing :**

The curing shall be started overnight after finishing of plaster. The plaster shall be kept wet for a period of 7 days. During this period, it shall be protected from all damages.

**3.0. Mode of measurement & payment**

**3.1.** The relevant specifications of item No. 17.58 shall be followed except that the sand face plaster on outside up to 10 m. above ground level shall be measured under this item.

**3.2.** The rate shall be for a unit of One sq. meter.

**Item No 29**      **P & L 24" x 24" vitrified 8 mm thick tile flooring over 20 mm (average) base of cement mortar 1:6 ( 1 cement: 6 coarse sand) on new surface or fixing on existing flooring by adhesive material including dismantling of existing flooring and jointed with color cement slurry including finished with flush pointing & cleaning the surface etc. complete for light shade (more than 10 ton)**

**Item No 30**      **' Providing Green Marble for Stair Toppla & Riser storage cabat partion,self complete with material like cement, marble, camical etc complete including all Labour work complete as per drawing and direction by Site Engineer**

**1.0. Materials**

Water shall conform to M-1 Cement mortar shall conform to M-11 Grenite stone shall conform to M-55

**2.0. Workmanship**

**2.1. Bedding :**

**2.1.1.** The sub grade shall be cleaned, wetted and mopped. The bedding shall then be laid evenly over the surface tamped and corrected to desired level and allowed to harden enough to offer a rigid

cushion to tiles and to enable the monsoon to place wooden planks across and squat on it.

- 2.1.2. The white glazed tiles shall be laid on cement mortar bedding of 12 mm. thick in C.M. 1:4. The mortar shall have sufficient plasticity for laying and there shall be no hard lumps that would interfere with the evenness of bedding. The base shall be cleared and well wetted. The mortar shall then be spread in thickness not less than 10 mm. at any place and average 12 mm. thickness. The proportion of the cement mortar shall be as specified in the item.

**2.2. Fixing tiles :**

- 2.2.1. The tiles before laying shall be soaked in water for at least two hours. Neat gray cement grout at 33 kg/Cement/Sq. mt. of honey like consistency shall be spread over the mortar bedding as directed. The edges of the tiles shall be smeared with neat cement slurry. The tiles shall be well pressed and gently tapped with a wooden mallet till they are properly bedded and in level with the adjoining tiles. There shall be. no hollows in bed or joints. The joints between the tiles shall be as thin as possible in straight line or as per pattern.

- 2.2.2. The tiles shall not have staggered joints. The joints shall be true to centre line both ways. The Nahni trap coming in the flooring shall be so positioned that its grating shall replace only one tile as far as possible. Where full size tiles cannot be fixed they shall be cut (Swan) to the required size and the edges rubbed smooth to ensure straight and true joints. The joints shall be filled with grey cement grout with wire brush or trowel to a depth of 5 mm. and loose material removed. White cement shall be used for pointing the joints. After fixing the tiles finally in an even plane the flooring shall be kept wet and allowed to nature undisturbed for 7 days.

**2.3. Cleaning :**

- 2.3.1. The surplus cement grout that may have come out of the joints shall be cleaned off before it sets. Once the floor has set, it shall be carefully washed, cleared by dilute acid and dried. Proper precautions and measures shall be taken to ensure that the tiles are not damaged in any way till the completion of the .construction.

**3.0. Mode of measurements & payment**

- 3.1. The work done shall be measured in sq. mt. for visible area of work done. The length and width of the flooring shall be measured not between the faces of skirting or dedos or plastered face of wall as the case may be. The paving under dedo or skirting shall not be measured. No deduction shall be made not extra paid for any opening in the floor of area-up to 0.1 sq.mt. Nothing extra shall be paid for laying the floors at different levels in the same rooms.

3.2. The rate shall be for a unit of one sq. meter

- Item No.31** (A) Providing and laying internal cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terrace,etc. consisting of following operations.(a) Applying and grouting a slurry coat of neat cement using 2.75 kg/sqm of cement admixed with proprietary water proofing compound conforming to IS : 3645 over the R.C.C. slab including cleaning the surface before treatment.(b) Laying cement concrete using broken bricks/brickbats 25 mm to 100 mm size with 50% of cement mortar 1:5 admixed with proper water proofing compound confirming to IS : 2645 over 20 mm thick layer of cement mortar of mix 1:5 admixed with proprietary water proofing compound confirming to IS : 2645 to required slope and treating similarly the adjoining walls up to 300 mm height including of junction of walls and slabs.
- (c) After two days of proper curing applying a second coat of cement slurry admixed with proprietary water proofing compound confirming to IS : 2645.
- (d) Finishing the surface with 20 mm thick jointless cement mortar of mix 1:4 admixed with proprietary water proofing compound confirming to IS : 2645. and finally finishing the surface with neat cement slurry and making of 300 x 300 mm square.
- (e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. all above operations to be done in order and as directed and specified by the Eng-in-charge.

C.M. (1:3) (By adding "Pidi proof LW" 200 ml. per 50 kg of cement bag) using approved

quality glazed tiles pieces of required sizes laid in line and level in necessary gradient for easy flow of rain water from roof of any height of quarters or any type of building with finishing (Flush pointing) the top surface of china mosaic with approved quality of white cement by adding waterproof compound. The treatment is carried along the vertical surface of the parapet and other joining wall up to height of about 150 to 300mm in a shape of quarter round vatah and finishing the adjoin surface between china mosaic and vertical surface of the parapet. Contractor should give guarantee for water proofing for 5 years with depositing 20% of item value by F.D.R. All the material including cement should be brought by the contractor at his own cost etc complete as directed.

**1. Material:**

- 1.1. The glazed tiles pieces shall be of best quality as approved by authority. The glazing shall be uniform shade. The thickness of tile shall be 6 mm.

**2. Preparation of surface:**

- 2.1. Well defined cracks other than hair cracks in the roof structure shall be cut to 'V' section cleaned and filled up flush with cement-sand slurry by adding water proof compound "Pidiproof LW".
- 2.2. The surface of floor, part of parapet and gutters, drain mouths etc; over which the water proofing treatment is to be applied, shall be cleaned of all foreign matter such as fungus, moss and dust by wire brushing and dusting.
- 2.3. The existing Shalimar water proofing layers shall be remove completely. Then the top of RCC / IPS surface after removing the tarfelt will be made rough by chipping and clean the same for proper bond with new water proofing.

**3. Workmanship:**

- 3.1. Item includes china mosaic flooring for water proofing treatment of slab. Before laying the bedding of C:M contractor shall be applying cement slurry on prepared surface at the rate of 2 kg/smt by adding waterproof compound "Pidiproof LW" 200ml per 50 kg of cement bag.
- 3.2. First of all cement mortar in CM (1:3) (1 cement 3 sand) shall be laid on floor 20 to 25 mm thick average bedding by adding waterproof compound "Pidiproof LW" 200ml per 50 kg of cement bag and laid in line & level in necessary gradient for easy flow of rain water from roof of any height of quarters or any type of building.
- 3.3. The grading shall be carried out prior to the application of waterproofing treatment by cement mortar as specified in description of item.
- 3.4. Before laying the pieces of glazed tiles on bedding contractor shall be spray dry cement and finishing (Flush pointing) the top surface of china mosaic with approved quality of white cement.
- 3.5. The treatment shall be carried out along the vertical surface of the parapet and other joining wall up to height of about 150 to 300mm in a shape of quarter round vatah and finishing the adjoin surface between china mosaic and vertical surface of the parapet.
- 3.6. Required chipping for outlet shall be done for proper drain of rainwater including refixing of existing drainpipe if required.
- 3.7. Drain outlet shall be suitably placed with respect to the roof gradient to ensure rapid drainage and prevent local accumulation of water on the roof, surface, masonry drain mouth shall be widen sufficiently and rounded with cement mortar.
- 3.8. From cast iron drain outlets a groove shall be cut all round to touch the treatment.
- 3.9. When a pipe passes through a roof on which water proofing treatment is to be laid, a cement, concrete angle fillet shall be built round it and the waterproofing treatment taken over the fillet.
- 3.10. Contractor shall be give waterproof test by filling water pond 150 mm deep for seven days.
- 3.11. Contractor shall be wash prepared waterproofing surface finally by mild acid as per instruction.
- 3.12. Contractor should give guarantee for water proofing for 5 years with depositing 20% of item value by F.D.R. up to guarantee period (i.e. 5 years). If any leakage observed, the agency will carry out repairing work time to time during 5 years of guarantee period and keep the terrace water proof. On failing of repairing by agency timely, GSECL will attend leakages time to time

and recovery will be made as per GSECL rules.

**4. Mode of measurements and payment.**

- 4.1. Measurement shall be measured in square meter area covered in treatment with treatment done over the parapet walls.
- 4.2. In measurements, no deduction shall be made for either openings or recesses for chimney; stacks roof lights, columns etc. for areas up to .40 sq. mt. Nor anything-extra labour and materials in forming such openings. For similar area exceeding 40 sq.mt. deduction shall be made in measurements for full opening but nothing extra shall be paid for extra labour and materials in forming such opening.
- 4.3. Treating the cracks shall not be paid separately.
- 4.4. All necessary tools, tackles, labour, scaffolding etc; required shall be arranged by contractor and rate quoted shall be inclusive of all

**Item No.32 Finishing wall with water proofing cement paint of on wall surface ( Two coats) to give an approved brand manufacture and of required shape even shade after throughly brushing of loose powered materials.**

**Materials**

- 1.1. The water shall conform to M-1. Cement water proofing paint shall conform to I.S. 5410-1969.

**2.0. Workmanship**

- 2.1. **Scaffolding :** The relevant, specifications of item No. 18.11 shall be followed.

**2.2. Preparation of surface :**

The relevant specifications of item No. 18.11 shall be followed except that the word white wash colour wash shall be substituted with water proofing cement paint. The surface shall be thoroughly wetted with clean water before cement water proofing paint is applied.

- 2.3. **Preparation of paint:** Portland cement paint shall be prepared by adding paint powder to water and stirring to obtain a thick paste, which shall then be diluted to a brush able consistency. Generally, equal volumes of paint powder and water make a satisfactory paint. In all cases, The manufacture's instructions shall Site followed. The paint shall be mixed in such quantities as can used up within an hour of mixing as otherwise the mixture will set and thickness, affecting flowing and finish. The lids of cement paint drums shall be kept tightly when not in use.

**2.4. Application of Paint:**

- 2.4.1. No painting shall be done when the paint is-likely to be exposed to a temperature of below 7<sup>0</sup> c within 48 hours after application.
- 2.4.2. When weather conditions are such as to cause be carried out in the shadow as far as possible. This helps the proper hardening of the paint film by keeping the surface moist for a longer period.
- 2.4.3. To maintain the uniform mixture and to prevent segregation, the paint shall be stirred frequently in the bucket.
- 2.4.4. For undecorated surfaces, the surface shall be treated with minimum two coats of water proof cement paint. Not less than 24 hours shall be allowed between two coats. Next coat shall not be started until the proceeding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the proceeding coat shall be slightly moistened before applying the subsequent coat.
- 2.4.5. The finished surface shall be even and uniform in shade, without patches, brush marks, paint drops etc.
- 2.4.6. The cement paint shall be applied with a brush with relatively short stiff hog or fiber bristles. The paint shall be brushed in uniform thickness and shall be free from excessively heavy brush marks. The lamps shall be brushed out.
- 2.4.7. Water proof cement paint shall not be applied on surface already treated with white wash, colour wash, distemper dry or oil bound varnishes, paint etc. It shall not be applied on gypsum, wood and metal surfaces.

- 2.5. Curing : Painted surfaces shall be sprinkled with water two or three times a day. This shall be done between coats and for at least two days following the final coat. The curing shall be started as soon as the point has hardened so as not be damaged by the sprinkling of water say about 12 hours after the application.
- 2.6. Protection measures shall be taken as per item No. 18.11 Para 2.6.
- 3.0. **Mode of measurements and payment**
- 3.1. The relevant specifications of item No. 18.11. shall be followed.
- 3.2. The rate shall be for a unit of One sq. meter.



**Item No 33      painting two coats (including priming coats) on new steel and other metal surface with enamel paint, brushing interior to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.**

**1.0.      Materials**

**1.1.**      emulsion paint and primer shall be of approved brand and manufacture. The emulsion paint shall be of required colour and shade and the same shall conform to I.S. : 428-1969.

**2.0.      Workmanship**

**2.1.      Scaffolding**

Where scaffolding is required, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be distempered. A properly secured and well tied suspended platform (Joola) may be used for distempering. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the walls and floors. For distempering to ceiling, proper stage scaffolding shall be erected where necessary.

**2.2.      Preparation of surface :**

**2.2.1.**      The undecorated surface to be distempered shall be thoroughly brushed from dust, dirt, grease, mortar dropping and other foreign matter and sand papered smooth. New plaster surface shall be allowed to dry for at least 2 months before applications of distemper.

**2.2.2.**      All unnecessary nails shall be removed. Pitting in plaster shall be made good with plaster again with a fine grade sand paper and made smooth. A coat of distemper shall be applied over the patches. The surface shall be allowed to dry thoroughly before the regular coat of distemper is allowed. The surface affected by moulds, moss, fungi, algae lichens, efflorescence etc. shall be treated in accordance with I.S; 2395 (Part 01) 1966. Before applying distempering, any unevenness shall be made good by applying putty made of plaster of Paris mixed with water on entire surface including filling up the undulation and then sand papering the same after it is dry.

**2.3.      Priming coat :**

**2.3.1.**      A priming coat of distemper primer of approved manufacture and shade shall be applied over the papered surface in case of new work on undecorated surface. If the distemper priming is done after the wall surface dries completely, the distemper primer shall be applied.

**2.3.2.**      Application of primer shall be done as under: The primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours before oil bound distemper or paint is applied.

**2.3.3.**      Oil bound distemper is not recommended to be applied within six months of the completion of wall plaster.

**2.4.      Preparation of oil bound distemper :**

**2.4.1.**      The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer only. Sufficient quantity of distemper required for a day's work shall be prepared.

**2.5.      Application of Distemper coat:**

**2.5.1.**      For undecorated surfaces, after the primer coat is dried for at least 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out priming coat. All loose particles shall be dusted off after rubbing. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed immediately by vertical strokes which together shall constitute one coat. The subsequent coats shall be applied after a time interval of at least 24 hours between consecutive coats to permit proper drying of the preceding coat. The finished surface shall be even and uniform without patches, brush marks, distemper drops etc.

**2.5.2.**      Sufficient quantity of distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room which cannot be completed on the same day.

**2.5.3.**      15 cm. double bristled distemper brush shall be used. After day's work brushes shall be thoroughly

washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

**2.6.** Protective measurements : The surfaces of doors, windows, floors, articles of furniture etc. and such other parts of the buildings as are not to be distempered shall be protected from being splashed upon. Such surfaces shall be cleaned of distemper splashes if any.

**3.0. Mode of measurements and payment**

**3.1.** Priming coat of distemper primer, scraping of surface spoiled by struck roots, removal of oil and grease spots, treatment for infraction of effloresces., mould moss, fungi, algae and lichen and patch repairs to plaster shall be included in this item for which nothing extra shall be paid.

**3.2.** All the work shall be measured net in the decimal system as in place subject to the following limits unless otherwise stated hereinafter:

(a) Dimensions shall be measured to the nearest 0.01 m.

(b) Area in individual items shall be worked out to the nearest 0.01 sq. m. All work shall be made for ends of joints, beams, posts etc., and openings, not exceeding 0.5 sq.mt. each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings not for finish around ends of joints, beams, posts etc.

**3.3.** Deductions of opening exceeding 0.5 sq.m. but not exceeding 3 sq. m. each shall be made as follows and net addition shall be made for reveals, jambs, soffits etc. of these openings :

(a) When both the faces of wall are provided with same finish, deductions shall be made for one face only.

(b) When each face of wall is provided with different finish, deduction shall be made for that side of frame for doors, windows etc. on which width of reveals is less than that of the other side but no deduction shall be made on the other side. Where the width of reveals on the both the faces of wall are equal, deduction of 50% of area of opening on each face shall be made from area of finish.

(c) When only one face of wall is treated and the other face is not treated, full deductions shall be made if the width of the reveal on treated side is less than that on untreated side but if the width of the reveal is equal or more than that on untreated side neither deductions nor additions to be made for reveals, jambs, soffits, sills etc.

**3.4.** In case of opening of area exceeding 3 sq. m. each deduction shall be made for openings but jambs, sills and soffits shall be measured.

**3.5.** No deductions shall be made for attachments such as casings, conduits, pipes, electric wiring and the like.

**3.6.** Item includes removing nails, making good holes, patches with materials similar in composition of distemper.

**3.7.** The rate includes cost of all materials, labours, scaffolding, protective measures etc. involved in all the operations described above. This shall also include conveyance, delivery, handling, unloading, storing work etc

**2.8.** The rate shall be for a unit of one sq. meter

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## **Schedule for Testing of Materials**

For ensuring quality control and workmanship, various test prescribed below corresponding to the material concerned shall be taken as periodic intervals as stipulated below..

The Material shall be got tested at GERI or Govt. recognized Laboratory or field Laboratory of GERI for which 1 % of the estimated amount put to tender shall be recovered from the contractor from the R.A. Bill and Final Bills as the testing charges shall be paid by the Govt. to the Laboratory. However if the charges increase over 1 % no excess recovery shall be made from the contractor as per resolution of B&C department dated 10th May 1985, vide TNC/1085 (4) S.

Item No. as per Sch. B	Brief Description of Materials to be tested	Qty. of Material	Prescription of test which shall be carried out	Frequency @ which test shall be carried out	Total No. of Test to be carried out
	Coarse Aggregate ( Metal, Kapchi, Gravel etc.)		<ul style="list-style-type: none"> <li>- Gradation test</li> <li>- Impact Value</li> <li>- Flakiness Index</li> <li>- Water absorption</li> <li>- Stripping Value</li> </ul>	1 to 100 Cum – 1 test 100 to 500 – 3 tests 500 to 1500 – 5 tests 1500 to 5000 – 7 tests	
	Grit		<ul style="list-style-type: none"> <li>- Stripping Value</li> </ul>	One test per work	
	Sand		<ul style="list-style-type: none"> <li>- Gradation</li> <li>- Fineness Modulus</li> <li>- Specific gravity</li> <li>- Water absorption</li> <li>- Silt – Content</li> </ul>	One test per 150 Cum or as per requirement of relevant specification	
	Tiles		<ul style="list-style-type: none"> <li>- Dimension Test</li> <li>- Transverse strength</li> <li>- Water Absorption</li> <li>- Abrasion Test</li> </ul>	One test per 2000 tiles	
	Teakwood		<ul style="list-style-type: none"> <li>- Anatomy Test</li> <li>- Density Test</li> <li>- Moisture Content Test</li> </ul>	One test per work	
	Bricks		<ul style="list-style-type: none"> <li>- Dimension and tolerance</li> <li>- Water absorption</li> <li>- Effluence</li> <li>- Compressive Strength</li> </ul>	1 Test @ 50,000 Bricks	
	Cement		<ul style="list-style-type: none"> <li>- Consistency</li> <li>- Setting Time</li> <li>- Compressive Strength</li> <li>- Fineness</li> <li>- Chemical analysis</li> <li>- Soundness</li> </ul>	Up to 50 MT      1 Test 50 – 100 MT      2 Test 100 – 200 MT      3 Test 200 – 300 MT      4 Test	

				300 – 500 MT      5 Test 500 – 800 MT      6 Test 800 – 1300 Mt      7 Test and 8 test for larger consignment	
	Steel		- Tensile Strength - Yield Stress - Elongation - Size	One test/40 tonnes/per category	
	C.C. Cube test 1:2:4		- Compressive Strength	1 to 5 Cum.    1 Test. 6 to 15 Cum.   2 Test. 16 to 20 Cum. 3 Test. 21 to 50 Cum. 4 Test 51 & Above Cum. 4 + 1 for each additional 50Cum or part thereof	
	Aluminum Sections		- Gauge, Section	One Test for each section	

Testing Charges shall be born by Govt. No refund be made or extra charge over 1 % shall be recoverable form the contractor.

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