

GENERAL TECHNICAL SPECIFICATIONS FOR BUILDING WORKS

GENERAL

1. In the specifications, "as directed /" Approved" shall be taken to mean "as directed"/"approved" by the Architect/Engineer-in charge
2. Wherever a reference to any India Standard appears in the specifications, it shall be taken to mean as a referenced to the latest edition of the same in force on the date of agreement.
3. In "Mode of Measurement" in the specification wherever a dispute arises in the absence of specific mention of a particular point or aspect, the provisions on these particular points, or aspects in the relevant India Standards shall be referred to.
4. All measurements and computations, unless otherwise specified, shall be carried out nearest to the following limits:
 - (i) Length, width and depth (height) ----- 0.01 Meter
 - (ii) Areas ----- 0.01 Sq.Mt
 - (iii) Cubic Contents ----- 0.01 Cu.Mt.
5. The distances which constitutes lead shall be determined along the shortest partials route and not necessarily the route actually taken. The decision of the Engineer-in-charge in this regard shall be taken as final
6. Where do lead is specified, it shall mean "all leads"
7. Lift shall be measured from plinth level.
8. Up to "floor two levels" means actual height of floor (Maxi. 4 M) up to 3 Mt. above plinth level
9. Definite particulars covered in the items of work, though not mentioned or elucidated in it, specification shall be deemed to be included therein
10. Reference to specification of materials as made in the detailed specification of the items of work in the form of a designation containing the number of the specification of the material and prefix 'M' e.g., 'M-5'
11. Approval to the samples of various materials given by the Engineer-in-charge shall not be absolve the contractor from the responsibility of replacing defective material brought on site or materials used in the work found defective at a later date. The contractor shall have no claim to any payment or compensation whatsoever on account of any such materials being rejected by the Engineer-in-charge.
12. The contract rate of the item of work shall be for the work completed in all respects.
13. No collection of materials shall be made before it is got approved from the Engineer-in-charge.
14. Collection of approved materials shall be done at site of work in a systematic manner. Materials shall be stored in such a manner as to prevent damage, deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work.
15. Materials, if and when rejected by the Engineer-in-charge, shall be immediately removed from the site of work.
16. No materials shall be stored prior to, during and after execution of a structure in such a way as to cause or lead to damage or overloading of the various components of the structure.
17. All works shall be carried out in a workmanlike manner as per the best techniques for the particular item
18. All tools, templates, machinery and equipment for correct execution of the work as well as for checking lines, levels alignment of the works during execution shall be kept in sufficient numbers and in good working condition on the site of the work.
19. The mode, procedure and manner of execution shall be such that it does not cause damage or over loading of the various components of the structure during execution or after completion of the structure.
20. Special modes of construction not adopted in general Engineering practice, if proposed to be adopted by the Contractor, shall be considered only if the contractor and completion of work to the required strength and quality.

Acceptance of the same by the Engineer-in-charge shall not, however, absolve the contractor of the responsibility of any adverse effects and consequences of adopting the same in the course of execution of the work.

21. All installation pertaining to water supply and fixtures thereof as well as drainage lines and sanitary fittings shall be deemed to be completed only after giving satisfactory tests by the Contractor.

22. He contractor shall be responsible for observing the rules and regulations imposed under "Minor Minerals Act", and such other laws and rules prescribed by Government from time to time.

23. All necessary safety measures and precaution (including those laid down in the various relevant Indian Standards) shall be taken to ensure the safety of men, materials and machinery on the works as also of the work itself.

24. The testing charges of all materials shall be borne by the Contractor unless recovery at one percent towards using charges is separately made.

25. Approval to any of the executed items for the work does not in any way relieve the contractor of his responsibility for the correctness, soundness and strength of the structure as per the drawings and specification.

TECHNICAL SPECIFICATIONS FOR EARTHWORK

1. Scope of Work

This specification covers the general requirements of earthwork in excavation in different materials, site grading, filling in areas as shown in drawing, filling back good earth around foundations and in plinths, pre-constructional anti-termite treatment, conveyance and disposal of surplus soils or stacking them properly as shown on the drawings and as directed by engineer and all operations covered within the intent and purpose of this specification.

Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to:

IS: 1200 (PART 1): 1992 Methods of Measurement of Building and Civil Engineering Works - Earthwork.

IS:2720 Methods of Test for Soils

PART 2: 1983 Determination of Water Content.

PART 7:1980 Determination of Water Content - Dry Density relation using light compaction

PART 8 :1983 Determination of Water Content - Dry Density relation using heavy compaction

PART 28 :1974 Determination of Dry Density of Soils in place by the Sand Replacement Method.

PART 29 :1975 Determination of Dry Density of Soils in place by the Core Cutters Method

IS: 3764:1992 Safety Code for Excavation Work.

IS: 1498 Classification and identification of soils for general Engineering purpose.

IS: 6313:2013 Part –1 Code of practice for anti-termite measures in buildings: constructional measures.

Part–2:Code of practice for anti-termite measures in buildings: Pre constructional chemical treatment measures.

Drawings

Engineer will issue further drawings wherever, in his opinion such drawings are required to show areas to be excavated/filled, sequence of priorities etc. Contractor shall follow strictly such drawings.

General Requirements

1. Contractor shall furnish all tools, plants, instruments, qualified supervisory personnel, labor, materials, any temporary works, consumable, any and everything necessary, whether or not such items are specifically stated herein for completion of the job in accordance with specification requirements.

2. Contractor shall carry out the survey of the site before excavation and set properly all lines and establish levels for various works such as earthwork in excavation for grading, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to

established reference/grid lines at 8 m intervals or nearer as determined by Engineer based on ground profile. These shall be checked by Engineer and thereafter properly recorded.

3. The excavation shall be done to correct lines and levels. This shall also include, where required, proper shoring to maintain excavation and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night for ensuring safety.

4. The rates quoted shall also include for dumping of excavated materials in regular heaps, bunds, riprap with regular slopes as directed by Engineer, within the lead specified and leveling the same so as to provide natural drainage. Rock/soil excavated shall be stacked properly as directed by Engineer. As a rule, all softer material shall be laid along the center of heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Rock shall be stacked separately.

5. The area to be excavated filled shall be cleared of fences, trees, plants, logs, stumps, bush, vegetation, rubbish, slush, etc. and other objectionable matter. If any roots or stumps of trees are met during excavation, they shall also be removed. The material so removed shall be burnt or disposal off as directed by Engineer. Where earth fill is intended, the area shall be stripped of all loose/soft patches, topsoil containing objectionable matter/materials before fill commenced.

Classification of SoilAll materials to be excavated shall be classified by Engineer, into one of the following classes and shall be paid for at the rates tendered for that particular class of material. No distinction shall be made whether the material is dry, moist or wet. The decision of Engineer regarding the classification of the material shall be final and binding on Contractor and not be a subject matter of any appeal or arbitration. Any earthwork will be classified under any of the following categories:

Ordinary & Hard Soils

These shall include all kinds of soils containing kankar, sand, silt, murrum and/or shingle, gravel, clay, loam, peat, ash, shale, etc., which can generally be excavated by spade, pick axes and shovel, and which is not classified under "soft and decomposed rock" and "hard rock" defined below. This shall also include embedded rock boulders not longer than 1 meter in any direction and not more than 200 mm in any one of the other two directions.

Soft and Decomposed Rock

This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite and all other materials which in the opinion of Engineer is rock, but does not need blasting and could be removed with picks, hammer, crew bars, wedges, and pneumatic breaking equipment. The mere fact that Contractor resorts to blasting for reasons of his own shall not qualify for classification under "hard rock". This shall also include excavation in macadam and tarred roads and pavements. This shall also include rock boulders not longer than 1 meter in any direction and not more than 500 mm in any one of the other two directions. Masonry to be dismantled will also be measured under this item.

Hard Rock

This shall include all rock occurring in large continuous masses, which cannot be removed except by blasting for loosening it. Hard varieties of rock with or without veins and secondary minerals, which, in the opinion of Engineer require blasting, shall be considered as hard rock. Boulders of rock occurring in such sizes and not classified under (a) and (b) above shall also be classified as hard rock. Concrete work both reinforced and unreinforced to be dismantled will be measured under this item, unless a separate provision is made in the Schedule of Quantities.

Backfilling Material

To the extent available, selected surplus spoils from excavated materials shall be used as backfill. Fill materials shall be free from clods, salts, sulphates, and organic or other foreign material. All clods of earth shall be broken into pieces not larger than 150-mm size mixed with properly graded fine materials consisting of murrum or earth to fill up the voids and the mixture used for filling.

If any selected fill material is required to be borrowed; Contractor shall make arrangements for bringing such material from outside borrow pits. The material and source shall be subject to prior approval of Engineer. The approved borrow pit area shall be cleared of all bushes, roots of trees, plants, rubbish etc. top soil containing salts/ sulphates and other foreign materials shall be removed. The materials so removed shall be burnt or disposed of as directed by Engineer. Contractor shall make necessary access roads to borrow areas and maintain the same, if such access road does not exist, at his cost.

Preparation of Area

1. Prior to the commencement of earthwork operations, areas to be excavated, or on which embankment is to be placed, shall be cleared, grubbed and scalped as required. Earthwork shall not start until an area has been prepared which is suitable to allow efficient and uninterrupted progress.
2. Contractor shall carry out the survey of the site before excavation and set properly all lines and establish levels as per approved drawings.
3. Before excavation work begins the contractor shall check all underground utilities such as electrical cables, pipelines, tanks etc.
4. The Contractor shall not remove any tree without the prior permission of the Architect / Engineer-in-charge. Adjacent tree/shrubs subject to possible damage shall be properly marked and/or protected during construction.
5. The Contractor shall provide and maintain barricades, guard rails, fences and other protective devices necessary for prevention of injury to persons/property around all work area and at other locations where such potential hazard exists.
6. The Contractor shall preserve all Bench marks, Boundary and reference pillars.
7. 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 removed as directed. The materials so obtained shall be conveyed and 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.
8. The rate of site clearance is being paid separately under BOQ item no. 1.01

Weather Limitations

During the periods when weather conditions are such or have previously been such, as to preclude satisfactory execution of the work, earthwork operations shall be suspended or shall be limited to those activities which can be successfully executed under prevailing conditions. For this purpose, excavation can be carried out in such area or depth where concrete will be poured immediately after the excavation has been completed. The Contractor may if he wishes cover the bottom of excavation with suitable material to keep off the frost/rain from affecting the exposed earth surface. The material for this purpose shall be furnished by the Contractor and removed by him immediately before pouring concrete at his cost.

Preservation of Property, Antiques and Relics

1. Excavating operation shall be conducted in such a manner that all properties, facilities, utilities and improvements on or near the project site, which are to remain in place, are not damaged.
2. All gold, silver, oil minerals, archaeological and other findings of importance, precious stones, coins, treasures, relics, antiquities and other similar things which may be found in or upon the site shall be the property of the Owner and the contractor shall duly preserve the same from time to time and deliver the same to such person or persons as owner may from time to time authorize or appoint to receive the same.
3. Where circumstances require so the contractor shall furnish and install sheet-piling, cribbing, bulkheads, shores, bracing or other means as may be necessary to adequately support materials carrying such items or to support the items themselves, shall maintain such supports until they are no longer needed.

Drainage

1. The Contractor shall take suitable precautions to prevent ingress of water into the excavated areas during construction. Contractor shall ensure positive drainage at all time of all areas affected by the work.
2. Areas to be fixed or to have the placement of dikes shall be drained of all surface water and such ground water as may impair the construction of embankment or areas fill. The area may be drained by well points and/or temporary ditches, sumps and pumps. Pumping and bailing from the interior of any foundation enclosure shall be done in such a manner as to prevent the possibility of movement of water through or alongside any concrete being placed.

Excavations shall be as dry as possible prior to and during placing concrete.

All water pumped or bailed out during de-watering of pits and trenches shall be disposed of suitably through properly laid channels or pipes by the contractor at his own cost.

Disposal of water shall be carried out in such way that no inconvenience or nuisance is caused to the work in progress in the area or to the other agencies working in the area or cause damage to property and structures nearby.

Setting Out

1 The Contractor shall be responsible for the true and proper setting out of the work in relation to original points, lines and levels of reference and for the correctness of the levels, dimensions and alignment of all parts of the work. If at any time during progress of the work any error appears or arises in the position of level, dimension, or alignment of part of the work, the Contractor at his own expense shall rectify such errors to the satisfaction of the Architect / Engineer-in-Charge. The checking of any line or level by the architect/ engineer-in-Charge shall not in any way relieve the contractor of his responsibilities.

2 The Contractor shall lay out, and construct one or more permanent bench marks in some central place before the start of the work, from which all important levels for the excavations will be set. The contractor shall provide all material & labor for establishing permanent benchmark at his own cost. These permanent bench marks shall consist of masonry pillars with top neatly plastered and leveled as per the directions of the Architect / Engineer-in-Charge. These permanent benchmarks shall be properly founded to ensure no settlements. Bench marks shall be well connected with triangular grid system or any other bench mark approved by the Architect / Engineer-in-Charge.

Earthwork In Excavation

1 Excavation shall be carried out in any material met on the site to the lines, levels and contours shown on the detailed drawings and the contractor shall remove all excavated materials to soil heaps on site or transport for use in filling on the site or stack them for reuse as directed:

2 Excavated materials shall not be deposited within 1.5m from the top edge of the excavation.

3 The sides of the excavation may be cut sloping, or shored and strutted to hold the face of earth as per site requirements and as directed by the Engineer-in-Charge or as per approved drawings.

4 Foundation pits/trenches shall not be excavated to the full depth unless construction is imminent. The last 15cm depth of the excavation shall not be done until concreting work is imminent. The full depth may at the discretion of the Architect / Engineer-in charge be excavated as specified in schedule of rates/shown on drawing, after watering and consolidating the bed.

5 If the bottom of any excavation has been left exposed by the Contractor and in the opinion of the Architect / Engineer-in-Charge, that has become badly affected by the atmosphere or by water, then the Contractor shall remove such portions of the deteriorated material as the Architect / Engineer-in charge may direct and shall make good with lean concrete 1:4:8 mix (1 Cement: 4 Coarse Sand: 8 crushed Stone Aggregate). All expenses for such additional concrete and excavation shall be borne by the Contractor.

6 Where excavation is made in excess of the depth required, the Contractor shall, at his own expense, fill up to required level with lean concrete 1:4:8 mix (1 Cement: 4 Coarse Sand: 8 Crushed Stone aggregates) or as decided by Architect/ Engineer-in-Charge.

7 The Contractor shall provide suitable drainage arrangement to prevent surface water from any source entering the foundation pits at his own cost.

8 The Contractor shall make all arrangements for dewatering during excavation and subsequent works, the accumulated water from any source (including subsoil water) in the excavated pits/trenches and keeping the excavated pits/trenches dry for subsequent works.

9 The Contractor shall make necessary arrangements for lighting, fencing and other suitable measures for protection against risk of accidents due to open excavation.

10 Where the excavation is to be carried out below the foundation level of an adjacent structure, the precaution to be taken such as under pinning, shoring and strutting etc. shall be determined by the Engineer-in-Charge. No excavation shall be done unless such precautionary measures are carried out as per directions of the Architect / Engineer-in-Charge. The payment for such precautionary measures shall, however, be made separately.

11 Loose or soft bed ground encountered in excavation at the required depth shall on the Engineer-in-charge's instructions be excavated to a firm bed and difference made up to the required level with lean concrete 1:4:8 mix (1 cement: 4 coarse sands: 8 crushed stone aggregates).

12 Any obstacle encountered during excavation shall be reported immediately to the Architect / Engineer-in-Charge and shall be dealt with as instructed by him. Removal of buried pipes or cables shall not be done without prior permission of the Architect. Contractor shall provide all measures to protect the same. Cost of such protective measures is deemed to be included in the rates for various items of excavation.

13 The Contractor shall not undertake any concreting in foundation until the excavation pit/trench is approved by the Architect / Engineer-in-Charge.

14 The specification for earth work shall also apply to excavation in rock in general.

Payment:

1 Payment for earthwork in excavation shall be made on cubic meter (m³).

The lesser of the two quantities mentioned below will be considered for payment purpose:

(i). the measurement of volume of pit / trench of excavation with working space as per relevant Indian Standard (IS:1200) and slopes / stepping as permitted by the Architect / Engineer in charge.

(ii). Theoretical volume of excavated earth as per excavation plan or approved drawings.

The rate shall include cost of all the operations of excavation, taking out excavated soil, making of all arrangements for dewatering the accumulated water from any source in the excavated pit or trench, removal and disposal of surplus excavated soil within a lead of 50m from construction areas. The rate shall also include setting out and line out work required for the excavation.

2 The following works shall not be measured separately and allowance for the same shall be deemed to have been made in the description of main item:

- a) Setting out works, profiles, etc.
- b) Site clearance, such as cleaning grass and vegetation;
- c) Unauthorized battering or benching of excavation;
- d) Forming (or leaving) 'dead men' or 'tell-tales' in borrow pits and their removal after measurements;
- e) Forming (or leaving) steps in sides of deep excavation and their removal after measurements;
- f) Excavation for insertion of planking and strutting;
- g) Unless otherwise specified, removing slips or falls in excavations;
- h) Baling out or pumping of water in excavation from rains;
- i) Baling out or pumping of water in excavation from sub-soil water, and
- j) Slings or supporting pipes, electric cables etc., met during excavation.

3 Special pumping other than what is included in 11.15.2 (h and i) and well point dewatering where resorted to, shall each be measured separately, unless otherwise stated, in kilo-litres of water against separate specific provision(s) made for the purpose.

4 The Contractor shall intimate to the Architect / Engineer-in-Charge as soon as different classification of soils are met with. The measurements of various soil classifications then shall be worked out by either of the following alternatives in the order of their decreasing importance.

- a) Joint levels shall be taken as to the levels of different soil classifications and volume worked out on the basis of levels only.
- b) Where levels of different strata cannot be clearly marked and defined the Contractor shall stack different soils of various classifications separately for measurement purpose and then dispose it off.
- c) If soil of any classification other than that specified herein is met with during excavation, the decision of the Architect/ Engineer-in-Charge as to the classification of soil, levels of the strata of different classifications and their location shall be binding. In above case, the total quantity of excavation shall be computed from the measurement of the pit / trench excavated. The hard rock and soft rock shall be measured separately.

Excavation of Rock

1 Should rock be encountered above contract levels; it shall be immediately brought to the notice of the Architect / Engineer-in-charge. When directed the rock surfaces shall be uncovered and contractor shall submit a survey report indicated the levels of rock surface on a 3.0 M grid.

2 Blasting for rock excavation shall be carried out by persons skilled in such work and only with prior approval of Architect / Engineer-in-charge. It shall be performed in strict accordance with the requirements of Explosives Rules 1940, Indian Explosive act 1844 and other local and Governmental laws. The contractor shall remain totally responsible for any accident arising out of blasting operations or driving storage and transport of blasting materials.

3 Excavations in rock shall be cut as close as practical to the lines required for the installation of the full thickness of floors, footings and trenches or as indicated on the construction drawings.

Shoring and Strutting

1 The Contractor shall provide timbering, sheet piling, bracing, anchoring and other supports as may be necessary to protect the excavated slopes, adjacent paving, structures, utilities and to prevent personnel injuries and property damage.

2 Braced sheet piling shall be provided where deemed necessary. Shoring shall be installed so as not to interfere with the proper placement and compaction of back fill.

3 Shoring of excavation shall be removed only when excavation is safe from cave-in and as back filling progresses.

Quality Control of Fill / Fill density

1 Prior to carrying out filling the Contractor shall carry out sufficient laboratory moisture - density tests to evaluate compaction. From these tests, the maximum dry density and optimum moisture content for the approved fill material shall be determined. The laboratory tests shall be in accordance with Indian Standards IS:2720 - Parts 2, 7 and 8. Field compaction test shall be carried out at different stages of filling and also after the fill to the entire height has been completed.

When earth filling is being carried out field tests shall be carried out at various stages to ensure that adequate compaction is being achieved. The field tests shall be in accordance with IS:2720, Part 28 and 29.

The compaction, shall comply with the specified (proctor modified proctor) density at moisture content differing not more than 4 percent from the optimum moisture content. Contractor shall demonstrate adequately at his cost, by field and laboratory tests that the specified density has been obtained.

Frequency of Field Density Tests

To ensure adequate quality control on compaction of earth fill, the following minimum number of field density tests shall be performed:

- (i). One test for every 500 cum of fill material placed for fill construction in site grading.
- (ii). One test for every 500 cum of fill material placed for fill construction in plinth filling.

LEAD

Lead for deposition/disposal of excavated material, shall be as specified in the respective item of work. For the purpose of measurement of lead, the area to be excavated or filled or area on which excavated material is to be deposited/disposed of shall be divided into suitable blocks and for each of the blocks, the distance between center lines shall be taken as the lead which shall be measured by the shortest straight-line route on the plan and not the actual route taken by Contractor. No extra compensation is admissible on the grounds that the lead including that for borrowed material had to be transported over marshy or subsoil land/route.

Transportation of Surplus Earth / Soil

Surplus earth shall be used to the maximum extent in the compound. Earth useful for filling shall be separately stacked as directed by the PMC from time to time. Approved quality earth shall be used in the filling. Rate for excavation shall include sorting out of useful materials.

All surplus and unusable soil from excavation shall be removed from construction area to the area demarcated by the Architect/ Engineer-in-Charge. The contractor shall quote his rate for disposing off or carting away the items considering requirements and standards of the local authority.

Clean - Up

At the conclusion of all fill and back fill operations, the contractor shall clear away from the job site as well as from private and public roads, ditches and surrounding areas, all rubbish and construction materials and all contractor's tools, equipment and other property.

Safety Rules

Safety rules as laid down by the statutory authority and as provided in National Building Code (NBC) and IS 3764 shall be followed.

BOQ SPECIFIED:

2.2 Earth Work in Excavation Mechanically (Using excavators like BACKHOE /POCLAIN with bucket) for depth up to 3.0m from Existing GL.

This shall include earthwork in excavation in all kinds of soils (Ordinary or Hard) including murrum, hard murrum, soft rock etc. by mechanical means i.e. by earth excavators like Backhoe / Porcelain etc. for depth up to 3.0m from existing ground level to correct line and levels as per approved excavation plan or drawings and stacking useful excavated earth as soil heaps on site within 50 m lead or transport for reuse in filling to the areas demarcated by the Architect / Engineer-in charge for this purpose.

The contractor shall follow general technical specifications as described above for carrying out this work.

Lead: The work also includes lifting out the excavated soil and disposal / stacking of useful earth (to be used for back filling) within a lead of 50m from site. Nothing extra shall be paid for stacking useful earth within a lead of 50 m from site premises.

Disposal of earth beyond 50 m from site premises will be paid under a separate item (BOQ item no.1.04).

Mode of Measurement:

The excavation up to 3.0 m depth shall be measured under this item. Dimension shall be done in cm. Mean depth from the surface of the ground obtained by theodolite in total station (TS) shall be considered. Actual quantity of work will be the multiplication of the mean depth and the area of the plot excavated measured in cum with two decimals.

Payment:

Payment for earthwork in excavation shall be made on cubic meter (m³).

The lesser of the two quantities mentioned below will be considered for payment purpose:

- (i). the actual measurement of volume of pit / trench of excavation with working space as per relevant Indian Standard (IS:1200) and slopes / stepping as permitted by the Architect / Engineer in-charge.
- (ii). Theoretical volume of excavation as per excavation plan or approved drawings.

The rate shall include cost of all the operations of excavation, taking out excavated soil, making of all arrangements for dewatering the accumulated water from any source in the excavated pit or trench, removal and disposal of surplus excavated soil within a lead of 50m from construction areas. The rate shall also include setting out and line out work required for the excavation.

3.1/ 3.2 Filling in Foundations and Plinth with Selected Excavated Earth:

i). This shall include filling in foundations and plinth, backfill in retaining walls above existing grade with approved good earth which was stacked separately while excavation, in layers of 15-20 cm, watered and compacted with manual /mechanical/vibrato roller finished to desire levels as per drawings, to get moisture dry density (proctordensity) of 95% as per the detailed drawings.

ii). The contractor shall follow general technical specifications as described above for carrying out this work.

iii). The base surface shall be cleared of vegetation by up-rooting or any organic matter, prior to commencement of filling operation.

iv). Filling shall be done in layers not exceeding 20 cm in depth. Earth used shall be free from roots, grass and rubbish and all lumps and clods exceeding 8 cm in any direction shall be broken down. The compaction of the plinth fill shall be carried out by means of 10/12-ton rollers smooth wheeled or mechanical vibrato-roller, as rolling proceeds water sprinkling shall be done to assist consolidation. Each layer shall be watered with optimum moisture content to achieve 95% consolidation. Where the roller cannot work, wooden or steel rammers of seven to ten kg weight with flat base of 20 sq.cm or 20cm dia. should be used. Manual compaction will be permitted under special condition and as per engineer's instruction etc.

v). When filling reaches the finished level, the surface shall be flooded with water, if directed by the Engineer, for 24 hours, allowed to dry and then the surface is again compacted as specified above to avoid settlements at a later stage. The finished level of the filling shall be trimmed to the level/slope specified.

vi). Each building plinth to have at least one set of proctor density conducted irrespective of plinth area or for every 500sqm of compacted area or part thereof.

Mode of Measurement:

Dimensions of volume back-filled shall be measured after consolidation to calculate the actual quantity of filling. It shall be measured in Cum correct to two places of decimals.

Payment:

Payment for back-filling with earth shall be based on volume in cubic meters (m³) of consolidated fill. This volume shall be derived from the difference between the volume of excavation and the volume of structure or trenches as the case may be. The rate shall include cost of extracting suitable approved earth from available excavated soil from soil heaps within a lead of 50m, placing, watering, rolling, ramming compacting in layers, trimming and dressing finished surface and disposal of surplus material up to a lead of 50m. However, backfilling done with material other than good earth shall be paid separately under relevant items.

Disposal of surplus earth, debris etc. outside the Site:

- i). The work under this section includes disposing off all surplus and unusable earth outside the plot but at a location approved by local authority (beyond a lead of 50 m) and confirming to their specification. The constructor shall quote his rate for disposing off or carting away the items considering requirements and standards of the local authority with whose permission surplus and unusable earth shall have to be disposed of.
- ii). Surplus earth, debris, or such materials, if ordered by Site in charge, shall be collected & transported away from the site to approved disposal sites & dumped causing no inconvenience to any neighborhood, all as per permissible rules. The contractor shall be held responsible for all consequences if any complaint is received from public/statutory body etc.
- iii). The site from where the surplus earth is lifted shall be dressed in neat & tidy manner, when the work is complete.

Payment:For payment purpose, lesser of the two values calculated as mentioned below shall be considered:

- (a). Theoretical difference of the excavation quantity and the filling quantity.
- (b). Actual quantity executed computed as 60% of the filled-up volume of the Truck / Dumper used for carting.

3.3 SUPPLYING THE CHEMICALS AND CARRYING OUT PRE-CONSTRUCTION ANTI- TERMITE TREATMENT.

Scope of Work:

The scope of pre constructional anti-termite treatment covers the soil treatment with approved chemicals in water emulsion in foundation trenches for columns, plinth beams, plinth filling, at junction of walls and floor, in expansion joints etc. in stages as detailed in these specifications and drawings. This shall include supplying the chemicals and carrying out pre-construction Anti- termite treatment at the various stages of construction as per IS 6313: 2013 and as recommended by the chemical manufacturer / Engineer in charge to safeguard the building against termite including execution and submission of guarantee for a period of 10 years. (On non-judicial stamp paper of required value as per format approved by Architect/ Bank) against any subterranean pests' infestation.

General Requirements:

Pre-constructional anti-termite treatment is a process in which soil treatment is applied to a building in early stages of its construction. The purpose of anti-termite treatment is to provide the building with a chemical barrier against the sub-terrain termites. Anti-termite treatment being a specialized job, calls for thorough knowledge of the chemicals, soils, termite to be dealt with and the environmental conditions, in order to give effective treatment and lasting protection to the property undergoing treatment. It is therefore imperative that the works of anti-termite treatment should be got executed through specialized agencies only. The specialized agency should be preferably a member of the Indian pest control Association and shall have sufficient experience of carrying out similar works of magnitude envisaged in this tender.

The pre-constructional soil treatment is required to be applied during the construction stages of the sub-structure up to plinth level. The contractor has to be watchful of the various stages of sub-structure works and arrange to carry out the soil treatment in time after proper coordination with Department and other contractors if any, working at site. Anti-

Termite Treatment shall be as per ISI-6313 – 2013 and latest revisions and shall be carried out by an approved specialist agency as approved and directed by the Architect to the following general specifications:

Essential requirements:

- A copy of ground or basement floor plan should be made available to contractor before the start of the work.
- Contractor shall provide specialized agency's suitable space with lock and key arrangement for the storage of chemical and the equipment.
- The removal of trees, stumps, logs or roots from a building site reduce the hazards from the subterranean termites. Area of treatment shall be kept free from all debris.
- Treatment should not be carried out when it is raining or when the soil is saturated with sub-soil water. The chemical shall be applied to soil when the soil is dry and absorbent. Immediate steps to be taken to cover the treated layer by laying soiling /PCC etc.
- Once formed treated soil barriers zone must not be disturbed. In case treated soil is disturbed, immediately steps shall be taken to restore the continuity and completeness of barrier system.
- All the extra soil-filling for flower-Bed, Terrace Garden, Mud, Fusca etc. coming above ground level of the building must be treated. Sub-terranean termites may develop colonies in such fillings when conditions are favorable
- Infants and aged or any person having breathing problem or sensitive to chemicals should avoid being present in the premises during the treatment.
- In the unlikely event of any subterranean termite infestation during the contract period, the contractor shall carry out such treatment as may be necessary to control the infestation at no extra cost to the owner.
- Warranty Certificate shall be issued in Bank's prescribed format to certify that the said structure will be free from termite infestation.

Materials:

Materials of approved/best quality conforming to IS 6313: 2013 in approved concentration in water emulsion shall be used. Chemicals shall be brought to site of work in sealed original containers. The material shall be brought in at a time in adequate quantity to suffice for Hand operated pressure pump shall be used for uniform spraying of the chemical. To have proper check for uniform spraying of chemical, graduated containers shall be used. Proper check should be kept that the specified quantity of chemical is used for the required area during the operation. The whole of the materials, employed in connection with the permanent work, shall be new and of the best of its kind. The chemicals shall be stored in safe location out of reach of children. All materials shall be in accordance with these specifications and shall be as approved by the Architect.

Time of Application:

Soil treatment should start when foundation trenches and pits are ready to take mass concrete in foundations. Laying of mass concrete should start when the chemical emulsion has been absorbed by the soil and the surface is quite dry. Treatment should not be carried out when it is raining or soil is wet with rain or sub-soil water. The foregoing applies also in the case of treatment to the filled earth surface within the plinth before laying the sub grade for the floor.

Chemicals:

Chemicals are available in concentrated form in the market & concentration is indicated on the sealed containers. Before accepting the supply of material required tests shall be conducted and clarification shall be obtained. To achieve the specified % of concentration, chemical should be diluted with water in required quantity. For example, to dilute chemical of 30% concentration, 59 parts of water shall be added to one part of chemical to achieve the 0.5% concentration. Any one of the following chemicals which are effective when applied uniformly over the area to be treated shall be used in water emulsion for the soil treatment with the concentration shown against it. The empty containers of chemicals shall be disposed of carefully, so as to prevent any health hazard and environmental pollution.

Chemical Relevant, Indian Standard Concentration by weight (percent), Dosage

Chlorpyrifos: as per IS :8944-1978: 1.0 % - 250 ml in 5 litrewaters

Imidacloprid: as per IS :16131: 0.075% - 10.5 ml in 5 litrewaters.

Treatment:

The principle of the treatment is to create a continuous chemical barrier/ treated zone below and around the building. Treatment is designed depending on the type of building is described below:

(h)Treatment for masonry foundations and basement (Load Bearing Structures):

- i. The bottom surface and the side (up to a height of 300mm) of the excavation made for masonry foundation and basement shall be treated with the chemical emulsion at the rate of 5 liters per square meter of surface area
- ii. After the masonry foundations and the retaining wall of the basements come up, the backfilling immediate contact with the foundation structure shall be treated at the rate of 7.5 liters per square meter of the vertical surface of the sub-structure for each side. The earth is usually returned in layer and the treatment shall be carried out in similar stages. The chemical emulsion shall be directed towards the masonry surface so that the earth in contact with these surfaces is well treated with the chemical. Followed by below stages 3.2.2. to 3.2.6.

(i)Treatment of RCC Foundation (Buildings without basement):

In case of reinforced cement concrete (RCC) foundation, the treatment shall start at a depth of 500 mm below the ground level except when such ground level is raised or lowered by filling or cutting after the foundation have been cast. In such cases, the depth of 500 mm shall be determined from the new soil level resulting from the filling or cutting mentioned above, and soil in immediate contact with the vertical surface of RCC shall be treated at the rate of 7.5 liters per sq m.

(j)Treatment of top surface of plinth filling:

The top surface of the consolidated earth within plinth wall shall be treated with chemical emulsion at the rate of 5 liters per square meter of the surface before the sand-bed or sub -grade is laid. If the filled earth has been well rammed and surface does not allow the emulsion to seep through, holes up 50 to 75 mm deep at 150 mm centers both ways may be made with 12 mm diameter mild steel rod on the surface to facilitate the absorption.

(k)Treatment at junction of the Wall and the floor

Special care shall be taken to establish continuity of the vertical chemical barrier /zone of inner wall surface from ground level up to the level of filled earth surface .To achieve this a small channel 30 mm x 30 mm shall be made at the junction of wall and columns with the floor (before laying the sub-grade) and rod holes made in the channel up to the ground level 150 mm apart and the rod moved backward and forward to break up the earth and chemical emulsion poured along the channel at the rate of 7.5 liters per square meter of the vertical wall or column surface so as to soak the soil right to the bottom. The soil should be tamped back into place after this operation.

(l)Treatment of Soil along External Perimeter of Building

After the building is complete, the earth along the external perimeter of the building should be rodded at intervals of 150 mm and to a depth of 300 mm. The rods should be moved backward and forward, parallel to the wall to break up the earth and emulsion poured along the wall at the rate of 7.5 liter per square meter of vertical surfaces. After the treatment, the earth should be tamped back into place. Should the earth outside the building be graded on completion of building, this treatment should be carried out on the completion of such grading. In the event of filling more than 300 mm , the external perimeter treatment shall extend to the full depth of filling up to the ground level so as to ensure continuity of the chemical barrier /Zone.

(m)Treatment of Soil Surrounding Pipes, Wastes and Conduits:

When pipes, wastes and conduits enter the soil inside the area of the foundation, soil surrounding the point of entry shall be loosened around each of such pipe, waste or conduits for a distance of 150 mm and up to a depth of 75 mm before the treatment is commenced. When they enter the soil external to the foundation, they shall be similarly treatment for a distance of 300 mm, unless they stand clear of the walls of the building by about 75 mm.

(n)Treatment for Expansion Joints:

Expansion joints at ground floor level are one of the biggest hazards for termite infestation. The soil beneath these joints should receive special attention when the treatment under 3.3 is carried out. This treatment should be

supplemented by treating through the expansion joint after the sub – grade has been laid, at the rate of 2 liters per linear meter.

(o) Treatment to RCC Basement Buildings:

The treatment starts after the excavation for basement is complete and before laying soling and plain cement concrete (PCC). The treatment shall be carried out in the following stages.

Treatment to soil below raft:

Before laying the rubble soling and PCC, the compact and leveled soil shall be treated at 5 liters per sq m.

Treatment to soil along the retaining wall:

The soil retained by the walls (soil coming in contact with retaining wall) shall be treated at the rate of 7.5 liter per sq m of the vertical surface so as to affect a continuous outer chemical barrier, in continuation with that of the one formed under 3.3.1. The treatment shall follow the backfilling as backfilling is done in stages of 300 mm but not to exceed a depth of 1 m. Roding may be carried out to facilitate the treatment.

(p) Treatment of soil along external perimeter of building:

After the building is complete, the earth along the external perimeter of the building should be rodded at intervals of 150 mm and to a depth of 300 mm. The rods should be moved backward and forward, parallel to the wall to break up the earth and emulsion poured along the wall at the rate of 7.5 liter per square meter of vertical surfaces. After the treatment, the earth should be tamped back into place. Should the earth outside the building be graded on completion of building, this treatment should be carried out on the completion of such grading. In the event of filling more than 300 mm, the external perimeter treatment shall extend to the full depth of filling up to the ground level so as to ensure continuity of the chemical barrier /Zone.

(r) Treatment of Soil Surrounding Pipes, Wastes and Conduits:

When pipes, wastes and conduits enter the soil inside the area of the foundation, soil surrounding the point of entry shall be loosened around each of such pipe, waste or conduits for a distance of 150 mm and up to a depth of 75 mm before the treatment is commenced. When they enter the soil external to the foundation, they shall be similarly treatment for a distance of 300 mm, unless they stand clear of the walls of the building by about 75 mm. Note: - For further details refer to the IS Code 6313 Part (II)-2013.

(s) Guarantee:

The contractor has to furnish the guarantee for 10 (ten) years from the date of completion of work, starting that in case of reappearance of termites within the building area due to defective materials or workmanship or due to any other reasons, the contractor will carry out the necessary post constructional treatment to keep the entire area free from termite, once again, without any extra cost to the Department during the guarantee period.

(t) Payment:

Contractor shall quote rates taking into account the cost of chemicals, supplying the chemicals and carrying out pre-construction Anti- termite treatment at the various stages of construction as per IS 6313: 2013 and as recommended by the chemical manufacturer to safeguard the building against termite including execution and submission of guarantee for a period of 10 years.

The payment will be made on the basis of area measurements at Parking Level only in Sq.mts correct to two places of decimals which will include all the stages of treatment. No deductions shall be made in area for columns, beams, walls, retaining walls, lifts and stairs. Rate includes the cost of materials, labor and all tools, plants, sprayers required for complete operation.

4.1 SPECIFICATIONS FOR STEEL REINFORCEMENT

This section covers the requirements for fabricating, delivering and placing of steel reinforcement in position for casting all types of concrete work.

Applicable Codes and Standards:

The codes and standards generally applicable to the work in this section are listed below: -

IS: 280 Mild wire for general engineering purpose

IS: 432 Part I Mild steel and medium tensile steel bars Part II Hard drawn steel wire

IS: 456 Code of practice for plain and reinforced concrete

IS: 1139 Hot rolled mild steel, medium tensile steel and high yield strength steel deformed bars for concrete reinforcement

IS: 1566 Hard drawn steel wire fabric for concrete reinforcement

IS: 2502 Code of Practice for bending and fixing of bars for concrete reinforcement

The following clauses are intended to amplify the requirements of the reference documents listed above and the contractor/Project-in-charge shall comply with these clauses.

Bar Bending Schedule:

The Contractor shall prepare Bar Bending Schedule for reinforcement before fabrication

Steel Reinforcement:

Steel reinforcement to be procured by the Contractor for works shall be TMT Fe 500 High yield strength cold worked deformed steel bars of tested quality conforming to IS: 1786.

Binding Wire:

Binding wire shall be black annealed steel wire conforming to IS: 280 and of minimum 20 gauge.

Welding Electrodes:

Electrodes used for welding of steel bars shall be of ordinary mild steel grade electrodes conforming to IS: 814 and shall be of the best quality approved by Consultant/Project-in-charge.

Storage:

Reinforcement steel shall be handled and stored in a manner that bending or distortion of the bars is avoided and contamination of steel is prevented. All reinforcement shall be stored horizontally above ground level on supports, skids or other approved supports, clear of any running or standing water Contact with soil should be avoided. Proper drainage and protection from the elements shall be provided to minimize corrosion Bars of different classifications and diameters shall be stored separately A record shall be kept of the batch numbers of reinforcement deliveries in such a form that the part of the works in which particular reinforcement is used can be readily identified.

Welding electrodes shall be stored in moisture-controlled environment in accordance with the manufacturer's recommendations.

Fabrication:

1. Reinforcement Steel shall be clean and free from rust and loose mill scale at the time of fixing in position and subsequent concreting. The steel shall be carefully and accurately cut, bent or formed to the dimensions and configurations shown on the drawings and as per bar bending schedules approved by the Consultant / Project in-charge.

2. All reinforcement shall be bent cold using appropriate pin size. Bars may be preheated only on approval of the Consultant. Quenching shall not cool hot bars.

3. Bends shall be in accordance with IS: 2502. It shall be ensured that the bars are not straightened in any manner that will injure the material. Any bars incorrectly bent shall be used only if means for straightening and rebinding be such as not to affect adversely the material.

4. Reinforcement shall not be re-bent or straightened without prior review by the Consultant. No reinforcement shall be placed in position on the works without approval of the Consultant, whether or not it is partially embedded in hardened concrete.

5. Bars bent during transport or handling shall be straightened before being used on the work. They shall not be heated to facilitate bending. Unless otherwise specified, a 'U' or 'L' type hook at the end of each bar shall invariably be provided to main reinforcement. The radius of the bend shall not be less than twice the diameter of the round bar. In case of bars which are not round and in case of deformed bars, the diameter shall be taken as the diameter of circle having an equivalent effective area. The hooks shall be suitably encased to prevent any splitting of the concrete.

6. Reinforcement steel having a reduced section, visible transverse cracks in bends, or otherwise damaged in anyway shall not be used. Spiral reinforcement shall be accurately fabricated to the diameter and pitch shown on the drawings. One- and one-half finishing turns shall be provided at both top and bottom unless shown otherwise. Cut ends of galvanized rods shall be given a protective coat of approved zinc paint immediately after cutting.

Lapping:

1. As far as possible bars of maximum length available shall be used. All bars shall be in one length unless otherwise shown on the drawings or agreed with the Consultant/Project-in-charge.
2. Laps shown on the drawings or otherwise specified by the Consultant shall be based on the use of bars of maximum length by the contractor. In case the Contractor wishes to use shorter bars, laps shall be provided at the Contractor's cost in the manner and locations approved by the Consultant /Project-in-charge.
3. Reinforcement bars shall not be welded unless shown on the drawings or instructed by the Consultant / Project-in-charge.
4. When practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm. or 1.25 times the maximum size of the coarse aggregate whichever is greater by concrete between them. Where not feasible, overlapping bars shall be bound with annealed wires not less than 1 mm. thick twisted tight. The overlaps shall be staggered for different bars and located at points along the span where neither shear nor bending movements is maximum. Not more than 1/3 rd of the bars or as specified in the drawings shall be lapped at one section.
5. Whenever indicated on the drawings or desired by the Engineer-in-charge bars shall be joined by couplings which shall have a cross section sufficient to transmit the full stresses of bars. The ends of the bars that are joint by coupling shall be upset for sufficient length so that the effective cross section at the base of threads is not less than normal cross - section of the bar. Threads shall be standard threads. Steel for coupling shall confirm to I.S. 226.
6. When permitted or specified on the drawings, joints of reinforcement bars shall be butt-welded so as to transmit their full stresses. Welded joints shall preferably be located at points when steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section not more than 20 percent of the bars are welded. Only electric arc welding using a process which excludes air from the molten metal and confirm to any or all other special provisions for the work shall be accepted. Suitable means shall be provided for holding bars securely in position during welding. It shall be ensured that no voids are left in welding and when welding is done in two or three stages, previous surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust grease, paint and other foreign matter before welding. Only competent welders shall be employed on the work. The M.S. sheet electrodes used for welding shall confirm to I.S. 814. Welded pieces of reinforcement shall be tested. Specimen shall be taken from the actual site and their number and frequency of test shall be as directed.

Placement: 1. All reinforcement shall be placed accurately and maintained in the position indicated on the drawings It shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm. in size and by using stay blocks or metal chair spacers, metal hangers, supporting wire or other approved devices at sufficiently close intervals. Bars shall not be allowed to sag between supports nor displaced during concreting or any other operations of the work.

2. All devices used for positioning shall be of non - corrodible material. Wooden and metal support shall not be extended to the surface of concrete, except where shown on drawings.
3. All intersections of the reinforcements shall be securely tied with two strands of binds wire twisted tight to make the skeleton or network rigid so that the reinforcement is not displaced during placing of concrete. Tack welding of crossing bars shall not be done except as authorized or directed by the Consultant / Project in- charge. Nothing extra will be paid for tack welding.
4. The contractor shall provide approved type of supports for maintaining the bars in position and ensuring required spacing and correct cover of concrete to the reinforcement as called for in drawings. Pre-cast cement concrete spacer blocks of required shapes and size, MS. chairs and spacers bars shall be used in order to ensure accurate positioning of reinforcement. Pre-cast concrete blocks shall be cast well in advance and shall be at least equal in quality to the class of concrete specified in the work.
5. Pieces of broken stone or brick and wooden blocks shall not be used.
6. In fair faces of concrete, temporary spacers only shall be used and removed or withdrawn as compaction of concrete proceeds. Spacers will not be permitted to be left in fair faces of concrete.

7. The contractor shall take all responsible precautions to ensure that when handling or erecting reinforcement no damage shall be done to finished concrete. Bars that are partially embedded in concrete shall not be filed bent unless concurrence has been obtained from the Consultant / Project-in-charge.
8. Walkways and borrow runs for placing and compacting the concrete shall be independent of the reinforcement.
9. Loose binding wire and other extraneous metal shall be removed from inside the form work prior to concrete placing. Without relieving the Contractor of the responsibilities for the correctness thereof, the reinforcement shall be inspected and approved by the Consultant in writing before any concrete is placed and the contractor shall allow sufficient time for such inspecting and any subsequent remedial action to be carried out.
10. No part of the reinforcement shall be used for conducting electrical currents.

Cover to Reinforcement:

1. Unless shown otherwise on the drawings, minimum cover for all reinforcement shall be provided as per IS: 456. Care shall be taken to maintain the correct cover to reinforcement.
2. For concrete members exposed to weather, earth, action of harmful chemicals, acid vapor, saline atmosphere, sulfurous smoke etc. minimum cover for reinforcement shall be increased by 15 mm to 40 mm as directed by the Consultant / Project-in-charge.
3. The maximum cover for reinforcement shall not be greater than that specified above or shown on the drawings plus 10 mm except for bundled bars. For bundled bars, minimum, concrete cover shall be equal to the equivalent diameter of the bundle but need not be greater than 50 mm.
4. Exposed reinforcement intended for binding with future extensions shall be protected from corrosion.

Cleaning:

After placing, the reinforcement shall be maintained in a clean condition until the concrete is placed. On no account the bars shall be oiled or painted or mould oil used on the formwork be allowed to come in contact with the bars. Before concreting is commenced, the bars shall be thoroughly cleaned with dry gunny bags if they are coated lightly with rust or other impurities.

Work will Include:

- a) All cutting to lengths, labor in bending and cranking, forming hook ends, handling, hoisting and all that is necessary to fix reinforcement in work as per Drawings and specifications This shall also include all that is fairly intended and is necessary for completion of work.
- b) Cost of pre-cast concrete cover blocks to maintain cover and holding reinforcement in position, chairs, spaces, dowels, pins, laps, etc.
- c) For fabricating and fixing reinforcement in any structural member irrespective of its location, dimension and level.
- d) Work at all levels.
- e) All the above-mentioned works shall be included in the quoted rates Nothing extra shall be payable to the contractor on this account
- f) Reinforcement Steel procurement shall be done by the Contractor.

Mode of measurement and payments:

1. Reinforcement shall be measured in length including overlaps, separately for different diameters as actually used in the work and as per drawings. Quantity of steel shall be ascertained by Bar bending schedule. Where welding or coupling is resorted to in place of lap joints such joints shall be measured for payment as equivalent length of overlap as per design requirement.
2. From the length so measured, the weight of reinforcement shall be calculated in tones. Length shall include hooks at the ends. Wastage and annealed steel wire for binding shall not be measured and the cost of these items shall be deemed to be included in the rate for reinforcement.
3. The rate for reinforcement shall include providing, fabricating and fixing in position steel bars conforming to IS 1786 for RCC structures as per design of all diameters including transporting, unloading and incidental charges for handling, de-coiling, straightening, cutting, cranking, bending, and binding with two strands of annealed steel wire of 20-gauge, welding if necessary, etc. complete as shown on the drawings and as directed. It shall also include all devices for keeping reinforcement in approved position, cost of joining as per approved method and all wastage and spacer bars.
4. The rate shall be for a unit of One Kg.

5.1 SPECIFICATION FOR CAST – IN – SITU PLAIN CEMENT CONCRETE (PCC) M15 (1:2:4)

General Specification:

- In plain cement concrete coarse aggregate should be hard durable and free from impurities.
- Fine aggregate should contain sharp, angular grain.
- Cement should be fresh Portland cement.
- Mixing should be done by hand mixing or by machine mixing.
- Laying and compaction should be done before setting of concrete i.e., within 30 min.
- Curing should be done for minimum 14 days.

Detail Specification: MATERIALS

Coarse aggregate:

1. Aggregates shall comply with the requirements of IS 383.
2. Aggregate for Design Mix Concrete: Coarse aggregate shall be of machine crushed stone of black trap equivalent hard stone and be hard strong dense, durable clean and free from skin and coating likely to prevent proper adhesion of mortar.
3. The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the best, black trap or equivalent hard stones as approved. Aggregate shall have no deleterious reaction with cement.
4. The grading test shall be taken in the binning and at the change of source of materials. The necessary test indicated in S 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates. If the aggregates are covered with dust, they shall be washed with water to make them clean.
5. It shall be crushed or broken from hard stone from the approved quarry. It shall be hard, strong, dense and durable, clean and free from soft friable, thin, flat, elongated or laminated, flaky pieces and shall be roughly cubical in shape. It shall be clean and free from dirt and any other foreign matter.
6. Coarse aggregate may be graveled; may either be river bed shingle or pit graveled. It shall be sound, hard, clean suitably graded in size.
7. This shall be free from flat particles of shale, powdered clay, slate, loam and other impurities. Gravel shall have to be washed if it contains soil materials adhering to it.
8. Unless specially mentioned the size of the coarse aggregate shall be 20 mm graded down and shall be retained in 5mm square mesh so that the voids do not exceed 42%.
9. In case of Grit, it shall consist of crushed or broken stone and be hard strong, dense, durable, clean of proper gradation and free from skin or coating likely to prevent adhesion of mortar. Grit shall generally be cubical in shape and as far as possible flaky elongated pieces. The grit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer-in-charge. The grit shall have no deleterious reaction with cement.
10. The necessary tests for grit shall be carried out as per the requirements of I.S. 2386 (Parts I to VII) 1963, as per instruction of the Engineer-in-charge. The necessity of test will be decided by the Engineer-in-charge.
11. The crushing strength of grit will be such as to allow the concrete in which it is used to build up the specified strength of concrete.

Fine aggregate:

Aggregate most of which passes 4.75mm IS sieve is known as fine aggregate. Sand as fine aggregate shall be coarse, consisting of sharp, angular grains and be of standard specification.

1. Sand shall be natural sand, clean, well graded, hard strong curable and gritty particle free from injurious amounts of dust clay, kankar nodules, soft or flaky particles shale, alkali, salts organic matter, loam, mica or other deleterious substance and shall be got approved from the Engineer-in-charge. The sand shall not contain more than 8 percent of silt as determined by field test. If necessary, the sand shall be washed to make it clean.
2. Coarse Sand: The fineness modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.0.

3. Crushed dust stone may also be used as fine aggregate. This shall be obtained from crushing hard trap or equivalent. It shall not contain more than 8% of silt as determined by field test with measuring cylinder. The method of determining silt contents by field test is given as under:
4. A sample of stone dust to be tested shall be placed without drying in 200 mm. measuring cylinder. The quantity of the sample shall be such that it fills the cylinder upto 100 mm thick. The clean water shall be added up to 150 mm. mark. The mixture shall be stirred vigorously and the content allowed to settle for 3 hours.
5. The height of silt visible as settled layer above the stone dust shall be expressed as percentage of the height of the stone dust below. The stone dust containing more than 8 % silt shall be washed so as to bring the silt content within the allowable limit

Cement:

1. Cements shall be phrased as Portland cement and confirmed to relevant ISI specifications. The white cement shall conform to I.S. 80412-E 1978. Coloured cement shall be with white or gray Portland cement as specified in the item of the work.
2. It should have required compressive and tensile strength and fineness.

Water:

Water used shall be clean and reasonably free from injurious quantities of deleterious materials such as oils, acids, alkalis, salts and vegetable growth.

1. Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in R.C.C. Container for transport, storage and handling of water shall be clean. Water shall conform to the standards specification in I.S. 456-1978
2. If required by Engineer-in-charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in I.S. 269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 percent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.
3. Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interface with the hardening of concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.
4. Hard and bitter water shall be not used for curing
5. Generally potable water shall be used.
6. The pH value of the water should not be less than 6.
7. The maximum permissible limits for solids shall be as per IS 456:2000 Clause 5.4

Proportion

Proportioning of cement, sand and coarse aggregate shall be as specified.

1. Coarse aggregate and sand shall be measured by measuring box of 30cmx30cmx38cm or suitable size equivalent to one bag cement of $1/30 \text{ m}^3$ or 0.035 m^3 .
2. Cement shall be measured by bag weighing 50kg.
3. Sand shall be measured on the basis of its dry volume.
4. While measuring the aggregate sacking, ramming or hammering shall not be done.
5. If damp sand is used compensation shall be made by adding additional sand to the extent required for the bulking of damp sand.

Mixing & Laying

Hand mixing:

1. Hand mixing by batches shall be permitted on small works.
2. The mixing shall be done on a clean water tight masonry or concrete slab or steel plate platform.

3. Measured quantity of sand shall be sprayed evenly. The cement shall be dumped on the sand and distributed evenly. The sand and cement shall be mixed thoroughly with spade turning the mixture over and over again until its even color throughout and free from streaks. The measured quantity of coarse aggregate shall be sprayed out and the sand cement mixture shall be sprayed on its top.

4. This shall be mixed at least three times by shoveling and turning over by twist from center to side then back to the center and again to the sides.

5. A hollow shall be made in the middle of the mixed pile.

6. Three quarters of the total quantity of water required shall be added while the material is turned in toward the center with spades.

7. The remaining water shall be added by water can fitted with rose head slowly turning the whole mixtures over and over until a uniform color and consistency is obtained throughout the pile.

Machine Mixing:

1. Measured quantity of dry coarse aggregate, fine aggregate and cement shall be placed in the hopper respectively.

2. The dry materials shall be mixed in the mixing drum for at least four turns of the drum after which correct quantity of water shall be added gradually while the drum is in motion.

3. The total quantity of water for the mixing shall be introduced before 25% of the mixing time has elapsed and shall be regulated to achieve the specific water cement ratio.

4. The mixing shall be thorough to have a plastic mix of uniform color.

Mixing time:

1. The materials shall be mixed in a drum for a period of not less than 2 min and until a uniform color and consistency obtained.

2. The time shall be counted from the moment all the materials have been put into the drum.

Consistency:

1. The quantity of water to be used for each mix of 50kg cement to give the required consistency shall be as follows:

Not more than 34 lit – 1:3:6 mix

Not more than 30lit – 1:2:4 mix

Not more than 27lit – 1:1 ½:3 mix

Not more than 25lit – 1:1:2 mix

2. The quantity of water shall be regulated by carrying out regular slump test.

Laying

1. The entire concrete used in the work shall be laid gently in layers not exceeding 15cm and shall be thoroughly vibrated by means of mechanical vibrators till a dense concrete is obtained.

2. Hand compaction shall be done with the help of punning rods and tamping rods and tamping with the wooden tampers so that concrete is thoroughly compacted and completely walked into the corners of the form work.

3. The layers of concrete shall be so placed that the bottom layer does not finally sit before the top layer is placed.

4. Compaction shall be completed before the initial setting starts that is within thirty minutes of addition of water to the dry mixture.

Protection and Curing

1. Freshly laid concrete shall be protected from rain by suitable covering

2. After the concrete as begun to harden, that is about one to two hours after its laying it shall be protected with moist gunny bags, sand or any other materials against quick drying.

3. After 24hrs of lying of concrete the surface shall be cured by flooding with water of about 25mm depth or by covering with weight absorbent materials Curing shall be done for a minimum period of 14 days.

Formwork

1. If centering and shuttering are required to be done for this work.

2. This shall be done in accordance with the specifications for form work under R.C.C

6.1 SPECIFICATION FOR CAST – IN – SITU REINFORCED CEMENT CONCRETE (RCC) M25

General Description:

This section covers the requirements for finishing of cement concrete, proportioning, batching, mixing, testing, placing, compacting, finishing, jointing, curing and all other work as required for cast in place exposed reinforced concrete. The contractor shall provide all the materials including cement, steel, labor, equipment, 'form work', scaffolding etc., required for completion of all reinforced concrete works as per drawings and documents. Cement concrete shall be composed of cement, fine aggregate, coarse aggregate, water, with or without admixture as approved, proportioned and mixed as specified herein.

Applicable Codes and Standards:

The codes and standards generally applicable to the work of this section are listed hereinafter:

IS 383 Coarse and fine aggregates from natural sources for concrete
IS 456 Code of practice for plain and reinforced concrete
IS 516 Methods of testing for strength of concrete
IS 1199 Methods of sampling and analysis of concrete
IS 1838 Performed fillers for expansion joints in concrete non-extruding and resilient type
IS 1946 Code of practice for use of fixing devices in walls, ceiling and floors of solid Construction
IS 2389 Methods of testing of aggregate for concrete
IS 2505 Concrete vibrators, immersion type
IS 2645 Integral cement water proofing compounds
IS 3414 Code of practice for design and installation of joints in buildings
IS 3558 Code of practice for use for immersion vibrators for consolidating concrete
IS 4082 Recommendation on stacking and storage of construction materials at site
IS 7861 Code of practice for extreme weather concretizing
IS 7861 Recommended practices for hot weather (part I) concretizing
IS 8112 Ordinary Portland Cement grade 43
IS 12269 Ordinary Portland Cement grade 53

PART— I

The following clauses are intended to amplify the requirements of the reference document listed above and the contractor shall comply with these clauses

Submittals:

Material Report:

Prior to start of delivery of materials required, the following shall be submitted by the contractor to the Consultant / Project-in-charge for approval:

Suppliers and / or sources of all consumable materials including cement, steel, fine and coarse aggregates, water additives, bricks and timber etc.

Quality Inspection Plan to ensure continuing quality control of ingredients by periodic sampling, testing and reporting to the Consultant on the quality of materials being supplied.

Plant And Equipment:

The contractor shall submit the following to the Consultant well in advance:

- i. The proposed program, methods and details of plant and Equipment for be used to testing of ingredients and concrete samples.
- ii. The proposed program methods and details of plant & equipment to be used for concrete work.

Reports For Inspection and Testing

During concreting operations, the contractor shall conduct inspection and testing as described under the list of mandatory tests in this volume and all reports thereon shall be submitted in summary form to the Consultant / Project-in-charge.

Schedules

Before commencement of the work the contractor shall prepare working schedules of concreting giving dates and rate of pour for each item of work and submit the same to the Consultant / Project-in-charge for their approval.

Materials

Before bringing to the site, all materials for cement concrete shall be approved by the Consultant / Engineer-in charge. All approved samples shall be deposited in the office of the Consultant / Engineer-in charge before placing orders for the materials with suppliers. The materials brought on to the work shall conform in every respect to their approved samples. Fresh samples shall be deposited with the Consultant / Project-in-charge whenever type or source of any material changes. The contractor shall check each fresh consignment of materials as it is brought on to the works to ensure that they conform to the specification and / or approved samples.

The Consultant / Project-in-charge shall have the option to have any of the materials tested to find whether they are in accordance with specifications at the contractor 's expense. All bills' vouchers and test certificates which in the opinion of the Consultant / Project-in-charge are necessary to convince him as to the quality of materials or their suitability shall be produced for his inspection when required. Any materials which have not been found to the specification and not approved by the Consultant / Project-in-charge shall be rejected forthwith and shall be removed from the site by the Contractor's at his own cost within the time stipulated by the Consultant / Project-in-charge. The Consultant / Project-in-charge shall have the powers to cause the contractors to purchase and use materials from any particular source, as may in their opinion be necessary for the proper execution of work.

Cement

Cement shall be provided by the Contractor. On the following types of cement as specified shall be used

- a. Ordinary Portland Cement 43 grade confirming to BIS 8112-1987**
- b. Ordinary Portland Cement 53 grade confirming to BIS 12269-1987**

Cement at site shall be stored in dry weather proof go-downs (or shed) built by the Contractor at his own costs in stacks which are not higher than 10 bags. The cement go-down shall be constructed as per CPWD specifications. The contractor shall conduct all necessary tests as specified in the IS, at his own cost to ascertain himself on quality of the material.

Aggregates:

Aggregates from natural sources shall be in accordance with IS:383. The contractor shall submit to the Consultant / Project-in-charge certificates of grading and compliance from the suppliers for all consignments of aggregate. In addition, at site from time to time, the contractor shall test the aggregates in accordance with IS: 2386 parts I, II, III and IV. The contractor shall allow for and provide all necessary apparatus for carrying out each test and for supplying test records to the Consultant.

- b) For fair faced concrete, the contractor shall ensure that aggregates are free from iron pyrites and impurities which may cause discoloration.
- c) The fine aggregates shall be river sand, stone dust or other approved sand. It shall be free from clay, loam, earth or vegetables matter and from salt or other harmful chemical impurities. It shall be clean sharp, strong angular and composed of hard siliceous material.

The grading of sand as determined by the method prescribed in IS: 2386 part I shall be within the limits of grading zone III given in Table 1. When the grading falls outside the percentage limits given for sieves other than 600-micron, 300 microns, and 150-micron (I.S) sieves by not more 5 percent, it shall be regarded as falling within this zone. The 5 percent can be excess submission on one more sieve.

Fine Aggregate:

TABLE 1

IS Sieve (mm)	Specification as per IS: 383(percentage of passing)			
	Zone I	Zone II	Zone III	Zone IV
10.00	100	100	100	100
4.75	90 - 100	90 - 100	90 - 100	95 - 100
2.36	60 - 95	75 - 100	85 - 100	95 - 100
1.18	30 - 70	55 - 90	75 - 100	90 - 100
0.600	15 - 34	35 - 59	60 - 79	80 - 100
0.300	5 - 20	8 - 30	12 - 40	15 - 50
0.150	0 - 10	0 - 10	0 - 10	0 - 10
Pan	-	-	-	-

The maximum quantity of silt as determined by the method prescribed in IS: 2386 Part II shall not exceed 8%. Stone dust shall be within the limits of Grading Zone III given in table 1. When the grading falls outside the percentage limits given for the sieves other than 600 micron and 300-micron (IS) sieves by not more than 5 percent and on 150-micron sieves by not more than 20 percent it shall be regarded as falling within this zone. The 5 percent can be excess summation on one or more sieves.

Coarse Aggregate:

1.Coarse aggregate shall be of machine crushed stone of black trap equivalent hard stone and be hard strong dense, durable clean and free from skin and coating likely to prevent proper adhesion of concrete. The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the best, black trap or equivalent hard stones as approved. Aggregate shall have no deleterious reaction with cement. The coarse aggregate should be obtained from the approved source/quarry.

2.In case of Grit, it shall consist of crushed or broken stone and be hard strong, dense, durable, clean of proper gradation and free from skin or coating likely to prevent adhesion of mortar Grit shall generally be cubical in shape and as far as possible flaky elongated pieces. Thegrit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer-in-charge. The grit shall have no deleterious reaction with cement. The crushing strength of grit will be such as to allow the concrete in which it is used to build up the specified strength of concrete.

3.Coarse aggregate may be graveled; may either be river bed shingle or pit graveled. It shall be sound, hard, clean suitably graded in size. with or without broken fragments and free from flat particle of shale, clay, silt, loam and other impurities. Gravel shall have to be washed if it contains soil materials adhering to it.

4.Except where it can be shown to the satisfaction of the Consultant than a supply of properly graded aggregate of uniform quality can be maintained over the period of the obtaining the coarse aggregate in different sizes & blending them in correct proportions as and when required. The maximum size of coarse aggregate shall be such that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the comers of form work.

5.Unless specially mentioned the size of the coarse aggregate shall be 20 mm graded down and shall be retained in 5mm square mesh so that the voids do not exceed 42%.

Water:

1.Water used in the works shall be potable water and free from deleterious materials. Water used for mixing and curing concrete as well as for cooling and/or washing aggregate shall be fresh and clean, free from injurious amounts of oil, salts, acids, alkali, other chemicals and organic matter. Water shall be from the source approved by the Consultant / Project-in-charge and shall be in accordance with Clause 4.3 of IS: 456.

2.Container for transport, storage and handling of water shall be clean. Hard and bitter water shall be not used for curing. Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interface with the hardening of concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.

3. Before starting any concreting work and whenever the source of water changes, the water shall be tested for its chemical and other impurities to ascertain its suitability for use in concrete for approval of the Consultant. No water shall be used until tested and found satisfactory. Cost of all such tests shall be borne by the contractor.

Admixtures And Additives:

1. Chemical admixtures are not to be used until permitted by the Consultant/Project-in-charge in case their use is permitted, the type, amount and method of use of any admixture proposed by the contractor shall be submitted to the Consultant for approval. The contractor shall further provide the following information concerning each admixture to the Consultant/Project-in-charge.

- a) Normal dosage and detrimental effects, if any, of under dosage and over dosage.
- b) The chemical names of the main ingredients in the admixture.
- c) The chloride ion content, if any, expressed as a percentage by weight of admixture.
- d) Whether or not the admixture leads to the entrainment of air when used in the manufacturer's recommended dosage.
- e) Where two or more admixtures are proposed to be used in any one mix, the manufacturer's written confirmation of their compatibility.

2. In reinforced concrete, the chloride ion of any admixture as determined in accordance with IS: 6925 and the total chloride ion in all admixtures used in concrete mix shall not exceed 0.30n percent by weight of cement.

3. The admixtures when used shall conform to IS: 9103. The suitability of all admixtures shall be verified by trial mixes. The addition of calcium chloride to concrete containing embedded metal will not be permitted under any circumstances. Waterproofing admixtures shall comply with IS: 2645.

Plant

The contractor shall obtain the approval of the Consultant/Project-in-charge for all plant items he proposes to use for the manufacture and placing of concrete. The arrangement shall maintain all items of plant at all times in a clean and efficient working condition.

Storage

All goods and products covered by these specifications shall be procured well in advance and stored as specified below.

Cement

1. Cement shall be stored on a raised floor in dry weather **proof & dust free but** well ventilated shed.

2. Cement bags shall be stacked close together away from external walls and in stacks of not more than ten bags to avoid lumping under pressure.

3. Cement stored during monsoons or cement expected to be in store for more than eight weeks shall be completely enclosed in 700-micron polyethylene sheet so arranged that the flap closes on the top stack. The contractor shall ensure that protective polyethylene sheet is not damaged at any time during use.

4. Consignments of cement shall be used in order of delivery. A record shall be kept of the batch numbers of cement deliveries in such a form that the part of the works in which the cement is used can be readily identified. If during delivery or by test, the cement is found to be defective, the same shall be returned back forthwith.

5. The contractor shall be responsible for the storage of cement at the site and no claim will be entertained in the event of any damage occurring to cement due to faulty storage by the contractors or on account of his negligence.

6. Cement stored on site for a period longer than eight weeks shall be tested to the satisfaction of the Consultant/Project-in-charge before it is used in the works. Cement that has failed the tests conducted shall not be used in the works and shall be removed from the site immediately without fail.

Storing of Aggregate:

1. Aggregates shall be stored on a suitable well drained raft of concrete, timber, metal or other approved material. The storage of aggregates on the ground will not be permitted. Each size of aggregate shall be stored separately in such a manner as to prevent spillage and mixing of one aggregate with an adjacent aggregate the dividing walls of any bin shall be of sufficient height and the aggregate shall be so deposited that a distance of 100 mm shall be left between the top of the division wall and any part of the aggregate stack

2. When stack piling, the aggregate shall not form pyramids resulting in segregation of different size particles. The stacks shall be regular and of a height not exceeding two meters.

Grades of Concrete:

The grades of concrete shall be in accordance with the following table. The grade of concrete to be used in each section of work will be shown in the drawings or in the Bill of Quantities:

Characteristic Strength

Grade of Concrete	Characteristic strength i.e., compressive strength of 15 cm cubes at 28 days (N/mm²)	Nominal maximum aggregate size (mm)
10	10	25
15	15	25
20	20	20
25	25	20
30	30	20
35	35	20

1. Unless otherwise specified in the drawings, the maximum nominal size of coarse aggregates for different grades of concrete shall be as under:

2. All mix design grades viz., M10, M15, M20, M25, M30 etc., shall be designed and have a minimum cement content as per relevant IS codes.

3. Any change in the source of aggregates will require the re-designing of the concrete mix for the Engineer's approval.

Mix Design:

1. At the commencement of the contract, the Contractor shall make preliminary tests to determine the proportions by weight of cement, fine aggregates, coarse aggregates and water necessary to produce required grades of concrete.

2. The mix proportions shall be selected to ensure that workability of the fresh concrete is suitable for the conditions of handling and placing and when concrete hardens, it shall have the required strength, durability and surface finish. The Contractor shall get approval of the Engineer to such proportions before start of concreting. However, such approval shall not relieve the contractor of his responsibility to produce concrete having compressive strengths as laid down in the foregoing table.

3. No departure from the approved proportions will be permitted during the works unless and until the Engineer gives written authorization for any change in proportion. The Engineer shall have authority at any time to check whether the mixing of concrete is being carried out according to the approved proportions.

4. For the major and important RC works and for all special works, the design of mixes shall be made by the Contractor at his own cost, for each grade of concrete as well as for various workability. The design of mixes shall be made according to relevant I.S. codes or to approved standard methods.

5. The concrete made by designing the mix is termed hereinafter as "Design Mix Concrete".

Water/Cement Ratio:

Where a particular water/cement ratio is stipulated in the design or drawing along with the characteristic grade of concrete, the design of mix shall be carried out by adjusting the other variable factors to obtain characteristic strength of concrete with stipulated water/cement ratio. In the structures where the impermeability and shrinkage of concrete have an important bearing on the durability and serviceability of the structures, such as water retaining structures, basements, underground premises, tunnels, pump houses, exposed structures near sea side or deserts, pre-stressed structure, thin precast members etc., the water/cement ratio shall be kept low and preferably not exceeding 0.45. The water cement ratio as achieved in the mix design or as specified in the drawings shall be adhered to strictly and shall not be varied without the permission of the Engineer.

Workability:

1.The workability of fresh concrete shall be such that the concrete is just suitable for the conditions of handling and placing so that after compaction, it becomes completely consistent and homogeneously surrounds all the reinforcement and completely fills the form-work.

2.The workability of fresh concrete at the place of disposition by means of slump test. During the finalization of trial mixes, the slump values shall be established for each grade of concrete as well as for various levels for workability. Normally, in the condition of low water cement ratio as well as for medium/high workability, the workability shall be achieved by increasing the cement content.

3. In cases where the cement content is to be limited to reduce the heat of hydration, and the water / cement ratio is also to be kept low to reduce the permeability or due to other requirements the desired workability may be achieved with the use of limited doses of plasticizer or air entraining agent. In such cases, the method of mixing and dosage of the plasticizer / air entraining agent shall be according to the manufacturer's specification and with the approval of the Engineer.

4.Consistency and workability of concrete shall be checked by measuring the slump of a truncated cone of concrete straight from the mixer under normal working conditions. The conical mould shall be of metal, 300 mm high and 100 mm and 200 mm in diameter at top and base respectively. Moulds shall be prepared by the Contractor. The slump range of concrete shall be as per the tabulation given below, as well as standards.

5.Slump tests shall be performed as per IS:1881 at intervals established by the Engineer at the Contractor's cost in such a way as to check that the degree of consistency established by the Engineer for work in progress is maintained. The general slump range to be followed for various types of construction shall be as per design mix from an approved NABL accredited laboratory or as per instructions of Architect/ Engineer in charge.

Durability:

The durability of concrete, depending on the exposure condition, is to be taken into account while designing the mix. For given aggregates, the cement content should be sufficient to make sufficiently low water/cement ratio and Appendix A of IS: 456 shall be taken as guideline for durability considerations.

Trial Mixes:

After approval of the mix design by the Engineer, the Contractor shall make in presence of the Engineer the trial mixes for each grade of concrete as well as for required workability.

Before starting the trial mixes, necessary preparatory works like determination of sieve analysis of the aggregates, densities of different ingredients, moisture contents in the aggregates, shall be completed according to the relevant BIS Codes.

Each trial mix shall be handled and compacted by the method which the Contractor proposes to use for that mix in the works and the mixes shall not show tendency of inadequate compaction by the method proposed.

The compacting factor and the slump of each trial mix shall be determined immediately after mixing and the values shall not exceed the maximum value obtained in the mix design. Five (5) 150 mm test cubes shall be made from each trial mix. These shall be cured and tested in accordance with relevant BIS codes. In order to have the specified characteristic strength in the field, the concrete mix as designed in the design mix shall have higher average compressive strength depending on the degree of quality of control at site.

Before commencement of the concreting works of particular grade of concrete, the Contractor must complete the work of trial mixes and subsequent testing of the test cubes obtained there from and the desire of the approved mix for that particular grade of concrete. The entire cost of all the trial mixes including all the preparatory works for trial mixes, preparation of test cubes and their testing shall be borne by the Contractor.

Nominal Mix Concrete:

Nominal mix concrete may be used for all concrete of grade M-10 and below. If design mix concrete cannot be used for any reason for grade M-15 and M-20, nominal mix concrete may be used with the permission of the Engineer. Nominal mix concrete shall be in accordance with Table-3 of clause 8.3 of IS 456. The stipulations of clauses 8.3.1 and 8.3.2 of IS: 456 shall also be taken into consideration.

Batching of Concrete:

Cement:

Cement shall always be batched by weight. A separate weighing device shall be provided for weighing cement. Where the weight of cement is determined by accepting the weight per bag, a number of bags shall be weighed separately to determine the average net weight of cement per bag and the same shall be checked regularly.

Aggregates:

For both design mix concrete and nominal mix concrete, the aggregates, (coarse and fine) shall be batched by weight. In particular cases, or where weight-batching is not possible, proportioning by volume batching may be allowed by the aggregates throughout the period of construction. For this purpose, the Contractor shall submit to the Engineer sufficient data indicating the weight/volume relationship of the aggregates shall be made by the Contractor to the satisfaction of the Engineer. Where moist and volume batching aggregates is adopted, allowance in bulking shall be in accordance with IS 383 (Part III). Suitable adjustments shall be made for the variation in the weight of aggregates due to variation in their moisture contents.

Water:

Water may be measured either by weight or by volume. When measured by volume, it shall be by well calibrated conical shaped jar or vessel or from a calibrated tank filled to the mixer.

Adjustment of Water Due to Moisture Contents in Coarse and Fine Aggregates:

It is very important to maintain the water cement ratio constant at its correct value. For the correct determination of the amount of water to be added in the concrete mix and to maintain the water cement ratio constant, the amount of moisture content in both coarse and fine aggregates shall be taken into consideration, be checked as frequently as possible, the frequency for a given job being determined by the Engineer according to weather condition.

Determination of Moisture Content in the Aggregates:

Determination of moisture content in the aggregates shall be according to IS 2386 (Part-III).
Coarser the aggregate, less the water it will carry

3.03.24.6 Admixtures: Any solid admixture, to be added, shall be measured by weight, but liquid or semi-liquid admixture may be measured by weight or volume. The Bidder shall indicate the brand name, the Manufacturer and the properties of any admixture to be used for the concrete as per Bill of Quantity items or on his own initiative.

Accuracy of Batching:

The accuracy of batching shall be within the following tolerance:

1. Cement within + 2% by weight
2. Aggregate within + 5% by weight
3. Water within + 0.5% by weight.

Mixing of Concrete:

Machine Mixing:

Concrete shall always be mixed in mechanical mixer. Water shall not, normally, be charged into the drum of the mixer until all other ingredients are already in the drum and mixed for at least one minute. Mixing shall be continued until there is uniform distribution of materials and the mass is uniform in color and consistency. The mixing time from the time of adding water shall be in accordance with IS 1791, but in no case less than 2 minutes or at least 40 revolutions.

Hand Mixing:

When hand mixing is permitted by the Engineer, it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in color and consistency. In case of hand mixing, 10% extra cement shall be added to each batch at no extra cost to EMPLOYER.

Transportation of Concrete:

Concrete shall be transported from the place of mixing to the place of placing concrete as rapidly as practicable by any means, which will prevent the segregation or loss of any of the ingredients and maintain the required workability. No water shall be mixed with the concrete after it has left the mixer. Where concrete is transported over long distances, the Contractor shall provide suitable means by which different grades of concrete are readily identifiable at the place of final deposit.

Preparatory Works/Surface Preparation:

For Concrete Directly on Earth Foundation:

Earth foundation on which direct placement of concrete is specified shall be rammed and consolidated as directed by the Engineer such that it does not crumble and get mixed with concrete during or after placement. If the foundation is quite wet, the same shall be kept dry and then sufficiently consolidated, if necessary, a thin top layer of the wet soil shall be removed and replaced by sand or other suitable materials as directed by the Engineer without extra cost to EMPLOYER, Care shall also be taken that earth from the sides also does not get mixed with the concrete, during or after placement, before it has sufficiently set and hardened. The earth foundation, over which concrete is to be placed directly, shall not be kept abandon at the specified level and concrete shall be placed immediately following otherwise suitable measures shall be taken, as directed by the Engineer **without extra cost** to EMPLOYER.

For Construction Joints:

Concrete shall be cast, as far as possible, continuously until the parts of structure to be built are finished. Should this not be feasible, the type, number and location of construction joints shall be approved by the Engineer prior to placing concrete. All such joints shall have continuous square bond grooves to produce substantial and water-tight-key and the exposed faces of joints shall be monolithic with the main mass of concrete formed and completed under substantially shattered faces. The Contractor shall take all the necessary steps by means of timber edgings etc. to ensure an exact horizontal straight finish to outside edge of any lift of concrete. Subject to the approval of the Engineer, the Contractor is at liberty to arrange his own construction joints but the following restrictions are to be observed:

1. There shall be no vertical construction joints
2. No longitudinal joints shall be made in the walls and floors of trenches and pits unless otherwise shown in the drawings.
3. Concrete pouring shall be reasonably large, but in no case shall the height of pouring concrete exceed 1.5 m without the Engineer's firm approval. Such approval of the Engineer shall not in any way relieve the Contractor of his responsibility to ensure that the construction is water tight and that no segregation takes place.
4. Laitance shall be removed from the surface of concrete before it has set hard by washing and wire brushing so as to expose the stones of the top layer without undue erosion of the mortar or damage to the under-laying concrete.
5. All beds and joints in concrete faces, which have become set, are to be picked all over and all loose materials removed before fresh concrete is deposited thereon. The indentations shall be at least 12 mm deep and not less than seventy five percent of the area of the existing concrete face to be covered over.
6. Immediately before depositing fresh concrete, the exposed surface shall be cleaned of foreign matter by further wire brushing, if necessary. It shall then be thoroughly washed and surplus water removed. The surface, while still moist, shall be covered with layer of 1:1 cement mortar which must be vigorously stippled into the surface by means of a stiff brush, the depositing of the fresh concrete following on closely. Pockets to form keys shall be left in the surface of the concrete at constructional joints, 75 mm deep and approximately **equal to 20% of the exposed surface**.
7. All costs in connection with the forming of construction joints shall be to the account of the Contractor and shall be deemed to be included in the rates for concreting and formwork and shall not be separately paid for.
8. In a column, the joint shall be formed 75 mm below the lowest soffits of the beams, including haunches, if any. Concrete in a beam shall be placed throughout without a joint but if the provision of a joint is unavoidable, then the joint shall be vertical and at the center of, or within, middle third of the span, unless otherwise shown on the drawings.

On Vertical Surfaces of Masonry:

When the concrete is placed on the vertical surface of masonry (as in the case of thin concrete fins projected from the vertical masonry surface), a groove of dimension as directed by the Engineer shall be cut in the masonry to ensure a proper bond and the surface shall be cleaned thoroughly. Before the placement of concrete, the surface shall be kept moist by spraying water at least for the period of 2 hours and a thick coat of cement slurry shall be applied immediately before the placement of concrete.

Inside the Form Works (Cleaning, Surface Preparation etc.):

The interior of the form works, where the concrete is to be placed, shall be thoroughly washed by high pressure water jet or air jet to completely clean the entire volume from the dirt, grease/oil foreign and deleterious materials etc. The reinforcements shall be completely cleaned and free from all sorts of dirt grease/oil, rust, foreign/deleterious materials etc. Before placement of concrete, the form works coming in contact with concrete, shall be coated highly with form oil or raw linseed oily material or provided with any approved material to prevent adhesion of concrete to the form work, but utmost care shall be taken so that such oily material does not come in contact with the reinforcement.

Placing and Compaction of Concrete:

Before placing the concrete, the Contractor shall ensure that:

1. All mixing and placing equipment is thoroughly cleaned
2. All concreting space is free from debris and rubbish
3. All forms have been thoroughly wetted or oiled and firmly installed in line and plumb to the Engineer's approval.
4. All reinforcement is cleaned of loose rust, scales and other injurious adherents and is firmly bound and correctly placed and has been so approved by the Engineer.
5. All inserts, sleeves, foundation bolts and embedded parts have been correctly and firmly installed to conform to the Engineer's drawings and have been carefully checked to comply with the drawings.
6. Special care shall be taken to locate and check sleeves or inserts, which may not be symmetrically placed with respect to center lines.
7. The Contractor and Engineer shall separately inspect and check the above-mentioned points and record and sign the results in a register/ format which shall be maintained by the Contractor in an approved form. No concrete shall be placed without the Engineer having inspected and approved in writing. In spite of ensuring the above requirements, the Contractor shall fill pour cards furnishing the necessary details of the job, duly signed by the Engineer. This, however, will not absolve the Contractor from his responsibility to correctly execute the work. Pour cards shall contain the following information:

Design Index

- Date
- Slump
- Workability
- Work test specimen
- Type of finishing and admixtures used (if any)
- Period of removal of shuttering/props/forms.

a. The concrete pouring method shall be submitted to the Engineer for approval and shall always be such as to avoid any possibility of segregation of the components or shifting of the reinforcement.

b. Special grout or mix shall be used for difficult and intricate locations as specified by the Engineer. During placing, the concrete shall be thoroughly worked around reinforcement, embedded parts and corners of the formwork.

c. Greatest possible care shall be taken by the Contractor that reinforcement and embedded parts, particularly foundation bolts and sleeves are not displaced during placement of concrete. While concreting mats and other such locations where top and bottom reinforcement are adopted, top reinforcement shall be thoroughly cleaned of all slurry and mortar sticking to them at the time of concreting top layers.

d. The concrete shall be placed and compacted before setting commences and should not be subsequently disturbed. No water shall be mixed with the concrete after it has left the mixer. Method of placing should be such as to preclude segregation. Approved mechanical vibrator shall be used for compacting concrete, and concrete shall not be non-vibrated or under vibrated. No concrete shall be placed until the place of deposit has been thoroughly inspected and

approved by the Engineer, all inserts and embedment properly secured in position and checked and forms properly oiled. No concrete shall be placed in the absence of the Engineer.

e. Concrete shall be placed on clean bed having the designed level. The bed shall be cleaned of all debris and other objectionable materials. Seepage water, if any, shall be controlled or diverted.

f. Concreting shall not be carried on during rains unless all precautions have been taken by the Contractor and necessary permission has been given by the Engineer. Suitable measures shall be taken to control the temperature of concrete.

g. Where plums are permitted in massive concrete, they shall be washed and carefully placed. No stone shall be closer than 30 cm to an exposed face, nor nearer than 15 cm to an adjacent stone.

h. Concrete shall not be dropped from a height of more than 2 m except through a chute, the design and type of which shall be subjected to approval of the Engineer.

i. The concrete shall be placed, spread and compacted by approved mechanical vibrator. Vibrators shall not be used for pushing concrete to adjoining areas.

j. For members involving vertical placing of concrete (e.g., columns, walls etc.), each lift shall be deposited in horizontal layer extending for the full width between shuttering and of such depth that each layer can be easily and effectively vibrated and incorporated with the layer below by means of compaction being employed.

k. For members involving horizontal placing of concrete (e.g., slabs, beams etc.), the concrete shall be placed along the line of starting point in such quantities as will allow members to be cast to their full depth along the full width between side shuttering and then gradually brought towards the finishing point along its entire front parallel to the starting line. Vibration and surface finish shall follow behind the placement as closely as possible.

l. Utmost care shall be taken to avoid the displacement of reinforcements/ embedded parts or movement of form work or damage to faces of the form work or transmission of any harmful vibration /shocks to the concrete which has not yet hardened sufficiently.

m. All members shall be concreted at such a rate that no cold joint is formed and fresh concrete is placed always against green concrete, which is still plastic and workable.

n. Should any unforeseen occurrence result in a stoppage of concreting for one hour or such other time as might allow the concrete, already placed, to begin to set before the next batches can be placed, the Contractor shall make at his own cost, suitable tongue, and groove construction joint, as approved by the Engineer. Any additional reinforcement required as directed by the Engineer shall also be provided by the Contractor at his own cost. Before placement of new batches of concrete over that construction joint, the surface preparation according to this specification stipulated earlier, shall be done by the Contractor.

o. The concrete shall be worked well up against whatever surface it adjoins and compacted to such a degree that it reaches its maximum density as a homogeneous mass, free from air and water holes and penetrates to all corners of moulds and shuttering and completely surrounds the reinforcement. All measures shall be taken to make the shape, size, and location of the finished concrete including its embedment, holes, openings etc., well within the accepted tolerance limit.

Construction Joints:

Normally, the construction joints including crack inducing joints shall be constructed as per locations and details indicated on the drawings. Where the location of the joint is not specified in the drawings, it shall be in accordance with the following guidelines. In all construction joints, the reinforcements shall pass through as per drawings and the same shall not be disturbed in any way.

a) In Columns

i) In case of Projection from **Basement Slab, 300 mm from the top of base slab or 75 mm from the top of the haunches whichever is higher.**

ii) In framing the beam at different elevation, 75 mm below the lowest soffit of the beam and in case of projection from beams and slabs 75 mm from the top surface of the beam/slab or at the top surface of beam/slab whichever facilitates formwork.

iii) For columns below flat slabs, 75 mm below the lowest soffit of the slab.

b) In Walls (Horizontal Construction Joints)

i) For Walls Projecting from Base Slab, 300 mm from top of base slab.

ii) For Walls supporting the suspended slab, 75 mm from the lowest soffit of the slab.

Note: In the case of water retaining structures and structures under the influence of ground water, approved water bars of suitable size shall be provided to make the joint completely watertight.

c) In Beams

Beams shall be cast, as a rule, without a joint. But if provision of a joint is unavoidable, the joints from simply supported beam shall be vertical and at the middle of the span; in continuous beam, the same shall be at the point of minimum shear force.

d) In Suspended Slabs

i) In slab of small span, there shall be reconstruction joints.

ii) In slabs of large span and continuous slabs, the Construction joint, if allowed by the Engineer, shall be vertical at the middle of span and at right angles to the principal reinforcement.

e) In Walls (Vertical Construction Joint)

As a rule, walls shall be cast monolithically without any vertical construction joint, unless specified in the drawing. However, for a long wall, Engineer may allow vertical construction joint and the same shall be at the place of minimum shear force.

f) In Slabs Resting on Ground

i) For Plain Concrete

Concreting shall be done in alternate panels not exceeding 10 m² in area. The largest panel dimension shall be 5 m.

ii) For Nominally Reinforced Slab The area of pour shall not exceed 40 m² and the maximum panel dimension shall not exceed 8m.

iii) For the Basement Slabs Which Act as Structural Member There shall be no construction joint.

g) In Ribbed Beams The beams shall be monolithic with the slab in one continuous operation.

Cold Joints:

An advancing face of pour, which could not be covered before expiry of initial setting time for unexpected reasons, is called a cold joint. The Contractor shall remain always vigilant to avoid cold joints. If however, a cold joint is formed due to unavoidable reasons, the following procedures shall be adopted for treating it:

1. If the concrete is so green that it can be removed manually and if vibrators can penetrate the surface without much effort, fresh concrete can be placed directly over the old surface and the fresh concrete along with the old concrete shall be vibrated systematically and thoroughly.

2. In case the concrete has hardened a bit more than (1), but can still be easily removed by a light hand pick, the surface shall be raked thoroughly and the loose concrete removed completely without disturbing the rest of the concrete in depth. Then a rich mortar layer of 12 mm thickness shall be placed on one cold joint and then the fresh concrete shall be placed on the mortar layer and vibrated thoroughly penetrating deep into the layer of concrete.

3. In case the concrete at the joint has become so stiff that it cannot be remolded and mortar or slurry does not rise in spite of extensive vibration, a tongue and groove joint shall be made by removing some of the older concrete and the joint shall be left to harden at least for 12-24 hours. It will then be treated as regular construction joint and the surface preparation of the same, before placement of concrete, shall be as described in the appropriate clauses of these specifications.

Sub-standard concrete:

Should the work strength of controlled concrete fall below the specified strength, Engineer shall decide:

1. To reject the work, in which case the Contractor shall replace the defective work with concrete of required strength and bear all costs for dismantling and replacing including cost of associated formwork, reinforcement, embedded parts & all associated works.
2. To accept the work at a reduced rate, in which case the unit rate payable for sub-standard work will be reduced by EMPLOYER, directly in proportion to the work strength as compared to the specified strength. The Engineer may, in addition, require other tests performed on the respective structural member so accepted period to its acceptance with or without necessary corrective measures and in each such case, the Contractor shall bear all costs for all such tests or corrective measures, besides the reduction in the unit rates as specified herein.
3. Concrete of strength below fifteen (15) percent of the specified strength will not be accepted.
4. The test load shall be 125% of the maximum superimposed load for which the structure was designed. Such test load shall not be applied before 56 days after the effective hardening of concrete. During the test, struts strong enough to take the whole load shall be placed in position leaving a gap under the members. The test load shall be maintained for 24 hours before removal.
5. If, within 24 hours of the removal of the load, the structure does not show a recovery of at least 75% of the maximum deflection shown during the 24 hours under load, the test loading shall be repeated after a lapse of at least 72 hours. The structure shall be considered to have failed to pass the test if the recovery after the second test is not at least 75% of the maximum deflection shown during the second test. If the structure is certified as failed by the Engineer, the cost of the load test shall be borne by the Contractor.

Optional Tests:

The Engineer, if he so desires, may order tests to be carried out on cement, sand, coarse aggregate, water in accordance with the relevant Indian Standards.

Tests on cement shall include

1. Fineness test
2. Test for normal consistency
3. Test for setting time
4. Test for soundness
5. Test for tensile strength
6. Test for compressive strength
7. Test for heat of hydration (by experiment and by calculation) in accordance with IS:269.

Tests on sand shall include

1. Sieve test.
2. Test for organic impurities.
3. Decantation test for determining clay and silt content.
4. Specific gravity test.
5. Test for unit weight and bulkage factor.
6. Test for sieve analysis and fineness modulus.

Tests on coarse aggregates shall include

1. Sieve analysis.
2. Specific gravity and unit weight of dry, loose and rodded aggregate.
3. Soundness and alkali aggregate reactivity.
4. Petro graphic examination.
5. Deleterious materials and organic impurities.
6. Test for aggregate crushing value.

Any or all these tests would normally be ordered to be carried out only if the Engineer feels the materials are not in accordance with the specifications or if the specified concrete strengths are not obtained and shall be performed by the Contractor at an approved test laboratory at the cost of the Contractor. If the work cubes do not give the stipulated strengths, the Engineer reserves the right to ask the Contractor to dismantle such portions of the work which, in his opinion, are unacceptable and re-do the work to standards stipulated, at the Contractor's cost. The unit rate for

concrete shall be all inclusive, including making preliminary mix design and test cubes works, cubes, testing them as per specification, slump tests, optional tests etc.

Concrete for Equipment or steel structures foundations:

Concrete for equipment foundation, whether principal or auxiliary, shall be poured continuously so that the structure becomes monolithic, particular care being exercised to see that the base slabs, if any, are of compact impervious construction. Tunnels, passages, apertures and so forth shall be provided in accordance with the drawings for the installation of mechanical and electrical equipment, pipes or cables. The top elevation of the equipment foundations or parts shall be accurately cast to 20/50 mm (or more as may be specified on the drawings) above the level required for grouting and it shall be pneumatically chiseled off and well roughened just prior to the erection of the equipment concerned. All embedded anchor bolts or bolt sleeves shall be accurately and firmly set with the aid of approved templates, steel supports and/or other accessories.

For holding the embedded bolts or sleeves in the correct position during concreting, template shall have to be of steel of suitable section approved by the Engineer. Two sets of templates shall have to be provided, one to hold the bottom and the other the top of the bolts or sleeves. The bottom template shall be securely and rigidly fixed by providing anchorage arrangement and by welding to the lowest part of the steel reinforcement and other structural supports. The top templates shall be securely fixed by tying with guy wires and turn buckle arrangements to firm and rigid adjoining structures and staging. The bottom template that is embedded in concrete will be measured and paid for as embedded steel. Bolt pockets, where required, shall be cast with wooden taper wedges. These shall be withdrawn at an appropriate time when the concrete has set, the pockets cleaned, roughened and then covered or blocked thoroughly to prevent debris getting into these. The exposed portions of bolts and embedded parts shall be kept well-greased and adequately protected from damage throughout construction. Any damages found shall have to be corrected at the Contractor's cost. EMPLOYER, shall have the right to use the foundations, pads, piers, slabs, floors and all concrete work as needed for other works or equipment erected prior to its "Taking Over".

Finishes to Exposed Surface of Concrete:

The Contractor is to include his quoted rate for concrete, the provision of exposed concrete/normal finishes in both formed and unformed surfaces as and when required by the Architect/ Engineer without any extra cost to EMPLOYER, some common finishes are indicated below:

Surfaces which do not Require Plastering:

Surface in contact with casing shall be brought to a fair and even surface by working the concrete smooth against casings with a steel trowel while it is being deposited and also by working over the surface with a trowel immediately after the removal of the casings or centering, removing any irregularities and stopping air holes, etc.

Use of mortar plaster is not permissible for correcting levels, removing unevenness etc. However, if in the opinion of the Engineer, such plastering is unavoidable, then the thickness of plaster shall in no case exceed 5 mm and the plastering shall be in CM (1:3).

Faces of Foundations which will be Back Filled:

Neither the smoothness of the surface nor the positions of the joints in the form work are important. Small blemishes caused by entrapped air are permitted. No special surface finish is required.

Exposed Surfaces:

Surface of beams/columns flush with the block work or other structures where it is intended to plaster, shall be backed adequately as soon as the shuttering is stripped off so that proper bond with the plaster can develop.

Surface for Non-integral Finish:

Where a non-integral finish such as floor finish is specified or required, the surface of the concrete shall be struck off at the specified levels shall be furnished and finished rough.

For Monolithic Finish:

Where no more finishing course is to be supplied as in the case of basement floor, industrial flooring or the screed concrete flooring etc., the concrete shall be completed and struck off at the specified levels and slopes in a screed board and then floated with a wooden float. Steel trowel ling is then started after the concrete has hardened enough to prevent the excess of fines and water to rise to the surface but not hard enough to prevent proper finishing. Troweling shall be such that the surface is flat, smooth and neatly finished.

Curing of Concrete:

The purpose of curing is either to provide sufficient water at optimum temperature or to prevent loss of moisture from the concrete itself so that the cement inside the concrete is sufficiently hydrated which, of course, is a slow and prolonged process. As soon as the concrete has hardened sufficiently, the curing shall be started.

1 Different Methods of Curing:

Any one of the following may be used for curing as approved by the Engineer.

a) Curing by Direct Water: This is done either by pounding or spraying water.

Ponding:

Ponding is widely used for curing slabs and pavement. Earth bands are formed over the slabs and water is pumped or poured into them and the same is replenished at interval to make up for the loss of evaporation. As this type of curing is one of the best methods, 10 days of curing after final setting is sufficient.

By Spraying Water Curing is done by spraying water by suitable means at approved time intervals. While spraying, it shall be ensured that the complete area is covered. In order to avoid cracking, cold water shall not be applied to massive members immediately after striking the form work, while the concrete is still warm. Alternative wetting and over drying shall be avoided. Curing by spraying water shall be continued at least for 18 days.

a) Curing of Concrete with Absorbent Material Kept Damp:

The entire concrete surface is covered either with hessian, burlap, sawdust, sand, canvas or similar material and kept wet continuously for at least 12 days after final settings.

Testing of Concrete:The Contractor shall carry out, entirely at his own cost, all sampling and testing in accordance with the relevant IS standards and as supplemented herein. The Contractor shall get all tests done in an approved laboratory and submit to the Engineer, the test result in triplicate within 3 days after completion of the test.

Consistency Test (Tests of Fresh Concrete):

At the place of deposition/pouring of the concrete, to control the consistency slump tests and/or compacting factor tests shall be carried out by the Contractor in accordance with IS 1199 as directed by the Engineer. The results of the slump tests/compacting factor tests shall be recorded in a register for reference duly signed by both the Contractor and the Engineer. That register shall be considered as the property of EMPLOYER, and shall be kept by the Contractor at site in safe custody.

The results of the slump tests/compacting factor tests shall tally, within accepted variation of 12%, with the results in the respective design mix, in case of mix design concrete and with the values indicated in the table under clause 6.1 of IS:456 in case of nominal mix concrete. For any particular batch of concrete, if the results do not conform to the requirements as specified in IS 456, the Engineer has the right to reject that batch and the Contractor shall remove the same immediately from the site, at no cost to EMPLOYER.

Strength Test of Concrete:

While placing concrete, the Contractor shall make six (6) 150 mm test cubes from particular batches of concrete as desired by the Engineer. The frequency of taking test cubes shall be either according to clause 14.2 of IS:456 or as directed by the Engineer. The cubes shall be prepared, cured and tested according to IS 516. Out of the six (6) test cubes, 3 shall be tested for compressive strength at 7 days after casting and the remaining 3 at 28 days after casting A register shall be maintained at site by the Contractor with the following details entered and signed by both the contractor and the Engineer. That register shall be considered as the property of EMPLOYER.

a) Reference to the specific structural member

- b) Mark on cubes
- c) The grade of concrete
- d) The mix of concrete
- e) Date and time
- f) Crushing strength at 7 days
- g) Crushing strength at 28 days
- h) Any other information directed by the Engineer.

Acceptance Criteria for Test Cubes:

The acceptance criteria of concrete on strength requirement shall be in accordance with the stipulations under clause 15 of IS:456.

Non-destructive Tests on Hardened Concrete:

If there is doubt about the strength or quality of a particular work or the test results do not comply with the acceptance criteria as stipulated under clause 15 of IS:456, non-destructive tests on hardened concrete like core tests and/or load tests or other type of non-destructive tests like ultrasonic impulse test etc. shall be carried out, as may be directed by the Engineer, by the Contractor at entirely his own cost. The core tests and load tests shall comply with the requirements of clause 16.6 of IS: 456.

Concrete Below Specified Strength:

In case of failure of test cubes to meet the specified requirements, the Engineer may take one of the following actions:

1. Reject the work and instruct that section of the works to which the failed cubes relate shall be cut out and replaced at the Contractor's expense.
2. Instruct the Contractor to carry out additional tests and/or works to ensure the soundness of the structure at the Contractor's expense.
3. Accept the work with reduction in the rate in appropriate item.

Concrete failed in Non-destruction Tests:In case test results of the core tests or load tests in a particular work do not comply with requirements of respective clause (16.3 for core test and 16.5 for load tests) of IS 456, the whole or part of the work concerned shall be dismantled and replaced by the Contractor as may be directed by the Engineer at no extra cost to EMPLOYER, and to the satisfaction of the Engineer. No payment for the dismantled concrete including relevant form work, reinforcement, embedded fixtures etc. shall be made. In the course of dismantling if any damage occurs to the adjacent structure or embedded item, the same shall be made good, free of charge by the Contractor, to the satisfaction of the Engineer.

Expansion Joints:

Expansion joints shall be provided where shown on the drawings or as directed by consultant. They shall be constructed with an initial gap between the adjoining parts of the works of the width specified in the drawings. The contractor shall ensure that no debris is allowed to enter expansion joints Expansion joints shall be provided as per drawings. Contractor shall ensure that expansion joints are made water-tight and that no leakage occurs through these joints for which he shall be responsible to redo at his own cost.

Open Joint Fillers:

Where shown on the drawings, open joints in the structure shall be filled with joint fillers.

The joint filler shall be easily and uniformly compressible to its original thickness, tamable, easily cut or sawn, robust, durable, resistant to decay due to termite or weathering, unaffected by water and free of any constituent which will bleed into or stain the concrete.

The joint filler shall be of same thickness of the joint width, it shall extend through the full thickness of the concrete unless otherwise specified and shall be sufficiently rigid during handling and placing to permit the formation of straight joints.

Joint Sealing Compounds:

Joints sealing compounds shall seal joints in concrete against the passage of water prevent the ingress of grit or other foreign material and protect the joint filler. The compound shall have good extensibility and adhesion to concrete shall have good extensibility and adhesion to concrete surfaces and shall have resistant to flow and weathering. Polysulphide joints where specified on the drawings shall be sealed with polysulphide liquid polymer, stored, mixed handled, applied and cured strictly in dimensions, thoroughly cleaned and treated with recommended primer strictly in accordance with the manufacturer's written instructions prior to sealing. The Contractor shall use only competent personnel experienced in the application of poly-sulphide for such work. Where specified in the drawings, rubber/bituminous based sealant shall be of an approved manufacturer. The treatment of the joint and the use of sealing compound shall be strictly in accordance with the manufacturer's written instructions.

Water Bars:

Where water bars are shown on the drawings, the joints shall incorporate an approved PVC external type water-bar complete with all necessary molded or prefabricated intersection pieces assembled in accordance with the drawings with bends and butt joints in running lengths made by heat welding in an electrically heated jig. Jointing and fixing of water-bars shall be carried out strictly in accordance with the manufacturers written instructions. The water-bars shall be installed so that they are securely held in their correct position during the placing and compacting of the concrete. Where reinforcement is present adjacent to water-bars, adequate clearance shall be left between the reinforcement and water-beds to facilitate of the concrete.

Cracks:

If any cracks develop in the reinforced cement concrete construction which in the opinion of the Consultant may be detrimental to the strength of the construction, the contractor at his own expense shall test the structural element in question If under these test loads the cracks shall develop further the contractor at his own expense shall dismantle the construction, cart away the debris, replace the construction and carry out all consequential work there to at no extra cost.

If the cracks are not detrimental to the stability of the construction in the opinion of the Consultant, the contractor at his own expense shall grout the cracks with pneumatically applied mortar. At his own expense and risk he shall also make good all other building works such as plaster, molding, surface finish of floods, roofs, ceiling etc. which in the opinion of the Consultant have suffered damage either in appearance or stability owing to such cracks. The repair work shall be carried out to the satisfaction of the Consultant/Project-in-charge. The decision of the Consultant/Project-in-charge as to the extent of the liability of the contractor in the above matter shall be final and binding on the contractor.

Supervision:

All concreting work shall be done under strict supervision of the qualified and experienced representatives of the Contractor as well as those of the Consultant The contractor's Engineer and supervisor who are in charge of concreting work shall be skilled in this class of work and shall personally supervise all the concreting operations.

Special attention shall be paid to the following: -

- (a) Proportioning, mixing and quality testing of the materials with particular control on the water cement ratio.
- (b) Laying of material in place and thorough compaction of the concrete to ensure solidity and freedom from voids and honey combing.
- (c) Proper curing for the requisite period.
- (d) Reinforcement and inserts/embodiment's position are not disturbed during concreting and consolidation by vibration.

Quality Control:

The Consultant/Project-in-charge reserves the right to make changes in the mix proportions including the increased cement content or/and a change in the Contractor's control procedure, should the quality control during progress of the works prove to be inadequate in his opinion. All the concrete work shall be true to level, plumb and square within the acceptable tolerance. The corners, edges and rises in all cases shall be unbroken and finished properly and carefully.

Tolerances:

The acceptable tolerances for formed concrete surfaces shall be given below: -

a) Variation from plumb for -

i. Columns and walls to be rendered 6 mm in 3 meters

ii. Exposed columns and walls 3 mm in 3 meters

b) Variation in cross sectional dimensions of columns and beams and in the thickness of slabs and walls: - 6 mm & + 12 mm. All the works executed beyond the tolerance limits are liable to be rejected and no extra cost shall be paid to the contractor for reconstructing the same as desired by the Consultant/Project-in-charge.

Testing Room:

A testing room of not less than 10 sqm equipped with the following apparatus and qualified concrete technician, labor and materials required for carrying out tests therein shall be provided by the contractor at his own cost:

1. Sieve Set (For aggregate 20 mm down)

40 mm, 20 mm, 16 mm, 12.5 mm, 10 mm, 4.75 mm, 600-micron, 300 micron, and 75 microns having diameter of 45 CMS.

2. Weighing

a) Physical balance cap. 200 Gms. with weigh box (accuracy 0.5 gm)

b) Counter Scale cap 20 Kg

c) Weights

5 kg - 1 No 500 gms - 1 No.

2kg - 2 Nos. 200 gms - 1 No.

1 kg - 1 No. 100 gms - 1 No.

3. Slump Cones 2 Nos

4. 15 cms moulds 18 no.

5. Electric/Kerosene Heater

6. Pans etc. as directed by the Consultant

7. Measuring Cylinders of 1000 ml., 500 ml and 100ml.

8. Wash bottles of the Capacity of 500 ml., 2 Nos.

9. Sink

10. Work benches, shelves, desks and any other furniture and lighting as required by the Consultant.

11. Spring balance dial type cap. 100 kg

12. Litre measures

a) 10 Lit - 1 No.

b) 5 Lit - 1 No.

c) 2 Lit - 2 Nos

d) 1 Lit - 1 No.

e) 1/2 Lit - 1 No.

13. Cube Testing Machine 100 Tons.

14. Oven.

15. Cores/ Apparatus for conducting Proctor Density Tests.

Co-Ordination of Work:

The contractor is fully responsible for coordinating with the other agencies for sanitary, electrical work, etc. to ensure execution of their work related to commencement of concreting. Nothing extra shall be payable to the contractor, if the works pertaining to concreting have to be dismantled and redone due to lack of coordination on the part of the contractor in ensuring completion of works of such agencies before concreting had been undertaken.

SPECIFICATIONS FOR FORMWORK:

This section covers the requirements for providing, fabricating and erecting of form work including propping, bracing, shoring, strutting, rising, bolting, wedging and all other temporary and all other temporary supports to the concrete during the process of setting subsequent removal of forms.

Applicable Codes and Standards:

The codes and standards generally applicable to the work of this section are listed hereinafter

IS: 456 Code of practice for plain and reinforced concrete.
IS: 4990 Ply wood for concrete shuttering work.

Submittals:

Type of Form Work:

Prior to start of delivery of material for formwork, the contractor shall prepare samples of different types of formworks for about 10 Sqm and obtain approval of the Consultant/Project-in-charge.

Design of Forms:

Before fabricating of forms, the contractor shall submit design calculations for proposed form work to Consultant/Project-in-charge for his approval. However, the approval of his responsibility for adequately constructing and maintaining the forms so that they will function properly.

Tie Bolts: In case the contractor proposes to use tie bolts running through the concrete, the location and size of such tie bolts shall be submitted to the Consultant/Project-in-charge for his Approval.

Materials:

Formwork shall be timber, plywood, steel or any other material capable of resisting damage to the contact faces under normal conditions of erecting forms, fixing steel and placing concrete. Fresh or new materials for formwork are preferable due to exposed concrete finish of the building. The selection of materials suitable for formwork shall be made by the Contractor based on the maximum quality consistent with the pattern, specified finished and safety.

Timber:

Timber used for formwork shall be easily workable with nails without splitting. It shall be stable and into liable to warp when exposed to sun and rain or wetted during concreting.

Plywood:

Plywood used for formwork shall be 12 mm thick shuttering quality (pre-laminated) plywood complying with IS: 4990 and of make approved by the Consultant.

Steel:

Steel form work shall be made of minimum 2 mm thick or more as required black sheets stiffened with angle iron frame made out of M S angles 40 mm X 6mm.

Design Criteria:

Formwork shall be designed for the loads and lateral pressures due to dead weight of concrete, superimposed live loads of workmen, materials and plants and for other loads as indicated on the drawings. Forms shall be designed to have sufficient strength to carry on the hydro-static head of concrete as a liquid without deflection tolerances exceeding the acceptable limits.

The formwork shall be cambered at suitable locations to compensate for anticipated deflections due to the weight and pressure of the fresh concrete, and also due to any other construction loads. The shuttering for beams and slabs shall have camber of 4 mm. per meter (1 in 250) or as directed by the Engineer-in-charge so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the projected length or as directed by the Engineer-in-charge.

Erection of Formwork:

1. Forms shall be used wherever necessary to confine the concrete during vibration and to shape it to the required line. The formwork shall conform to shapes, lines, levels and dimensions of the concrete sections shown on the drawings.

2. The formwork shall be placed in accordance with designs, patterns and textures shown in architect's drawings for exposed concrete work. New materials as per the architect's drawings for formwork, shall be used for exposed concrete work.

3. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of concrete and shall be maintained rigidly in position. Form work shall be adequately supported by adequate number and size of struts, braces, ties and props to ensure rigidity of forms during concreting. Where props rest on natural or filled up ground, to avoid any settlement, the soil shall be thoroughly compacted and bases of props shall be sufficient size so as to restrict the bearing on the ground to 50 t/ sqm. Forms shall be tight enough to prevent loss of mortar from the concrete and to produce dense, homogeneous and uniformly colored concrete completely free from honeycombing or surface roughness. Joints in formwork shall be designed to prevent leakage, not only between individual elements forming the panels but also from the horizontal and vertical junction between the panels themselves.

4. If form work is held together by bolts or wires, those shall be so fixed that no reinforcement bar is exposed on surface against which concrete is to be laid. The Consultant may at his discretion allow the contractor to use tie bolts running through the concrete at his own cost. Hole left in the concrete by these tie-bolts shall be filled as specified by him at the Contractor's expense. Formwork shall be constructed so as to facilitate loosening and permit removal without jarring the concrete. Wedges, clamps and bolts shall be used wherever practicable instead of nails. All formwork erected shall be approved by the Consultant/Project-in-charge before concreting is started.

5. If at any stage of work during or after placing concrete in the structure, the form work sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequately rigid form work. The complete form work shall be got inspected by and got approved from the Engineer-in-charge, before the reinforcement bars are placed in position.

6. The timber used in shuttering shall not be so dry as to absorb water from concrete and swell or bulge nor so green or wet as to shrink after erection. The timber shall be properly sawn and planed on the sides and surface coming in contact with concrete. The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacturer may be applied in place of soap solution. In case of steel shuttering either soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances black or burnt oil shall be permitted. Wooden form work with metal sheet lining or steel plates stiffened by steel angles is permitted.

7. As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoided.

CLEANING AND OILING OF FORMS: At the time concrete is placed in the forms, the surface of the forms in contact with the concrete shall be free from encrustations of mortar, grout or other foreign materials. Temporary openings shall be left at the bottom of formwork to enable, sawdust, shavings, wire cuttings and other foreign material to be worked out from the interior of the forms before the concrete is placed.

2. The surface of the forms to be in contact with the concrete shall be coated with an approved coating that will effectively prevent sticking and will not stain the concrete surfaces. After each use the surfaces of forms in contact with concrete shall be cleaned, well settled and treated with form oil approved by the Consultant / Project-in-charge. Lubricating (machine) oils shall not be used.

3. Oiling shall be done before reinforcement has been placed and care shall be taken that no oil comes in contact with the reinforcement while it is being placed in positions. Immediately before concreting is commenced the formworks shall be carefully examined to see that all dirt, shavings, sawdust and other refuse have been removed and the formwork shall be wetted thoroughly to prevent absorption of water from concrete. The formwork shall be kept wet during concreting and for the whole time that it is left in place.

Expansion joints - pre-molded filter: The item provides for expansion joints in R.C.C. frame structures for internal joints, as well as exposed joints, with the use of pre-molded bituminous joint filler. Pre-molded bituminous joint filler i.e., performed strip of expansion joint filler shall not get deformed or broken by twisting bending or other handling when exposed to atmospheric condition. Pieces of joint filler that have been damaged shall be rejected. Thickness of the pre-molded joint filler shall be 25 mm., unless otherwise specified. Pre-molded bituminous joint filler shall conform to I.S. 1836-1961.

Expansion Joints Copper Strips & Hold fasts: The item provided for expansion joints in R.C.C. frame structure for internal joints as well as for exposed joints with the use of necessary copper strip and holdfasts. Copper sheet shall be of 1.25 mm. thick and of 1.25 mm width with the 'U' shape in the middle. Copper strip shall have hold fast of 3 mm. diameter copper rod fixed to the plate soldered on strip at intervals of about 30 cm. or as shown in the drawing or as

directed. The width of each flange (horizontal side) of the copper plate to be embedded in the concrete work shall be 25 mm. Depth of 'U' to be provided in the expansion joint, in the copper plate shall be of 25 mm.

Removal of Form Work:

1. Form works shall be removed carefully so as to prevent damage to the concrete. Wooden wedge only shall be used between the concrete surface and the form where force is necessary to separate the form from the concrete. Metal wedge, bars or tools shall not be used for this purpose. Any concrete damaged in the process of removing the forms shall be repaired in accordance with the provision of concrete specifications.

2. Unless otherwise permitted by the Consultant, the forms shall not be stripped in less than the minimum periods specified in IS: 456. However, the Consultant may increase the above period if he considers it necessary for structural stability. All non-supporting forms shall be loosened and removed during regular working hours, and as soon as the concrete has hardened sufficiently to prevent damage from the removal of the forms. All false work and forms supporting concrete beam and slabs, or other members subject to direct bending stress, shall not be removed or released until the concrete has attained sufficient strength to ensure structural stability and to carry both the dead and live loads including any construction loads which may be placed upon it.

3. No construction loads exceeding the combination of superimposed dead load plus specified live load shall be supported on any unshared portion of the structure under construction, unless analysis indicates adequate strength to support such additional loads. Form work shall be removed in such a manner so as not to impair safety and serviceability of the structure. It shall be removed gradually to prevent sudden application of loads to the concrete. All concrete to be exposed shall have sufficient strength to prevent any damage caused by removal of formwork.

Hacking:

Immediately after removal of forms, the concrete surface intended to be either plastered or finished, shall be roughened with brush hammer or with chisel and hammer as directed by the construction manager to make the surface sufficiently coarse and rough to provide a bonding key for plaster.

No extra payments shall be made to the Contractor for such work on concrete surface after removal of the form work. No payment shall be made for temporary formwork used in concreting, or for form work required for joints or bulk-heads, in floor or elsewhere, whether such joints are to be covered later with concrete or mastic or other materials.

Pockets And Openings:

Where boxes, pockets or openings are required (not exceeding 0.1 sqm) to be formed in the concrete. No deduction shall be made for the area of box or pockets in measuring the area of concrete surface shuttered. In other words, the area of shuttering shall be reckoned as if box or pocket or openings were not present. However, on measuring the concrete quantity, the volume of the box or pocket shall be deducted. If the area of box or pocket or openings against the shuttered faces exceeds 0.1 sqm. It shall be paid not as a box or pocket or opening but as formwork at the rates for formwork. No extra payment shall be made for holes to be made in the form work for inserting electrical conduits hooks for fans etc.

Reuse of Forms:

Immediately after the forms are removed, they shall be cleaned with jet of water and a soft brush before they are reused. The contractor shall not be permitted reuse of any forms which in the opinion of the Consultant has worn out and has become unfit for formwork. The Consultant/Project-in-charge may in his absolute discretion, order rejection of any forms he considers unfit for use in the works, and order their removal from the site.

7.0 TECHNICAL SPECIFICATIONS FOR FIRST CLASS AUTOCLAVED AERATED CONCRETE (AAC) BLOCK MASONRY

Scope of work:

- The work covered under this specification pertains to procurement of best quality locally available or locally manufactured precast cement concrete solid block and laying AAC block masonry walls of various thicknesses in strict compliance with the specifications and applicable drawings.

- Providing and laying masonry walls in sub-structure and super structure, with first class autoclaved aerated concrete (AAC) blocks of approved make, laying with a specialized jointing adhesive mortar all as per manufacturers specification. Wall thickness shall be 125/150mm and 230mm all as per locations specified in detailed drawings.
- Mechanized Autoclave Fly Ash Lime Brick: These bricks shall be machine molded and prepared in plant by appropriate proportion of fly ash and lime. The autoclave fly ash bricks shall conform to IS 2185-PART3. Visually, the bricks shall be sound, compact and uniform shape, free from visible cracks, war page and organic matters. The brick shall be solid with or without frog, and of frog dimensions as 100/80 mm in length, 40 mm width and 10 to 20 mm deep on one of its flat sides as per IS 12894. The brick shall have smooth rectangular faces with sharp corners and shall be uniform in shape and color.
- RCC band of **100mm** thick to be provided at a maximum c/c distance of 1.00 meter in nominal mix of M15 grade and steel bars as specified in the BOQ.

Material:

- First class autoclaved aerated concrete (AAC) blocks shall be of best quality locally available manufactured at site and should be approved by the Engineer-in-charge before incorporation in the work. The ingredient and the cement concrete used shall conform to relevant IS as stipulated in specification for cement concrete works herein before. Minimum crushing strength of the solid blocks shall be 40 to 60kg/sq.cm at 28th day after curing. The type of the bond to be adopted will be decided by the Engineer-in-charge but vertical joints shall be staggered. The size of the blocks shall be as specified in the drawings / as instructed by the Architect / Engineer-in-charge and the proportion used in making the blocks shall be 1:4 (1 cement : 4 fine aggregates). The blocks shall be cured well at least for 14 days before incorporation into the work. The joints shall not be more than 10mm thick.

Mortars:

Any of the below mentioned mortars shall be used as per instructions of Architect / Engineer in charge:

AAC block jointing adhesive (such as magicrete, magic bond, sika or equivalent) is a thin bed mortar with high strength attributes for quick & firm laying of AAC blocks. It is a factory mixed mortar made up of cement, graded sand and blended with polymers to impart high strength and water retention properties even when in thickness of 2-3 mm layer. Bags or special silos are used for delivering these adhesives to the construction site. One just need to add water to the mix before using it.

Curing:

The blocks shall be adequately wet before use as per manufacturers specification.

It is intended to plaster concrete masonry; the block shall have a sufficiently rough surface to afford a good key to the plaster.

Workmanship:

- All workmanship shall be of first-class quality in every respect to get greatest accuracy to ensure that all walls shall be strong, sound and in true line, level and plumb. All ends shall be cut true to planes.
- All joints shall be thoroughly flushed with mortar of mix as specified in the schedule of quantities, at every course. Care shall be taken to see that the bricks are bedded effectively and all joints completely filled to the full depth.
- The joints of brick work to be plastered shall be raked out to a depth not less than 10mm as the work proceeds. The surface of brick work shall be cleaned down and wiped properly before the mortar sets.
- The adhesion between the brick masonry surface and the concrete surface of columns, beams, Chajja, lintels etc. should be proper by ensuring that the concrete surface coming in contact with brick masonry is backed / chipped / keyed, cleaned and cement slurry is applied so that a proper bond is achieved between the two dissimilar materials. It is responsibility of the contractors to ensure that there will not be any cracks / fissure anywhere in the block masonry.

Mode of measurement:

Volume of RCC/ lintel band shall be measured along with the block masonry and RCC bands will not be paid separately. The length and breadth of the concrete block masonry with block and RCC band, lintel bands shall be measured in meter nearest to two places of decimals and volume of wall will be measured in cubic meter correct to two places of decimals.

All opening in brick work for doors, windows and ventilators shall be deducted to get the net quantity of actual brick work done.

Opening or chases required for P.H. or electrical inserts less than 0.1 sqm. and bearing of precast concrete members shall not be deducted.

Rate:

The rate quoted shall include cost of all materials, labor including frame work in casting the blocks, curing, transporting, scaffolding, handling, hoisting the blocks to proper level, curing masonry etc. at all levels and heights complete in all aspects.

8.00 TECHNICAL SPECIFICATIONS FOR PLASTERING WORK

8.1 – 12MM Gypsum Plaster:

Scope of Work:

This shall include providing and laying average 12 mm thick single coat gypsum plaster to desired line, level and plumb. Gypsum plaster will be a premixed formulated gypsum lightweight plaster (Gyproc or equivalent) having additives and light weight aggregates as vermiculite / perlite respectively. Gyproc Plasters can be applied directly to brick walls, concrete blocks, or RCC surfaces as per manufacturer's specification. The RCC surfaces should be hacked or use of a bonding agent is recommended. The surfaces should not have paint, oil, dust, dirt or any other material that might prevent the development of proper bond.

Scaffolding: Double scaffolding independent of the work having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

Preparation of Surface: As specified above under item no. 7.01.

Materials:

Premixed light weight plasters of approved make and shade shall essentially consist of retarded hemihydrates gypsum plaster and light weight aggregate which are characterized by low density, high thermal insulation and sound absorption properties. Other additions may be incorporated to impart desired properties. The physical and chemical requirements shall conform to IS 2547 (Pt. II).

The minimum recommended water-premixed plaster ratio is 1:2 as per standard practice or as recommended by the manufacturers.

Application of Plaster:

- a. Ceiling plaster shall be completed before commencement of wall plaster.
- b. Plastering shall be started from the top and worked down towards the floor. All putlog holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 × 15 cm shall be first applied, horizontally and vertically, at not more than 2 meters intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be 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 trowel or wooden float according as a smooth or a sandy granular texture is required. Excessive trowel or over working the float shall be avoided. Contractor may follow the application procedure as mentioned by the manufacturer, after prior approval from the Architect / Engineer-in-charge.

- c. All corners, arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arises, provision of grooves at junctions etc. where required shall be done without any extra payment. Such rounding, chamfering or grooving shall be carried out with proper templates or battens to the sizes required. When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with cement slurry 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 wall and not nearer than 15 cm to any corners or arises. It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar. No portion of the surface shall be left out initially to be patched up later on.
- d. The plaster application may be done as recommended by the manufacturer.

Finish: The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5 m long and with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

Mode of Measurement: As specified above under item no. 7.01.

Rate: Rate shall include the cost of all cleaning, surface preparation, labor, material, fixing chicken mesh, scaffolding, curing, finishing etc., involved in all the operations described above for all heights and levels.

8.2 – 8MM TO 10MM CEMENT PLASTER:

Scope of work:

This shall include providing and laying single coat average 08 to 10 mm thick cement plaster 1:4 (1 cement: 4 coarse sand) on ceilings. The junctions of RCC and masonry shall be fixed with chicken mesh with a minimum overlap of 100 mm in all directions and curing complete.

All other specifications shall be as specified above.

8.3 – 18MM CEMENT PLASTER INCLUDING WATERPROOFING COMPOUND ON EXTERNAL SURFACES:

Scope of work:

This shall include providing and laying double coat average 18 mm thick comprising first layer 12 mm thick cement plaster 1:5 (1 cement: 5 coarse sand) and top layer 6mm thick cement plaster (1 cement: 3 coarse sand) with approved waterproofing compound (Sikka / Dr. Fixit / BASF or equivalent) @ 2%, by weight of cement on external wall surfaces or facades. The junctions of RCC and masonry shall be fixed with chicken mesh with a minimum overlap of 100 mm in all directions and curing complete.

The fineness modulus of the sand shall not be less than 2.5 mm.

Sand for Plaster- Sand shall consist of natural sand, crushed stone sand or crushed gravel sand or a combination of any of these. Sand shall be hard durable, clean and free from adherent coating and organic matter and shall not contain the amount of clay, silt and fine dust more than as specified in relevant Indian standards.

Water Proofing Compound

Integral cement water proofing compound conforming to IS 2645 and of approved brand and manufacture, enlisted by the Engineer-in-Charge shall be used.

Where so specified, water proofing material of approved quality shall be added to the mixture in accordance with the manufacturer's specification stating the quantity of water proofing material in liters or kg per 50 kg of cement.

Appearance - Opaque liquid

Density @20 degree Celsius: 1.05 +/- 0.02 kg/lit

pH: alkali

Chloride: nil

Storage: 24 months when kept unopened and away from frost.

Areas of Application:

External masonry walls, parapet walls, all shafts inner side etc.

Features & Benefits:

- Corrosion - Chloride-free hence no chances of corrosion of reinforcement bars. Water seepage - As an effective pore filler, helps to fill capillaries and pores to prevent water seepage.
- Consistency - Makes the mix cohesive and denser, hence the concrete & plaster has reduced permeability.
- Setting & strength - Does not affect the setting time and strength. Of the cured concrete.
- Compatibility – Compatible with all types & grades of cements.

Method of Application:

- Hand mixing of mortar not allowed, else otherwise specified and prior approval of Architect / Engineer-in-charge.
- Machine Mixing: Charge the Cement & sand as per the mix design into concrete mixer & mix for one minute. Add dosage of liquid waterproofing compound for every 50 kg bag of cement & mix for one minute.
- Add the measured quantity of potable water as per W/C ratio and mix for 2-3 minutes to a lumps free homogeneous concrete. Place the mixed cement mortar to the locations as specified. For exterior plasters procedure is to be carried from top to ground level.
- Cure the concrete / mortar surface as per regular practices of water curing.

Health & Safety Precautions

- Use rubber hand gloves & safety goggles, while using Powder Waterproof.
- In case of contact with skin, wash with plenty of water.
- Keep out of reach of children.

The contractor shall bring the materials to the site in their original packing. The containers will be opened and the material mixed with dry cement in the proportion by weight, recommended by the manufacturers or as specifically described in the description of the item. Care shall be taken in mixing, to see that the water proofing material gets well and integrally mixed with tied from the cement and does not run out separately when water is added.

Mode of Measurement:

- a. Length and breadth shall be measured correct to a cm and its area shall be calculated in square meters correct to two places of decimal.
- b. The measurement of wall plaster shall be taken between the walls or partitions (the dimensions before the plaster shall be taken) for the length and from the top of the floor or skirting to the ceiling for the height. Depth of coves or cornices if any shall be deducted.
- c. Deductions in measurements, for opening etc. will be regulated as follows: 1) No deduction will be made for openings or ends of joists, beams, posts, girders, steps etc. up to 0.5 sqm in area and no additions shall be made either, for the jambs, 2) soffits and sills of such openings. The above procedure will apply to both faces of wall. 3) Deduction for opening exceeding 0.5 sqm but not exceeding 3 sqm each shall be made for reveals, jambs, soffits sills, sills, etc. of these openings. When both faces of walls are plastered with same plaster, deductions shall be made for one face only. 4) When two faces of walls are plastered with different types of plaster or if one face is plastered and other is pointed or one face is plastered and other is un-plastered, deduction shall be made from the plaster or pointing on the side of the frame for the doors, windows etc. on which width of reveals is less than that on the other side but no deduction shall be made on the other side. Where width of reveals on both faces of wall are equal, deduction of 50% of

area of opening on each face shall be made from area of plaster and/or pointing as the case may be. (iii) For opening having door frame equal to or projecting beyond thickness of wall, full deduction for opening shall be made from each plastered face of wall. For opening exceeding 3 sqm in area, deduction will be made in the measurements for the full opening of the wall treatment on both faces, while at the same time, jambs, sills and soffits will be measured for payment.

Rate: The rate shall include the cost of all cleaning, surface preparation, labor, material, scaffolding, curing, finishing etc., involved in all the operations described above.

9.00 TECHNICAL SPECIFICATIONS FOR WATERPROOFING

Scope of work:

The work covered under this specification consists of providing and treating terraces, balconies, basements, toilets and overhead tanks with modern specialized waterproofing treatments, seamless PU application etc. strictly in accordance with these specifications and relevant drawings to protect and guard building against any type of water seepage or leakage.

General:

- 1.All surfaces to be applied shall be cleaned by water blasting, sandblasting, wire brushing, scraping or any other suitable means to remove dirt, grease, moss, moulds etc. A suitable algacide / fungicide solution shall be used to remove algae/ fungus.
- 2.Other cracks that are subjected to only minimal movement shall be raked out where necessary. These cracks shall be prepared with Hitchens formwork 122 or a similar epoxy repair mortar.
- 3.Where cracks are to be structural, a structural engineer shall be consulted and the structure assessed.
- 4.Large holes and defects shall be repaired by plastering or screeding or using approved epoxy repair mortar.
- 5.All spalled concrete and plaster must be repaired by appropriate methods prior to the installation of the waterproofing system.
- 6.The guarantee for water proofing treatment for 10 years in prescribed format approved by the Architect / Bank must be given by the specialized agency which shall be signed by the contractor in token of his overall responsibility. The guarantee for waterproofing treatment in the prescribed format shall also cover horizontal expansion joint and vertical expansion joint.

General Requirements:

Waterproofing treatment being a specialized job, calls for thorough knowledge of the advanced waterproofing techniques, compounds, chemicals, processes to be dealt with and the environmental conditions, in order to give effective treatment and lasting protection to the property undergoing treatment. It is therefore imperative that the works of waterproofing treatment should be got executed through specialized agencies only. The specialized agency should be preferably an expertise and reputed agency in modern waterproofing treatments and shall have sufficient experience of carrying out similar works of magnitude envisaged in this tender.

Testing and Guarantee:

- 1.The contractor shall test the surface where waterproofing treatment is provided for the bone-dry condition by filling with water inside the depressed plastered portion. No wet patches or leaks shall appear on the surrounding plastered walls or at the underside of the slabs. The testing shall be carried out to the entire satisfaction of the Engineer-in-charge. The contractor shall furnish guarantee in the Performa for the waterproofing treatment for maintaining the underside of the waterproofed surface in bone dry condition for a period of 10 years. During this period, contractor shall attend to all leakages, defects etc. if noticed, free for cost, starting his work of checking up and rectification within a week's time from the date of receipt of information about such leakages etc. by him.
- 2.The contractor shall test the surface by ponding water over roof for minimum seven days period to the entire satisfaction of the Engineer-in charge. Alternately, the curing of the finished surface done by ponding of water on the entire surface for seven days, can also be used for testing water tightness. After a period of two months, once again the roof should be ponded with water to check its efficiency of waterproofing treatment against leakage. The contractor shall furnish guarantee in the Performa specified for the waterproofing treatment provided by them to maintain the

underside of the roof in bone dry condition for a minimum period of ten years. During this period, the contractor shall be liable to attend all the leakages, defects etc. if noticed, free of cost, starting his work of checking and rectification within a week's time from the date of receipt of intimation of such leakages etc. by him.

3. The tank will thereafter be got filled into the full height immediately and water stored for a minimum period of seven days so as to observe any leakages / defects for necessary compliance by the waterproofing contractor. In the case of tanks whose external faces are exposed, the requirements of the test shall be deemed to be satisfied if the external faces shown no sign of leakage and remain apparently dry over the period of observation of seven days after allowing a seven day's period for absorption after filling the tank for full height. If the structure does not satisfy the conditions of test, the period of test may be extended for a further period of seven days and if specified limit is then reached, the structure may be considered a satisfactory. Suitable remedial measures shall be taken by the contractor at his own cost till the test as specified above is carried out satisfactorily. In the case of tanks whose external faces are exposed or can be left exposed prior to testing all leakages, wet patches and the like, shall be marked out on the outside of walls during test. The tank shall then be dewatered and the defects made good by grouting, waterproofing, plastering etc. as necessary to the entire satisfaction of the Engineer-in-charge, at no extra cost. The tank shall again be tested for leakage after rectification. The work shall not be accepted unless the water tightness is established.

4. Back filling in case of underground sump and waterproofing the roof where specified, shall be carried out after testing and rectification of defects. The completion certificate shall not be given unless the test for water tightness as described above is carried out to the entire satisfaction of the Engineer-in-charge. After a period of two months after the tank is left dry, once again the tank should be filled with water to check the efficiency of the waterproofing treatment done. If there is any leakage or wet patches, the same shall be rectified, with no extra cost, by the contractor.

Mode of measurement:

1. The length and breadth of the surface area shall be measured to two places of decimals of a meter from the finished surface of wall and parapet and cubic contents where ever required to be worked out with average thickness of coba/ fill provided. Vatas shall not be measured separately.

2. No deduction shall be made for W.C. pans, pipes etc. in the measurement.

3. Measurement for payment of waterproofing treatment shall be as per actual area covered by waterproofing treatment as provided at site. No deduction shall be made for inlet, outlet, scour connection, by out the same shall be finished as required.

Rate:

The rate quoted shall include all the cost of materials, labor, transportation, testing of water tank for water tightness, furnishing necessary guarantee for waterproofing so provided, all as detailed above.

BOQ SPECIFIED ITEMS:

9.1 Water proofing for Terraces

Scope of work:

The work covered under this specification consists of providing and treating terraces, with modern specialized waterproofing strictly in accordance with these specifications and relevant drawings to protect and guard building against any type of water seepage or leakage.

Application:

1. Providing and applying two coats of two component non-toxic heavy duty cementitious waterproof coating having adhesion strength of 0.8-1 N/mm², elongation of more than 100% and forming film thickness not less than 1000 microns as per manufacturer's method statement with all necessary surface preparation and providing protective screed on the coating. (Dr.Fixit/roof-sealflex, Equivalent treatment of BASF or any other equivalent brand).

2. The specifications in respect of **general requirements, testing and guarantee, mode of measurement and rate** shall be as described above in general specifications.

Measurement: The area of the floor treated shall be considered for payment purpose.

10.00 TECHNICAL SPECIFICATIONS FOR FLOORING WORKS AND DADO

1. Polished Kotah Stone Flooring

Scope of work:

The work covered under this specification consists of providing and laying at levels and floors, 25mm thick Kotah stone flooring with hand cut, machine cut for exposed edges and machine polished Kotah stone of specified thickness, size and the shade which shall be got approved by the Architect/ Engineer-in-charge on the locations as mentioned in detail drawings.

Material:

The slabs shall be of selected quality, hard, sound, dense and homogeneous in texture free from cracks, decay, weathering and flaws. They shall be hand or machine cut to the requisite thickness. The slabs shall have the top (exposed) face polished before being brought to site, unless otherwise specified. The slabs shall conform to the size required. Before starting the work, the contractor shall get the samples of slabs approved by the Engineer-in-Charge.

Dressing:

Every slab shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane. The thickness of the slab after it is dressed shall be 20, 25, 30 or 40 mm as specified in the description of the item. Tolerance of ± 2 mm shall be allowed for the thickness. In respect of length and breadth of slabs Tolerance of ± 5 mm for hand cut slabs and ± 2 mm for machine cut slabs shall be allowed.

Preparation of Surface and Laying:

a. Bedding of cement mortar 1:6 (1 Cement :6 Coarse Sand) bedding of required thickness to match Finished Floor Level, shall be applied and allowed slightly to harden. The bedding shall be roughened with wire brushes or by scratching diagonal at close intervals.

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

c. The joint shall be as fine as possible. The slabs fixed in the floor adjoining the walls shall enter not less than 10mm under the plaster, skirting or dado. The junction between the wall and floor shall be finished neatly the finished surface shall be true to levels and slopes as directed.

Curing, Polishing and Finishing:

The day after the stones is laid all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed and cleaned. Joints shall then be grouted with grey or white cement mixed with or without pigment to match the shape of the topping of the wearing layer of the tiles.

The floor shall then be kept wet for a minimum period of 7 days. Polishing shall be normally commenced after 14 days of laying the stone slab. The surface shall thereafter be grounded evenly with polishing machine fitted with coarse grade grit block (No. 120). Water shall be used profusely during grinding. After grinding the surface shall be thoroughly washed to remove all grinding mud, cleaned and mopped. It shall then be covered with a thin coat of grey or white cement, mixed with or without pigment to match the color of the topping of the wearing surface in order to fill any pin hole that appear. The surface shall be again cured. The second grinding shall then be carried out with machine fitted with fine grade grit block (No. 220).

The final grinding with machine fitted with the finest grade grit blocks (No. 320) shall be carried out the day after the second grinding described in the preceding para or before handing over the floor, as ordered by the Architect/ Engineer-in-Charge.

For small areas or where circumstances so require, hand grinding/polishing with hand grinder may be permitted in lieu of machine polishing after laying. For hand polishing the following carborundum stones, shall be used:

1st grinding — coarse grade stone (No. 60)

Second grinding — medium grade (No. 80)

Final grinding — fine grade (No. 120.) In all other respects, the process shall be similar as for machine polishing.

After the final polish, oxalic acid shall be dusted over the surface at the rate of 33 gm per square meter sprinkled with water and rubbed hard with a 'namdah' block (pad of woolen rags). The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.

If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished. The finished floor shall not sound hollow when tapped with a wooden mallet.

The surface shall be cleaned and kept wet by sprinkling water for seven days. The finished surface shall be clear, free of patches and glossy and shall not sound hollow. Finished dry surfaces shall be washed with mild organic acid, if so required. The finished surface shall meet the approval of the Architect.

Measurements:

Length and breadth shall be measured correct to a cm before laying skirting, dado or wall plaster and the area calculated in square meter correct to two places of decimal. Where coves are used at the junctions, the length and breadth shall be measured between the lower edges of the coves. No deduction shall be made nor extra paid for voids not exceeding 0.20 square meter. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 square meters.

Rate:

The rate shall include the cost of all materials, labor, scaffolding, curing, polishing, chasing, cutting holes or making openings, nosing etc. involved in all the operations described above.

Note: Wastage in obtaining the required machine cut, hand cut sizes as specified from the commercial sizes available in market shall have been taken into consideration by contractor shall quoting the rate for work to be measured as above and no extra claim on this account will be entertained.

Granite Stone Flooring

Scope of work:

The work covered under this specification consists of providing and fixing 18mm thick machine cut pre-polished Granite stone over required thickness of bedding for flooring at different locations strictly in accordance with these specifications and relevant drawings. The granite stone shall be fixed in single piece for treads and risers.

Material - Granite Stone Slabs:

The slabs shall be of selected color & quality, hard, sound, dense and homogeneous in texture free from cracks, decay, weathering and flaws. They shall be 18 mm thick machine cut pre-polished one-piece Granite stone for treads of 320 mm width. They shall be of the color indicated in the drawings or as instructed by the Architect/Engineer-in-Charge.

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

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

Dressing:

Every slab shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane. The thickness of the slab after it is dressed shall be 18mm as specified in the description of the item. Tolerance of ± 2 mm shall be allowed for the thickness. In respect of length and breadth of slabs Tolerance of ± 5 mm for hand cut slabs and ± 2 mm for machine cut slabs shall be allowed. Visible/External edge of tread shall be molded as per the design given by the architect.

Preparation of surface:

The surface shall be cleaned thoroughly, washed with water and kept wet before work is commenced. Where necessary, the surface shall be made uniformly to the requisite depth so that the tread face shall have the projection from the finished face as shown in drawings or as required by the Architect/Engineer-in-Charge. In no case the tread should project by more than thickness of stone.

Laying:

The tread shall be in grey or white cement admixed with or without pigment to match the shade of the stone, as specified in the description of the item, with the line of the slab at such a distance from the wall that the average width of the gap shall be 12 mm and at no place the width shall be less than 10 mm, if necessary, the slabs shall be held in position by temporary M.S. hooks fixed into the wall at suitable intervals. The face shall be checked for plane and plumb and corrected. The joints shall thus be left to harden then the rear of the tread slab shall be packed with cement mortar 1:3 (1 cement: 3 coarse sand) or other mix as specified in the description of the item. The fixing hooks shall be removed after the mortar filling the gap has acquired sufficient strength. The joints of the slabs shall be set in grey cement mixed with pigment to match the shade of the slabs.

Curing, Polishing and Finishing:

As detailed above under item no. 9.01

Risers of steps, skirting and dado shall rest on top of treads or flooring. Where full size stones cannot be fixed, they shall be cut to the required size and the edges be smoothed. The joints shall be cleaned and flush pointed with white/colored cement.

Measurements:

Exposed finished area of flooring shall be considered for payment purpose. Risers of steps, skirting and dado shall be measured in square meters. Length and height shall be measured along the finished face of the skirting or dado including cures, where special such as covers, internal and external angles, etc., used the length and height shall be measured correct to the centimeter except in case. of risers and skirting where height shall be measured correct to 3 mm.

Rate:

The rate for flooring shall include the cost of all materials, labor, scaffolding, curing, polishing, chasing, making anti-skid grooves, molding, nosing etc. involved in all the operations described above.

Granite Stone Urinal Partitions**Scope of work:**

The work covered under this specification consists of providing and fixing Granite Stone of approved shade with table rubbed, edges rounded and polished, of size 75x50 cm deep and 1.8 cm thick, fixed in urinal partitions by cutting a chase of appropriate width with chase cutter and embedding the stone in the chase with epoxy grout or with cement concrete 1:2:4 (1 cement: 2 coarse sands: 4 graded stone aggregate 6 mm nominal size) as per direction of Engineer-in-charge and finished smooth.

All other specifications remain the same as detailed above under item no. 9.02.

Kitchen Platforms and Vanity Counters

Scope of work:

The work covered under this specification consists of providing and laying counters/platforms of different types in pantries, washrooms and kitchens which can serve as a working platform strictly in accordance with these specifications and relevant drawings.

Laying and fixing of counters:

Base framing for counters shall be done with 25mm thick natural Kotah stone fixed in sandwich pattern of 500mm wide with cement mortar 1:4 (1cement :4 coarse sand) at a maximum interval of 1200 mm and held vertically to act as vertical supports to the whole assembly as per detailed drawings. Over these vertically held stones, a Kotah stone slab of width equal to the width of counter shall be laid to work as a base layer. Working platforms in kitchen/ pantry shall then be finished with 18mm thick Granite stone of approved make and shade(laid over this assembly of Kotah stone, having polished surface facing outward). The horizontal counters shall be fixed at a height of 800 mm from FFL. Granite slabs shall not be in more than two pieces for each side straight length of working platform. Granite shall be jointed with white cement slurry pigmented to the same color as that the granite stone including grinding smooth and polishing complete. The front fascia (75 mm) of the kitchen platform shall be provided with granite stone of same shade as that of platform.

Cutouts for sink, gas pipe line, Plumbing and Drainage lines etc. shall be provided as per detailed drawings or as per instructions of Architect / Engineer in charge.

The work shall also include making opla below platform at floor level of 75 mm height brickwork, finished with 25mm thick Polished Kotah stone in cement plaster 1:4 (1 cement :4 coarse sand). The granite 600mmX1200mm shall be fixed at end of counters where counter is not resting on wall support. The edges of end support, fascia Patti etc. shall be molded as per instructions given by the architect, polished as directed and complete in all aspects as per detail drawings.

Mode of Measurement: Exposed finished top area(plan area) of counters deducing the openings for washbasins shall be considered for payment purpose.

Rates: Rate shall include all labor, materials, transport, painting/polishing, finishing and scaffolding if necessary to carry out all works specified above. Rate shall be inclusive of making opla and fascia, which shall not be paid separately.

Glazed / Vitrified Tiles**Scope of work:**

The work covered under this specification consists of providing and laying at levels and floors, double charged Vitrified tiles of different dimensions, color, shade, types (glossy / matt finished, anti-skid) and of approved make on the locations as mentioned in detail drawings.

Material:

1.The tiles shall be of approved make, size, design and shall generally conform to IS 15622. They shall be flat, and true to shape and free from blisters crazing, chips, welts, crawling or other imperfections detracting from their appearance. The tiles shall be tested as per IS 13630.

2.Classification and Characteristics of pressed ceramic tiles shall be as per IS 13712. The tiles shall be square or rectangular of nominal size. The joint thickness in flooring shall not be more than 1mm. Thickness shall be as specified in the BOQ and/or approved by the Architect / Engineer-in-charge. Architect / Engineer-in-charge will choose the work size of tiles in order to allow a nominal joint width up to 2mm for unrectified floor tiles and up to 1mm for rectified floor tiles. The joint in case of spacer lug tile shall be as per spacer. The tiles shall conform to table12 of IS 15622 with water absorption 3 to 6%. The top surface of the tiles shall be glazed. Glaze shall be either glossy or matt as specified. The underside of the tiles shall not have glaze on more than 5% of the area in order that the tile may adhere properly to the base. The edges of the tiles shall be preferably free from glaze.

3. **Colored Tiles:** Only the glaze shall be colored as specified. The sizes, color, design and specifications shall be as specified in the BOQ and drawings and shall be done as approved by the Architect / Engineer-in-charge.

4. Decorative Tiles: Samples of tiles shall be approved by the Architect / Engineer-in-charge before commencing the work.

The specifications in respect of **mortar, preparation of surface, laying of tiles / flooring, Curing, Polishing and finishing, mode of measurement** shall be as described above in general specifications.

Rate: The rate shall include the cost of all materials, labor, scaffolding, cutting and finishing edges, curing, chasing, nosing etc. involved in all the operations described above. Nothing extra shall be paid for the use of cut (sawn) tiles in the work.

Glazed Ceramic Tiles in Flooring:

Scope of work:

The work covered under this specification consists of providing and laying at levels and floors, Ceramic tiles of different dimensions, color, shade, types and of approved make on the locations as mentioned in detail drawings or to serve as a sub base for carpet flooring/ engineered wooden flooring whatever the case may be.

Material:

The tiles shall be of approved make, size, and design and shall generally conform to IS 15622. They shall be flat, and true to shape and free from blisters crazing, chips, welts, crawling or other imperfections detracting from their appearance. The tiles shall be tested as per IS 13630. Classification and Characteristics of pressed ceramic tiles shall be as per IS 13712. The tiles shall be square or rectangular of nominal size. The joint thickness in flooring shall not be more than 1mm. Thickness shall be as specified in the BOQ. The tiles shall conform to table 12 of IS 15622 with water absorption 3 to 6% (Group BII). The top surface of the tiles shall be glazed. Glaze shall be either glossy or matt as specified. The underside of the tiles shall not have glaze on more than 5% of the area in order that the tile may adhere properly to the base. The edges of the tiles shall be preferably free from glaze. The tiles are to be fixed with cement mortar 1:4 (1Cement: 4 sand).

The specifications in respect of **preparation of surface, laying of tiles / flooring, Curing, Polishing and finishing, mode of measurement** shall be as described above in vitrified flooring specifications.

Rate:

The rate shall include the cost of all materials, labor, scaffolding, curing, polishing, chasing, nosing etc. involved in all the operations described above.

Dado in Toilets, Pantry and Kitchen

Scope of work:

The work covered under this specification consists of providing and fixing at levels and floors, 1st quality glazed ceramic wall tiles of different sizes of different colors, shade, types and of approved make on the locations as mentioned in detail drawings.

Glazed tiles of first quality shall be provided in dado of kitchen and toilets of all locations as per drawing. The tiles shall be set over screed / plaster 12 mm thick rough with cement mortar 1:3 (1cement: 3 coarse sand) to all surface, set and jointed with neat white cement slurry. The joints shall be neat and fine.

Size of glazed tiles both for toilets, Baths, WC and kitchen shall be as shown on drawings.

The tiles shall be of the approved make, design & shade.

Height of glazed tiles dado above 100 mm skirting in toilets shall be as shown in drawing / schedule of finishes. In kitchen glazed tiles shall be done above kitchen platform up to 600 mm high on the entire wall perimeter covered by the platform, sink and drain board. The height of the glazed tile dado in these locations shall be as shown above platform. The glazed tile dado shall also be provided below sink and drain board on the perimeter walls covered by drainage board and sink.

Rate:

The rate shall include the cost of all materials, labor, scaffolding, curing, polishing, chasing, nosing etc. involved in all the operations described above. The rate shall not include the cost of rough plaster which will be paid separately.

Heat Resistant Terrace Tiles

Scope of work:

The work covered under this specification consists of providing and laying Heat Resistant Terrace Tiles (300 mm x 300 mm x 20 mm) with SRI (solar refractive index) > 78, solar reflection > 0.70 and initial emittance > 0.75 on waterproof and sloped surface of terrace of different color, shade, types (glossy / matt finished, anti-skid) and of approved make as mentioned in detail drawings.

Material:

1.The tiles shall be of approved make, size, design and shall be flat, and true to shape and free from blisters crazing, chips, welts, crawling or other imperfections detracting from their appearance. The tiles shall be tested as per IS 13630.

2.The tiles shall be square or rectangular of nominal size. The joint thickness in flooring shall not be more than 1mm. Thickness shall be as specified in the BOQ and/or approved by the Architect / Engineer-in-charge. Architect / Engineer-in-charge will choose the work size of tiles in order to allow a nominal joint width up to 2mm for unrectified floor tiles and up to 1mm for rectified floor tiles. The joint in case of spacer lug tile shall be as per spacer. The tiles shall conform to table 12 of IS 15622 with water absorption 3 to 6%. The top surface of the tiles shall be glazed. Glaze shall be either glossy or matt as specified. The underside of the tiles shall not have glaze on more than 5% of the area in order that the tile may adhere properly to the base. The edges of the tiles shall be preferably free from glaze. The tiles shall be laid on 20 mm thick cement sand mortar in the ratio of 1:4 (1 cement: 4 coarse sand) and grouting the joints with mix of white cement & marble powder in ratio of 1:1, including rubbing and polishing of the surface up to 3 cuts complete, including providing skirting upto 150 mm height along the parapet walls in the same manner complete in all aspects as specified and directed by the Engineer/Architect

Measurements:

Exposed finished area of flooring shall be considered for payment purpose. Area of skirting will also be considered for payment.

Rate:

The rate shall include the cost of all materials, labor, scaffolding, cutting and finishing edges, curing, chasing, nosing etc. involved in all the operations described above. Nothing extra shall be paid for the use of cut (sawn) tiles in the work.

Tremix flooring

Scope of work:

The work covered under this specification consists of providing and laying at levels and floors, Vacuum Dewatering flooring (tremix flooring) with concrete of design mix M25 in parking areas as per these specifications or as per instructions of Architect/ Engineer in charge.

Material:

The material used for Vacuum Dewatering is the conventional one used for RCC flooring. The mix used is M25 design mix with nominal reinforcement. Floor hardener with capacity @3kg/Sqm shall be used. Nominal steel reinforcement of 8mm dia. @200 c/c both ways shall be laid and fixed by binding wires at bottom surface. Expansion joints shall be fixed with plain mild steel of 16mm bars and PVC pipes wherever applicable.

General:

The vacuum dewatering process consists of leveling, compacting and vacuum dewatering the concrete flooring by using vibrating screed, vacuum pumps, suction mats, filter pads, accessories etc. The sequence of operation shall be placing of concrete, vibration, vacuum treatment and floating and the operation shall follow immediately behind each other.

The contractor shall have persons well experienced in the vacuum dewatering process, and in the operation of all related equipment. All process equipment to be used shall be in good working condition and shall be subject to the approval of the Engineer.

The work should be planned well in advance with a view to determine areas to be concreted daily, the required number of equipment, size of vacuum mats, length of vacuum hoses, arrangement of rails, screeds etc.

The area to be concreted shall be thoroughly cleaned, reinforced checked and got approved by the Engineer. Then the specified grade of concrete shall be placed in position without any segregation and properly vibrated. Flooring shall be laid in panels, the size of which is mentioned on the drawings or as instructed by the Architect.

Preparation of surface: The surface to receive flooring shall be clean, free from dirt and free from foreign material. Any undulations or mortar remaining on the floor shall be trimmed. Base course shall be trimmed. The base shall be cleaned and watered before laying the floor.

Work includes at all depths and heights. The finished surface shall be kept wet for a maximum period of one week.

Execution:

1. Concrete shall be laid between the steel forms and a precast concrete rail acting, as a stop end and also 'rail to be used for surface vibration.

2. The concrete thus laid shall be vibrated with poker vibrator. During poker vibration, proper compaction of coarse aggregates, fine aggregates and cement shall be obtained. The surface will be then finished in level with the help of surface vibrator to give a dense level surface of concrete.

3. Vacuum dewatering method will be used to remove excess water from the laid concrete and filler pad and suction mat shall be laid on the freshly laid concrete which will not allow cement paste to flow out, and the suction pump are then started immediately to remove the excess water. The suction time normally is 20 to 30 minutes.

This vacuum process will enable to remove 15 to 25 % of water content and making the surface hard enough to enable to carry the floating operations.

4. The top surface after removal of mat shall be floated with a mechanical skim floater with troweling blade to enable the top surface to grind and give a uniform water resistance surface on top. Under no circumstances neat Cement be sprinkled directly on concrete surface to absorb bleed water as surface scaling may occur later.

Similarly, water should not be applied between troweling operation as it may cause surface weakness. Minimum two passes shall be carried out. The surface shall then be watered and cured for minimum 7 days.

Hardener screed:

Hard top to be prepared as per the specifications with Nitohardener and one part of dry cement. The hard top shall be provided over concrete base immediately after it is set, compacted and leveled with a steel trowel. The surface shall be troweled to bring the hardener coat to a leveled surface. Excessive troweling shall be avoided. After the initial set, further compaction shall be done by steel troweling. Final brushing shall be made before the floor top becomes too hard.

Dummy Joints:

The dummy joints shall be 5 mm wide and shall extend vertically from the surface of the slab to a depth equal to 1/3 to 1/4 of the thickness of the slab. The joint may be formed by depressing into the soft but compacted concrete a high tensile mild steel. 'Tee' or flat bar of depth not less than the required depth of the joint plus 25 mm. Alternatively the slot may be formed by sawing the concrete with a joint cutting machine (diamond cutter) of approved design within 6 hours of placing under moderate climatic conditions and when the concrete has sufficiently hardened. Care shall be taken that the edges of the joints are not damaged.

Construction Joints:

The construction joints shall be 10mm wide and straight and vertical though the full thickness of the slab. The vertical edge of the concrete on the side of the joint shall be treated with a coat of lime wash or bituminous paint before the adjacent bay is concreted. A groove 2.5 cm deep and 1 cm wide shall be formed at the top surface of the joint to

receive the sealing compound. The groove shall be formed in the same manner as that for a dummy joint. The edges of the groove shall be bull-nosed and not stand proud of the concrete surface.

Mode of Measurements:

Length and breadth shall be measured correct to a cm before laying skirting, dado or wall plaster and the area calculated in square meter correct to two places of decimal. Where coves are used at the junctions, the length and breadth shall be measured between the lower edges of the coves. No deduction shall be made nor extra paid for voids not exceeding 0.20 square meter. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 square meter.

Rate:

The rate shall include the cost of all materials, concrete, steel, labor, channel fixing, floating, dewatering, curing, nosing etc. involved in all the operations described above.

11. TECHNICAL SPECIFICATIONS FOR PAINTING WORKS

Scope of work:

These specifications cover the minimum requirements of all material, paint, equipment, consumables, utilities, application including all labor, supervision, inspection and tests of performance of all operations and incidentals necessary for painting of walls, finished plaster surfaces, columns, ceilings, lift shafts, service shafts, pipelines, steel structures, buildings etc. as per detailed specifications given below.

Materials:

All materials shall be the best of their kind and of approved manufacture for each item. Painting materials such as shellac, thinner, oils, driers, rollers, brushes, etc. shall be of the best approved quality and type. If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by Engineer shall be used.

Sealed Containers:

Approved paints, oils or varnishes shall be brought to the site of work by the Contractor in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The empty containers shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Engineer –in charge.

Storage

All materials shall be stored in a neat and orderly fashion in one single clean space. Care shall be taken to maintain this place as clean and dust-free as possible.

Precaution against fire

Paints and thinners leave vapors which are inflammable. Hence, adequate precautions shall be taken in the form of screens, covers etc. against fire while storing, painting, mixing of painting work is in progress.

Specialized Workmen:

All work shall be done by the specialized skilled workmen experienced in the trade. The contractor shall engage only skilled workmen for painting work. The application of paint on Tanks surface shall be made strictly by airless spray gun. The application of paint can be made by brush in case of inaccessible area or paint application area is small. The brushes used shall be of best quality suitable for painting.

Work as per Manufacturer's Instructions:

All work shall be done strictly as per this specification and manufacturer's printed instructions.

Scaffolding:

1. Scaffolding has to be in steel, arranged by the contractor at his own cost for carrying out entire painting jobs at all height and provide all facilities for proper inspection of surface at various stages. Material has to be erected as per safe methods. Ropes and guy wires shall be used for tying etc. Stage scaffolding to be used and shall not endanger the

painter. Scaffolding shall be sufficiently away from the tank shell/ surface to be painted so as to enable the painter to work with ease. The scaffolding shall be removed by the contractor promptly after completion of the work.

2. Ladders are not allowed to be used for the painting works.

Protective measures:

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

Finished Surface to the Architect / Engineer's Satisfaction:

All finished surface shall be required texture (smooth, rough or any other) and of even shade to the satisfaction of Architect /PMC.

Protection:

All work done shall be thoroughly protected from damage at all times by suitable methods. All other adjacent work or materials not received the finish at that time shall also be thoroughly protected by suitable canvas or paper covering or by other approved method.

Damages to be made good:

Any damage or disfigurement of other works shall be immediately made good. All paint and varnish spots and other stains shall be thoroughly and carefully removed from all floors, doors, windows, fittings, furniture, glass, hardware and all other surfaces required, by approved paint removers and the places left clean and tidy to the satisfaction of Architect /PMC

Preparation of surface:

Before painting, the surface shall be cleaned thoroughly leaving it free of all scales, rust, grease, oil coating, moisture and other matter. Any protrusions of weld metal etc. shall be ground by grinding machine to get smooth surface. Heavy deposits of grease and oily material if any shall be removed by a suitable solvent wash before painting. All loose places and scales shall be removed by scrapping. Surfaces shall be thoroughly, sand-papered to a smooth finish. Further preparation work shall be done as specified under different types of finishes. Before starting painting, all floors shall be washed clean and wiped dry.

Commencing Work:

Intimation before Starting: No work under this section shall start without approval from Architect /PMC. Painting shall not be started until Engineer has inspected the items of work to be painted, satisfied himself about their quality and given his approval to commence the painting work. Painting of external surface should not be done in adverse weather condition. Painting except the priming coat, shall generally be taken in hand after practically finishing all other builder's work.

The rooms should be thoroughly swept out and the entire building cleaned up, at least one day in advance of the paint work being started.

Samples: Before starting work under this section large size samples of all work shall be prepared by the Contractor for approval. Only after specific approval has been given to the samples, work shall commence. The actual work done shall be done as per the approved samples.

Application:

The number of coats including the undercoat shall be as stipulated in the item.

Undercoat:

One coat of the specified paint of shade suited to the shade of the top coat shall, be applied and allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface, free from brush marks and all loose particles dusted off.

Top Coat:

Top coats of specified paint of the desired shade shall be applied after the undercoat is thoroughly dry. Additional finishing coats shall be applied if found necessary to ensure properly uniform glossy surface.

Measurements:

Length and breadth shall be measured correct to a cm. and area shall be calculated in Sq.mt. correct to two places of decimals.

The measurement shall be taken between the walls or partitions (the dimensions before the painting shall be taken) for the length and from the top of the floor or skirting to the false ceiling for the height.

Exterior painting at a height greater than 10 m from average ground level shall be measured separately in each storey height.

Deductions in measurements, for opening etc. will be regulated as follows:

(a) No deduction will be made for openings or ends of joists, beams, posts, girders, steps etc. up to 0.5 sqm in area and no additions shall be made either, for the jambs, soffits and sills of such openings. The above procedure will apply to both faces of wall.

(b) Deduction for opening exceeding 0.5 sqm but not exceeding 3 sqm each shall be made for reveals, jambs, soffits sills, sills, etc. of these openings.

(i) When both faces of walls are painted with same paint, deductions shall be made for one face only.

(ii) When two faces of walls are painted with different types of paint or if one face is painted and other is pointed or one face is painted and other is not painted, deduction shall be made from the paint or pointing on the side of the frame for the doors, windows etc. on which width of reveals is less than that on the other side but no deduction shall be made on the other side. Where width of reveals on both faces of wall are equal, deduction of 50% of area of opening on each face shall be made from area of paint and/or pointing as the case may be.

(iii) For opening having door frame equal to or projecting beyond thickness of wall, full deduction for opening shall be made from each painted face of wall.

(c) For opening exceeding 3 sqm in area, deduction will be made in the measurements for the full opening of the wall treatment on both faces, while at the same time, jambs, sills and soffits will be measured for payment.

2. In measuring jambs, sills and soffits, deduction shall not be made for the area in contact with the frame of doors, windows etc.

3. Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentages to allow for the girthed area. Corrugated non-asbestos cement sheet 20% Semi corrugated non-asbestos cement sheet 10%

4. Cornices and other such wall or ceiling features, shall be measured along the girth and included in the measurements.

5. The number of coats of each treatment shall be stated. The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 50 sq. cm. each with material similar in composition to the surface to be prepared.

Rate:

The rate shall include the cost of all materials, labor, scaffolding, curing, polishing, finishing etc. involved in all the operations described above.

11.1 Acrylic Emulsion – Interior grade

Scope of work:

This includes providing and applying 02 or more coats of water based 100% Acrylic emulsion paint of approved make and shade, Interior grade to all walls, columns, ceilings, finished plaster surfaces on locations as per drawings or as per directions of Architect / Engineer in charge. Contractor shall follow general specifications as specified above.

Material:

The paint shall be Acrylic Emulsion smooth paint/premium acrylic smooth (interior grade) of approved make and color. This paint shall be brought to the site of work by the contractor in its original containers in sealed condition.

Preparation of Surface: Before painting, the surface shall be cleaned thoroughly leaving it free of all scales, rust, grease, oil coating, moisture and other matter. Any protrusions of weld metal etc. shall be ground by grinding machine to get smooth surface. Heavy deposits of grease and oily material if any shall be removed by a suitable solvent wash

before painting. All loose places and scales shall be removed by scrapping. Surfaces shall be thoroughly, sand-papered to a smooth finish. Further preparation work shall be done as specified under different types of finishes. Before starting painting, all floors shall be washed clean and wiped dry.

Application:

Base Coat: The surface shall be thoroughly cleaned of dust, old white or color wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty, as approved, on the entire surface including filling up the undulations and then sand papering the same after it is dry.

Primer: The primer to be used for the painting with acrylic emulsion on cement concrete surfaces, plastered surfaces, A.C. sheets, timber and metal surfaces, if necessary, shall be of approved base and as per recommendations of the manufacturers.

Putty: Plaster filler to be used for filling up (putting) uneven surfaces, small cracks and holes etc. shall be of approved compound and as per recommendations of the manufacturers. No oil-based putty shall be used. The putty should be made from a mixture of whiting and plastic emulsion paint or as per manufacturers recommendations.

Finishing Coats: All the finishing coats shall be of matt finish or any other finish as required by the Architects. The number of finishing coats shall be as specified in the item

Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its container, when applying also the paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform. Dilution ratio of paint with potable water can be altered taking into consideration the nature of surface climate and as per recommended dilution given by manufacturer. In all cases, the manufacturer's instructions & directions of the Engineer-in-charge shall be followed meticulously. The lids of paint drums shall be kept tightly closed when not in use as by exposure to atmosphere the paint may thicken and also be kept safe from dust.

Paint shall be applied with a roller / brush on the cleaned 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.

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

11.2 Apex exterior paint.

The general specifications shall be same as mentioned in the item 10.02, and above, except that the paint used will be exterior emulsion paint of required shade (Protek of Asian make).

12. Technical Specifications for Steel Works

12.1/12.2 /12.4 Fabrication work in Steel for MS grills, Collapsible gates and MS stair ladder

Scope of Work:

The work covered by this specification consists of supplying, fabricating, assembling, and fixing in position of structural steel in grating, frames, guard bar, ladders, brackets, gates etc. complete in strict accordance with these specifications and the applicable drawings.

Materials: All structural steel shall be of standard sections as marked on the drawing's and shall be free of scale, blisters, laminations, cracked edges and defects of any sort. All structural steel and electrodes shall comply in all respects with relevant I.S. codes.

Workmanship:

All workmanship shall be of first-class quality in every respect to get greatest accuracy to ensure that all parts will fit together properly on erection. All ends shall be cut true to planes. They must fit the abutting surfaces closely. All

stiffeners shall fit tightly at both ends. All holes in plates and section between 12mm and 20 mm thick shall be punched to such diameter that 3mm of metal is left all around the hole to be cleaned out to correct size by reamer. The base connection shall be provided as shown on drawings and the greatest accuracy of workmanship shall be ensured to provide the best connections. Figured dimensions on the drawings shall be taken.

Shop Drawing:

The shop drawings of structural steel based on contract drawings shall be submitted to the Engineer-in-charge. The necessary information for fabrication, erection, painting of structure etc. must be furnished immediately after acceptance of the Architect / Engineer in charge.

Painting:

Providing and applying Epoxy paint of approved make and desired shade, including the surface preparation (with emery paper 180 and wipe clean) by thoroughly cleaning all dust, dirt, applying red oxide oil primer and applying primer, again sand papering leveling rubbing the surface, to be free from undulation/ waviness, applying 1st coat of Epoxy paint & 2nd coat of Epoxy paint. Painting should be carried out on dry surfaces free from dust, scale etc. The paint shall be approved by the Engineer-in-charge.

Welding:

Welding shall be in accordance with IS 816-1969, IS 819-1957, IS 1024-1979, IS1261-1959, IS 1323-1982 and IS 9595-1980 as appropriate. For welding of any particular type of joint, welders shall give evidence of having satisfactory completed appropriate test as described in any of IS 817-1966, IS 1393-1961, IS 7307 (part-I) –1974, IS 7310 (part-I) 1974 and IS 7318 (part-I) 1974 as relevant.

Type of Welding:

Arc welding (direct or alternating current) or Oxyacetylene welding may use. Field welding may be used. Field welding shall be by D.C.

Note: On any straight weld the first run shall not ordinarily be deposited with a larger gauge electrode than No.8 S.W.G. For subsequent runs the electrode shall not be increased by more than two electrode size between consecutive runs.

Mode of Measurement:All structural steel shall be measured on weight basis in KG as mentioned in the schedule of quantities. The length or areas of various members including gusset plates shall be measured correct to two places of decimals as the net weight worked out from the standard steel tables approved by Indian Standard Institution. No separate measurements shall be taken for welding, riveting, bolting, field connections etc. The rate shall include cost at of all labor, materials, scaffolding, transport and also cost of welding, riveting and bolting, field connections if any all to complete the job as per specifications.

12.3 Rolling shutters

Material:

Rolling shutters shall be in extruded galvanized sections, of approved make, type and finish. These shutters shall be complete with locking arrangements, hoods, guides, pulling devices, springs and other accessories. Wherever specified, mechanical device shall be fixed for easy operation of the shutters. Metal rolling shutters should conform to IS:6248. Rolling shutter shall be gear operated. Gear operated shutters are provided with reduction gear operated by mechanical device with chain, crank, shaft and handle.

GI Sections:

GI sheets and plates used for manufacturing the guide channels, brackets and lock plate should be of hot rolled steel of thickness not less than 18 gauge conforming to IS: 5986. These shall be free from surface defects and the edges shall be cleanly sheared. All components of rolling shutter to be hot dip galvanized with a zinc coating containing not less than 97.5% pure zinc. The minimum weight of zinc coating to be 230g/Sq.mt. The coating shall be free from flaking/peeling.

Steel Pipe:

GI pipes used for the suspension shaft of the roller should be heavy duty pipe suitable for mechanical purposes and shall conform to IS:1161.

Springs:

The springs shall be, preferably of coiled type. The spring steel wire used or helical spring should conform to Grade 2 of IS:4454. Flat spring steel strip used for spiral spring shall be from 0.8 to 1.0 percent carbon steel strip especially hardened and tempered. The spring shall be manufactured from high tensile spring steel wire or strip of adequate strength to balance the shutters in all positions; the spring pipe shaft etc. shall be supported on strong mild steel brackets.

Both the side guides and bottom rails are joint less and of single piece of pressed steel of minimum 16-gauge thickness.

Guide Channels:

The guide channels shall be of mild steel deep channel section and or rolled pressed or built-up, jointless construction. The thickness of the sheet used shall not be less than 3.15 mm. The minimum depth of guide channels shall be 60 mm for clear width of shutters up to 3.5m and 75 mm for 3.5 m and above. The gap between the two legs of the guide channel shall be sufficient to allow the free movement of the curtain and at the same time closes enough to prevent the rattling of the curtain due to wind.

Each guide channel shall be provided with a minimum of three fixing cleats to the walls or columns by means of bolts or screws.

Hood Covers:

Hood covers shall be made of M.S.Sheets not less than 1.25 mm thickness.

Fixing:

Brackets shall be fixed on the lintel/ beam or under the lintel/ beam as shown with raw plugs, screws, bolts, etc. The shaft along with the spring shall then be fixed to the brackets.

The shutters shall be laid on the ground and the side guide channels shall be bound with it with ropes etc. The shutter shall then be placed in position and top fixed with pipe shaft with bolts and nuts. The side guide channels and the cover frame/shall be then fixed to the walls through the plate welded to the guides. Fixing shall be done accurately in workmen like manner so that the operation of the shutter is easy and smooth. The plates and screws, bolts shall be concealed in plaster to make their locations invisible.

The rolling shutters shall be of self-rolling type up to 8 sq.m clear area without ball bearing and up to 12 sq.m clear area with ball bearing. If the rolling shutters are larger, then gear operated type shutters shall be used. The locking arrangement shall be provided at the bottom of shutter at both ends. The shutters shall be opened from outside.

The shutters shall be completed with door suspension shafts, locking arrangements, pulling hooks, handles and other accessories.

Grilled Curtain:

Wherever specified rolling shutter shall be provided with grill curtain.

Finishing:

The rolling shutter together with guide channel, cover and accessories shall be supplied with one coats of approved primer and shall be painted finally with two coats of approved epoxy paint at site after installation, as specified.

Mode of Measurement:

The rolling shutter is measured in terms of area in square meter, the payable area shall be obtained from the net opening for which the rolling shutter has been provided.

Rates:

The rate shall include the cost of all materials, hardware, labor, scaffolding, fixing, painting, etc. involved in all the operations described above.

12.5 Stainless steel (Grade 316) knock down railing system with 50mm Ø Handrail, 50mm Ø balusters and 16mm Ø mid rails.

This shall include providing and fixing Stainless steel (Grade 316) knock down railing system with 50mm Ø Handrail, 50mm Ø balusters and 16mm Ø mid rails (03 nos.) with suitable fixtures all along staircase well and balcony. Contractor shall follow general specifications as specified above. The works of railing systems should be got executed through specialized agencies only.

Material:

Knock down railing system shall consist of following components:

- i). SS 316 Handrail - 50mm dia.
- ii). SS 316 Balusters - 50 mm dia. fixed @1200mm c/c.
- iii). SS 316 Mid-rails- 16mm dia. (03 nos.)
- iv). Stainless steel anchor fasteners for fixing railing.
- v). Fixing elements, brackets, SS caps etc.

Application:

Railing system is to be fixed with knock down railing system. Handrail will be 50mm dia., baluster will be round 50mm dia. fixed at a maximum spacing of 1200mm c/c, mid-rails of 16mm dia. (3nos) fixed with suitable fixtures on locations as per approved drawings and as per instructions of Architect/ Engineer in charge. The balustrade would be fixed onto floor with casted base plate of minimum 6mm thickness anchored down on slab with SS fasteners. Base plate shall be concealed with suitable S.S. cover cap so that the mounting anchor fasteners are not visible after installation. Wall thickness of all pipes shall be taken as 1.5mm along with all visible components developed in High Grade S.S. and whenever required, joints to be filled with bushings for extra strength. Railing height to be taken as 1000mm from finished floor level.

Payment: Hand railing shall be measured for payment in running meter. The lengths shall be measured along the top center line of the hand rail and shall be measured between ends of balusters, newels, posts as the case may be up to two places of decimals of a meter.

Rates: Rates should be inclusive of welding, grinding, buffing, polishing and making curvature (wherever required) fixing the railing with necessary accessories & stainless-steel dash fasteners, stainless steel bolts etc., of required size, on the top of the floor or the side of waist slab with suitable arrangement.

12.6 Stainless steel (Grade 304) wall mounted handrail system with 50mm Ø Handrail and wall brackets.

Scope of Work

This shall include providing and fixing Stainless steel (Grade 304) wall mounted handrail system with 75mm diameter / 50mm diameter pipe Handrail mounted on the wall through wall brackets & anchor fasteners. The works should be got executed through specialized agencies only.

Material

Wall mounted handrail system shall consist of following components:

- i). SS 304 Handrail –75mm/ 50mm dia.
- ii). SS 304 wall brackets fixed @1200mm c/c.
- iii). SS anchor fasteners for mounting brackets on walls.

Application:

Handrail is to be fixed with wall mounted railing system. Handrail will be 75mm/ 50mm diameter, Stainless steel pipe handrail (SS 304) mounted on the wall through wall brackets & anchor fasteners which will be placed at maximum spacing of 1200mm c/c or as per site requirement on side walls of staircases or on locations as per approved drawings. Wall thickness of all Pipes shall be taken as 1.5mm along with all visible components developed in High

Grade S.S. and whenever required, joints to be filled with bushings for extra strength. Wall Handrail height to be taken as 900mm from finished floor level.

Payment:

Hand railing shall be measured for payment in running meter. The lengths shall be measured along the top center line of the hand rail and shall be measured between two outer wall brackets as the case may be up to two places of decimals of a meter.

Rates:

Rates should be inclusive of welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless-steel nuts and bolts complete, including fixing the railing with necessary accessories & stainless-steel dash fasteners, stainless steel bolts etc., of required size, on the side of waist slab/wall with suitable arrangements.

13 TECHNICAL SPECIFICATIONS FOR DOORS AND WINDOWS

Scope of work:

The work covered under this specification consists of providing and fixing in position the different types of doors as specified in the item / as per design and detailed drawings. The doors are to be framed & finished as required, along with the accessories and hardware fittings to be installed in the same.

Frames:

The frames shall be wrought, framed and fixed in position as per detailed drawings and as directed by Engineer. It shall be sawn in the direction of the grains. Sawing shall be truly straight and square. The scantling shall be planed smooth and accurate to the full dimensions with rebates, rounding, and moldings as shown in the drawings made, before assembling. Patch work or plugging of any kind shall not be permitted except as provided. Tolerance of +2/3 mm shall be allowed in the finished cross dimensions of door and window frames. The maximum permissible limits for moisture content shall conform to IS 287-1973. Wood shall be drawn which are representative of the lot in dimension, quality and moisture content.

Joints: These shall be of mortise and tenon type, simple, neat and strong. Mortise and tenon joints shall fit in fully and accurately without wedging or filling. The joints shall be glued with approved adhesive, framed, put together and pinned with hardwood or bamboo pins not less than 10 mm dia., after the frames are put together pressed in position by means of a press.

Surface Treatment:

Wood work shall not be painted, oiled or otherwise treated before it has been approved by Engineer. All portions of timber abutting against masonry or concrete or bedded in ground shall be painted with approved bit mastic paint or with boiling coal tar.

Fixing in position:

Before the frames are fixed in position these shall be inspected and passed by Engineer. The frame shall be placed in proper position, and secured to walls or columns as the case may be with metallic fastener; iron hold fasts as shown in drawing or as directed by Engineer. These sills shall be embedded sunk in the floor to its full depth. The doorframes without sills, while being placed in position, shall be suitably strutted and wedged in order to prevent warping during construction. The frames shall also be protected from damage, during construction.

Opening for Glazing: When required, opening for glazing shall be provided and unless otherwise specified the opening for glazing shall be 250 mm in height and 150 mm or 200 mm in width unless directed otherwise. The bottom of the opening shall be at a height of 1.4 m from the bottom of the shutter. Opening for glazing shall be lipped internally with wooden batten of width not less than 25 mm. Opening for glazing shall be provided where specified or shown in the drawing.

Venetian Opening:

Where specified the height of the venetian opening shall be 350 mm from the bottom of the shutter. The width of the opening shall be as directed but shall provide for a clear space of 75 mm between the edge of the door and venetian opening but in no case the opening shall extend beyond the stiles of the shutter. The top edge of the opening shall be lipped internally with wooden battens of width not less than 25 mm. Venetian opening shall be provided where specified or shown in the drawing.

Tolerance:

Tolerance on width and height shall be + 3 mm and tolerance on nominal thickness shall be ± 1.2 mm. The thickness of the door shutter shall be uniform throughout with a permissible variation of not more than 0.8 mm when measured at any two points.

Adhesive:

Adhesive used for bonding various components of flush door shutters namely, core, core frame, lipping, cross-bands, face veneers, plywood etc. and for bonding plywood shall conform to BWP type, phenol formaldehyde synthetic resin adhesive.

Manufacturer Testing Certificate (MTC)

All the materials received at site shall have MTC for evaluation of testing and acceptance criteria. Material without MTC shall not be allowed for fixing.

Fittings:

Details of fittings to be provided shall be as per the schedule of fittings shown in the drawings. All fittings shall be heavy duty of approved make.

The fixing material of all the hardware e.g., screw, nuts & bolts shall be used as per manufacturer's specifications.

Fixing with Screws and Plugs:

In RCC work where lugs cannot be embedded due to reinforcement bars etc. rawl plugs or other approved of metallic fasteners such as Dash Fasteners of the required size and type as approved shall be used to fix the frame and doors.

Measurements:

Length and width of the shutters shall be measured to the nearest cm in closed position covering the rebates of the frames but excluding the gap between the shutter and the frame. Overlap of two shutters shall not be measured. All work shall be measured net as fixed and area calculated in square meters to nearest two places of decimal. No deduction shall be made for providing venetian opening and opening for glazing.

Rates: The rate shall include the cost of all materials, hardware, labor, scaffolding, fixing, polishing, chasing, nosing etc. involved in all the operations described above.

13.1 ALUMINIUM CASEMENT/SLIDING TYPE WINDOWS:**Scope of work:**

Providing and fixing factory made colored anodized aluminum two track sliding windows with 4mm/5mm thick clear glass. The outer frame should be heavy suitable size sections with tracks on all the sides & drain tray system for the bottom frame. The shutters should be of suitable for series - B (Shutter section - 18 mm) heavy (approx. 1.5 mm thick) sections for top & bottom member & for vertical with 5 mm. thk. Tinted reflective float glass & imported beading shall be used. Windows will have all req. Hardware such as Maruti locks cum handles, sliding system wool gasket etc. Silicon sealant shall be applied on external & internal sides of the windows. The entire window shall be finished in color anodized (20 microns) of the suggested shade. The windows will have necessary provision in case of window ac units with required additional member with wood in-filled. All work shall be completed as per instructions of Architect/ Engineer in charge.

Mode of Measurement: It is measured in terms of area in square meter, the payable area shall be obtained from the net opening for which the casement/sliding door / window has been provided.

Rates: The rate shall include the cost of all materials, hardware, labour, scaffolding, fixing etc. involved in all the operations described above.

13.2 Aluminum Ventilators

Scope of work: The work covered under this specification consists of providing and fixing in position powder coated aluminum (Jindal make) ventilator of size as suggested for toilets. The outer frame should be made out of 2 1/2 " x 1 1/2" aluminum sections of minimum 1.8 mm thick sections. One portion of ventilation should have 4 mm thick figure glass in fixed type louvers in aluminum framework by using hard PVC on fixed by means of screws. The other division will have provision for exhaust fan.

13.3 Flush Door – Single Leaf

Scope of work: The work covered under this specification consists of providing and fixing in position 30mm thick solid core phenol bonded single leaf flush door (over granite door jambs/ frames) finished with 1mm thick laminate on both sides along with all accessories and hardware fittings to be installed in the same on the locations as specified in detailed drawings.

Material:

- 30mm thick solid core phenol bonded flush door.
- Finishing to be done with 1mm thick laminate on both sides as per design and combination of approved make and shade.
- CPTW Lipping 33x6mm.
- Vision panel – Will be of required size, as per the drawings by 6mm clear glass.
- SS Matt finish butt door Hinges-4 Nos, 100mmX25mmX4mm.
- Door closer -Hafele DCL 15 Startech with standard arm Product Code-931.84.629 or Equivalent.
- Handle- SS matt Finish 19mm dia.200mm long handle.

The specifications in respect of **Joints, Surface treatment, adhesives, Polishing and finishing, mode of measurement and rates** shall be as described above in general specifications.

13.4 Mild Steel door- Cash room Door.

Scope of work:

The work covered under this specification consists of providing and fixing in position MS door with door frame made of MS angle as per these specifications.

Material:

- MS sheet door shutters: The door shall have overall width 1200mm and height 2235mm or as per architect's drawings. Door shutter is made of 40x40x6 mm MS angle on perimeter with 20-gauge MS sheet fixed all over on outer side and 16mm round MS bar @ 75 mm c/c vertically across length and 4 nos. 32 mmx6mm, MS flat horizontally on inside of shutter. Item to include applying premium red oxide and semi-gloss enamel, paint to all surfaces.
- MS door frame: The door frame made of 40x40x6 MS angle should be fixed to wall / RCC with 4 nos. of holdfasts on each side.
- Accessories: 3 nos. aldrops. Approved make Jalaramkadaka lock, Gordian lock with bars, 2 nos. of handle, 230mmX230mm MS plate complete as per the drawing.

The specifications in respect of **Joints, Surface treatment, adhesives, Polishing and finishing, mode of measurement and rates** shall be as described above in general specifications.

13.5 Fire rated door

Scope of work:

The work covered under this specification consists of providing and fixing 60 mm thick (Single leaf) 2-hour fire rated door with Epoxy paint, fully flush single skin door shell with lock seam joints at stile edges and internal reinforcement provided at top, bottom and stile edges for fire rating. The internal construction of door shutter shall be specially designed Honey comb structure with reinforcement as specified above. Door frame manufactured from galvanized steel sheet of 1.20 mm thickness formed to single rebate profile of size 100 x 57 mm (+/- 0.3mm) and shall be fixed in Brick / Block masonry using corrugated "Tee" Anchors but not welded to the frame (first fix). Door frames shall be knock down form with butt joints for bolted assembly at site with brass oxidized fittings, bead and locking arrangements, auto flush bolts, automatic Door closure of approved make and all accessories such door handle SS hair line brush finish, including with 6mm thick 1 hour fire rated Vision panels (1 Nos.) of 200 x 300mm size. The door frames and door shutter shall have primed with zinc-phosphate stoving primer and finished with Epoxy paint of approved make and shade complete as per specifications and detailed drawings. Hardwood frame to take care of Hot smoke size in the groove of the frame with fixing arrangements as specified in the drawings / approved by the Architect / Engineer-in-charge / as per National Building Code 2016.

A fire door should pass three tests i.e., Stability, Integrity and Insulation. 120 mins integrity and insulation tested Fire Door is the minimum requirement to be fulfilled by the door.

Insulation plays the most important role when there is a calamity at site. Insulation provides safety to the occupants by restricting the surface temperature on the non-fire side of the door to 140 degrees.

Measurements:

Length and width of the shutters shall be measured to the nearest cm in closed position covering the rebates of the frames but excluding the gap between the shutter and the frame. Overlap of two shutters shall not be measured. All work shall be measured net as fixed and area calculated in square meters to nearest two places of decimal. No deduction shall be made for providing venetian opening and opening for glazing.

Rates:

The rate shall include the cost of all materials, labor, scaffolding, fixing, polishing, chasing, nosing etc involved in all the operations described above.

13.6 Fully glazed door**Scope of work:**

The work covered under this specification consists of providing and fixing 12 mm thick clear toughened glass of approved make fixed with patch fittings as described in Bill of Quantities.

Material:

Glass paneling (Glazing) shall be done as specified in the drawings. Glazing in the shutters of doors, windows and ventilators of bath, WC and Lavatories shall be provided with frosted glass the weight of which shall be not less than 10 kg/sqm. Frosted glass panes shall be fixed with frosted face on the inside. Glass panels shall be fixed by providing a thin layer of putty conforming to IS 419 applied between glass pane and all along the length of the rebate.

Fixing:

For side hung shutters of height up to 1.2 m, each leaf shall be hung on two hinges at quarter points and for shutter of height more than 1.2 m, each leaf shall be hung on three hinges one at the center and the other two at 200 mm from the top and bottom of the shutters. Top hung and bottom hung shutters shall be hung on two hinges fixed at quarter points of top rail or bottom rail. Centre hung shutter shall be suspended on a suitable pivot in the center of the frame. Size and type of hinges and pivots shall be as specified. Flap of hinges shall be neatly counter sunk into the recesses cut to the exact dimensions of flap. Screws for fixing the hinges shall be screwed in with screw driver and not hammered in. Unless otherwise specified, shutters of height more than 1.2 mm shall be hung on butt hinges of size 100 mm and for all other shutters of lesser height butt hinges of size 75 mm shall be used. For shutter of more than 40 mm thickness butt hinges of size 125 x 90 x 4 mm shall be used. Continuous (piano) hinges shall be used for fixing cup-board shutters where specified.

Fittings:

Fittings shall be provided as per schedule of fittings decided by Architect/ Engineer-in-Charge. Drawings will give for guidance the schedule of fittings and screws usually provided. Cost of providing and fixing shutter shall include cost of hinges and necessary screws for fixing the same. All the fittings shall be included in the rate. The fittings includes patch fitting locking systems, 1 pair of 12" long S. S. (C Shape) Handles of approved make, floor springs, and any necessary hardware items. (DORMA MAKE Top Pivot - PT 24, Top Patch Fittings - PT 20, Bottom Patch fittings - PT 10, Floor Spring - BTS 75 V, Corner lock with strike plate and Euro Profile Cylinder - US 10, Handle - TG 9300 EQ - S 25mm dia. X 300mm length)

Measurements:

The glazed doors shall be measured in terms of area in square meter; the payable area shall be obtained from the net opening for which the door has been provided. The portions of the panel inserts or glazed panel inside the grooves or rebates shall not be measured for payment.

Rate:

Rate includes the cost of materials, frameworks, fittings and labor involved in all the operations described above.

13.7 Fixed clear glass partitions

Scope of work:

This shall include providing & fixing of 12mm thick toughened glass of approved make with Mild steel U channels(12mm x12mm x 2mm) fixed at floor and ceiling level to hold glass. The glass panes shall have square corners and straight edges. The glass panes shall be so cut that it fits slightly loose in the frames. In doors, windows, clerestory windows of bath, WC and lavatories frosted glass panes shall be used.

All joints and edges shall be sealed with transparent silicon sealant (interior grade of Dow corning or approved make).

Measurements: Length and breadth of superficial area of the finished work shall be measured correct to a cm. Area shall be calculated in square meter correct to two places of decimal.

Rate: Rate shall be inclusive of all works specified above and of floor chasing and making good and Gyp steel ultra-framing above the glass up to slab for partition support. Rate shall include cutting for openings and any other fixtures as directed.

14.0 SPECIFICATIONS FOR PLUMBING DRAINAGE & SANITARYWARE

SCOPE OF WORK

Work under this section shall consist of furnishing all materials & labour necessary and required to completely install all sanitary fixtures, chromium plated fittings and accessories as required by the drawings specified hereinafter and given in the Bill of Quantities.

Without restricting to the generality of the foregoing the sanitary fixtures shall include the following: -

Sanitary fixtures

Chromium plated fittings

Porcelain or stainless-steel sinks

Accessories e.g., towel rails, toilet paper holders, coat hooks etc.

Whether specifically mentioned or not, all fixtures and appliances shall be provided with all fixing devices, nuts, bolts, screws, hangers as required.

All exposed pipes within toilets and near fixtures shall be chromium plated brass or copper unless otherwise specified.

GENERAL REQUIREMENTS

Sanitary fixtures shall be of the best quality approved by the Architect / Consultant / PM / Client. Wherever particular makes are mentioned, the choice of selection shall remain with the Architect

/ Consultant / PM / Client.

All fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Bill of Quantities, specifications, drawings. Accessories shall include proper fixing arrangement, brackets, nuts, bolts, screws and required connection pieces.

Fixing screws shall be half round head chromium plated brass screws with C.P. washers where necessary.

Contractor shall furnish without cost all such accessories and fixing devices that are necessary and required but not supplied along with the Plumbing Fixtures & CP Fittings by the manufacturers as a part of the original and standard supply.

All fittings and fixtures shall be fixed in a neat workmanlike manner true to level and heights shown on the drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling or terrace shall be made good at Contractor's cost.

Contractor seal all fixtures fixed near wall, marble and edges. With an approved type of poly- sulphide sealant appropriate for its application.

EUROPEAN W.C

European W.C. shall be wash down or siphoned type wall mounted set flushed by means of dual flush Cistern systems which will be an integral part of the wall system. Framework, walling and finishing will not form a part of the contractor's work. Where applicable flush pipe / bend shall be connected to the W.C. by means of a suitable rubber adapter. Wall hung W.C. shall be supported by C.I. floor mounted chair.

Each W.C. set shall be provided with a plastic seat shall be with rubber buffers and chromium plated hinges.

Plastic seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C. Each W.C. shall be suitable for flushing in low volume of water 5-6 liters.

Flushing Cistern shall be provided with all internal flushing mechanism, 15 mm dia ball cock with unbreakable polythene float and overflow pipe. Any frame work required for fixing cistern has to be provided by the contractor.

LAVATORY BASIN

Lavatory basins shall be white glazed vitreous China of size, shape and type specified in the Schedule of Quantities.

Each basin shall be provided with brackets and clips of approved and securely fixed. Placing of basins over the brackets without secure fixing shall not be accepted.

Each basin shall be provided with 32 mm dia. C.P. waste with overflow, pop-up waste or rubber plug and chain as specified in the Bill of Quantities, 32 mm dia. C.P. brass bottle trap with C.P pipe to wall and flange.

Each basin shall be provided with Pillar Tap as specified in the Bill of Quantities.

Basins shall be fixed at proper heights as shown on drawings. If height is not specified, the rim level shall be 79 Cms. or as directed by Engineer-in-charge.

SINKS

Sinks shall be white glazed fireclay or vitreous China or stainless steel or any other material as specified in the Bill of Quantities.

Each sink shall be provided with brackets of approved and securely fixed. Counter top sinks shall be fixed with suitable brackets or clips as recommended by the manufacturer. Each sink shall be provided with 40 mm dia. C.P. waste with chain and plug as given in the Bill of Quantities. Fixing shall be done as directed by Engineer-in-charge.

Supply fittings for sinks shall be mixing fittings or C.P. taps as specified in the Bill of Quantities.

URINALS

Urinals shall be flat back type white glazed vitreous China of size, shape and type specified in the Bill of Quantities.

Bowl urinals shall be provided with 15 mm dia. C.P spreader, 40mm dia. stainless steel domical waste and C.P. cast brass bottle trap with pipe and wall flange, and shall be fixed to wall by C.I. brackets and C.I. wall clips as recommended by manufacturers complete as directed by Owner's Site Representative.

Urinals shall be fixed with C.P. brass screws and shall be provided with 32 mm dia. domical waste leading to urinal's trap.

Flush pipes shall be G.I. pipes concealed in wall chase but with chromium plated bends at inlet and outlet or as given in Bill of Quantities. Urinals shall be flushed by means of brass ball valves.

Waste pipes for urinals shall be uPVC pipes. Waste pipes may be exposed on wall or concealed in chase as directed by the Specifications.

URINAL PARTITIONS

Urinal partitions shall be white glazed vitreous China, marble, granite or any other material selected by the Owner's Site Representative. The same shall be fixed by Contractor executing the finishing work. The exact location shall however be co oriented by the Plumbing Contractor.

Urinal partitions shall be fixed at proper heights with C.P. brass bolts, anchor fasteners and M.S. Clips as recommended by the manufacturer and directed by Owner's Site Representative

ACCESSORIES

Contractor shall install all chromium plated and porcelain accessories as shown on the drawings or directed by the Engineer-in-charge.

All C.P. accessories shall be fixed with C.P. brass half round head screws and cup washers in wall with rowel plugs or nylon sleeves and shall include cutting and making good as required or directed by Engineer-in-charge.

Recessed porcelain accessories shall be fixed in walls and set in cement mortar 1:2 (1 cement: 2 coarse sand) and fixed in relation to the tiling work as per Interior Designer's drawings.

FINAL INSTALLATION

The contractor shall install all sanitary fixtures and fittings in their position in accordance with approved trial assemblies and as shown on drawings. The installation shall be completed with all supply and waste connections. The connection between building and piping system and the sanitary fixtures shall be through proper unions and flanges to facilitate removal/replacement of sanitary fixtures without disturbing the built-in piping system. All unions and flanges shall match in appearance with other exposed fittings.

Fixtures shall be mounted rigid, plumb and to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are butting on the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. Overflows shall be made to ensure that the necessary anchoring devices have been provided for supporting water closets, wash basins, sinks and other appliances.

PROTECTION AGAINST DAMAGE

The contractor shall take every precaution to protect all sanitary fixtures against damage, misuse, cracking, staining, breakage and pilferage by providing proper wrapping and locking arrangement till the completion of the installation. At the time of handing over, the contractor shall clean, disinfect and polish all the fixtures and fittings. Any fixtures and fittings found damaged, cracked chipped stained or scratched shall be removed and new fixtures and fittings free from defects shall be installed at his own cost to complete the work.

MEASUREMENT

Sanitary fixtures and accessories shall be counted by numbers in the unit given in the Bill of Quantities.

Rates for all items shall be inclusive of cutting holes and chases and making good the same, C.P Brass screws, nuts, bolts and any fixing arrangements required and recommended by manufacturers, testing and commissioning.

SPECIFICATIONS FOR SOIL, WASTE, VENT & RAINWATER PIPES & FITTINGS

SCOPE OF WORK

Work under this section shall consist of furnishing all labor, materials, equipment and appliances necessary and required to completely install all soil, waste, vent rain water pipes and fittings as required by the drawings, and given in the Bill of Quantities.

Without restricting to the generality of the foregoing, the soil, waste, vent pipes system shall include the following: -
Horizontal soil, waste and vent pipes, and fittings, joints, clamps, connections to fixtures.
Floor and urinal traps, cleanout plugs, inlet fittings.
Testing of all pipe lines.

GENERAL REQUIREMENTS

All materials shall be new of the best quality conforming to specifications and subject to the approval of Engineer-in-charge.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by suitable clamps intervals specified.

Access doors for fittings and clean outs shall be so located that they are easily accessible for repair and maintenance.

Any access panel required in the civil structure, false ceiling or marble cladding etc. shall be clearly reported to the Owner in the form of shop drawing so that other agencies are instructed to provide the same well in advance.

PIPING SYSTEM

Schedule of Pipes Use

C.I. IS-3989	For Vertical Stacks.
□ C.I IS-3989	From WC & Floor Trap to
□ uPVC Pipes I.S 4985	Connections from fixtures to
□ HDPE/C.I.	FT. For Rain water System.

SOIL, WASTE & VENT PIPES

The Soil & Waste Pipe System above ground has been planned as a "two pipe system" as defined in IS: 5329 having separate pipes for waste for kitchen sinks, bath tubs, showers, washbasins, condensate drains and floor drains and is approved by Engineer-in-charge.

Vertical soil & waste stacks shall be connected to a horizontal Soil and Waste Pipe as shown on the drawings.

Toilet layouts have been so arranged that the W.C. outlets shall be with "P" trap above ground.

JOINTING

The jointing of the pipes to the fittings shall be done as per the manufacturer's instructions /recommendation. The rubber ring socket fittings and pipes shall be jointed as follows:

Clean the outside of the pipe's spigot end and the inside of the ceiling groove of the fitting. Apply the lubricant uniformly to the spigot end, sealing ring and pass the spigot end into the socket containing sealing ring until fully home.

Mark the position of the socket edge with pencil or felt open on the pipe, then withdraw the pipe from the socket by approximately 10 mm. to make the pipe fully fitted to the fitting. The horizontal pipes on the wall shall be fixed with M.S. fabricated clamps with necessary provisions to take care the expansion and contraction in PVC pipes. The spacing of the clamps shall be at the intervals of 1.5 meter to 2 meter depending on the requirement of the supporting arrangements.

FIXING

All vertical pipes shall be fixed by Galvanized clamps and galvanized angle brackets truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard).

Horizontal pipes running along ceiling shall be fixed on galvanized structural adjustable clamps of special design shown on the drawings or as directed. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them.

Contractor shall provide all sleeves, openings, hangers, inserts during the construction. He shall provide all necessary information to the building Contractor for making such provisions in the structure as necessary. All damages shall be made good to restore the surfaces.

CLAMPS

All pipe clamps, supports and hangers shall be galvanized. Factory made pre-fabricated clamps shall be preferred. Contractor may fabricate the clamps of special nature and galvanize them after fabrication but before installation. All nuts, bolts, washers and other fasteners shall be factory galvanized.

Clamps shall be of approved designs and fabricated from M.S. flats (which shall be galvanized after fabrication) of thickness and sizes as per drawings or contractor's shop drawings. Clamps shall be fixed in accordance to manufacturer's details/shop drawings to be submitted by the contractors.

When required to be fixed on RCC columns, walls or beam they shall be fixed with approved type of galvanized expansion anchor fasteners (Dash fasteners) of approved design and size according to load.

Structural clamps e.g., trapeze or cluster hangers shall be fabricated by electro-welding from M.S. Structural members e.g., rods, angles, channels flats as per Contractor's shop drawing shall be galvanized after fabrication. All nuts, bolts and washers shall be galvanized.

Galvanized slotted angle/channel supports on walls shall be provided wherever shown on drawings. Angles/channels shall be of sizes shown on drawings or specified in Bill of Quantities. Angles/channels shall be fixed to brick walls with bolts embedded in cement concrete blocks and to RCC walls with anchor fasteners mentioned above. The spacing of support bolts on support members fixed horizontally shall not exceed 1 m.

TRAPS

Floor traps

Floor traps where specified shall be siphon type full bore P or S type uPVC/triplus having a minimum 50 mm or more than that which is more deep seal. The trap and waste pipes when buried below ground shall be set and encased in cement concrete blocks firmly supported on firm ground or when installed on a sunken RCC structural slab. The blocks shall be in 1:2:4 mix (1 cement: 2 coarse sands: 4 stone aggregate 20 mm nominal size).

Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30x30 CMS of the required depth.

Floor Trap inlet

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, Contractor shall provide a special type of floor or manhole inlet fitting fabricated from uPVC/triplus pipe without, with one, two or three inlet sockets welded on side to connect the waste pipe or joint between waste and inlet socket shall be solvent cement. Floor trap inlet and the traps shall be set in cement concrete blocks were varied in floors as specified without extra charge. Floor trap for the shower cubicle shall suit site and as per the approval of Engineer-in-charge.

Floor Trap Grating Floor and urinal traps shall be provided with 100 -150mm square or round Stainless-Steel gratings as approved with frame and rim of approved design and shape or as specified in the Bill of Quantities approved by the Engineer-in-charge.

Cleanout Plugs

Clean out plug for Soil, Waste or Rainwater pipes laid under floors shall be provided near pipe junctions bends, tees, "Ys" and on straight runs at such intervals as required as per site conditions. Cleanout plugs shall terminate flush with the floor levels. They shall be threaded and provided with key holes for opening. Cleanout plugs shall be Cast Brass suitable for the Pipe dia. With screwed to a G.I. socket. The socket shall be drip seal to the drain pipes.

WASTE PIPE FROM APPLIANCES

Waste pipe from appliances e.g., washbasins, sinks and urinals shall be of uPVC pipes in Toilets, kitchens, pantries, Equipment's and service areas where so required, and as given in the Bill of Quantities or shown on the drawings.

All pipes shall be fixed in gradient towards the connection to stack or drains. Pipes inside all toilets shall be in chase unless otherwise shown on drawings. Where so required and shown on drawings or directed by the Engineer-in-charge.

ENCASING IN CEMENT CONCRETE

Encasing of pipes is required to provide stability to the line and prevent its damage during construction.

Soil and waste pipes under floor

Pipes lay in sunken slabs and in wall chases (when cut specially for the pipe) shall be encased in cement concrete 1:2:4 mix (1 cement: 2 coarse sands: 4 stone aggregate 12 mm size) 75 mm in bed and all round. When pipes are running well above the structural slab, the encased pipes shall be supported with suitable cement concrete pillars of required height at intervals of 1.8 m.

Cutting And Making Good

Contractor shall provide all holes cutouts and chases in structural members necessary and required for the pipe work as building work proceeds. Wherever cutouts, holes are left in the original construction, they shall be made good with cement concrete 1:2:4 (1 cement: 2 coarse sands: 4 stone aggregate 20 mm nominal size) or cement mortar 1:2 (1 cement: 2 coarse sand) and the surface restored as in original condition.

Sleeves/ Cut-Outs

Contractor shall utilize all cut out and sleeves provided during construction to prevent breaking. The annular space between the pipe and the sleeve shall be filled up with approved type of fire-retardant sealant. When sleeves are misplaced or inaccurately located contractor shall make the holes in the wall or structural members at his own cost but only with the prior permission of the Engineer-in-charge.

TESTING

Testing procedure specified below apply to all soil, waste and vent pipes above ground.

Entire drainage system shall be tested for water tightness and smoke tightness during and after completion of the installation. No portion of the system shall remain untested. PVC pipes and fittings shall be tested for three meters of water head the openings of the pipes shall be sealed for the section to be tested. The water pressure shall be maintained for maximum of one hour. The Engineer shall examine carefully all the joints for leakage. Contractor must have adequate number of expandable rubber bellow plugs, manometers, smoke testing machines, pipe and fitting work test benches and any other equipment necessary and required to conduct the tests.

All materials obtained and used on site must have manufacturer's hydraulic test certificate for each batch of materials used on the site.

Measurements

Rates quoted for all items shall be inclusive of all work and items given in the Specifications and Bill of Quantities.

Rates are applicable for the work in basements, underground, floors, in shafts at ceiling level area for all depths and building up to 45 m in height.

Rates are inclusive of cutting holes and chases in RCC and masonry work where no sleeves or cut outs have been provided during construction and making good the same.

Rates are inclusive of pre testing, on site testing, of the installations, materials and commissioning of the works.

Pipes (unit of measurement linear meter to the nearest centimeter).

Soil, waste, vent, anti-siphon age, rain water pipes, shall be measured net when fixed correct to a centimeter including all fittings along its finished length.

G.I./C.I./uPVC pipes shall measure per running meter correct to a centimeter for the finished work which shall include fittings e.g., bends, tees, elbows, reducers, crosses, sockets, nipples and nuts. The length shall be taken along center line of the pipes and fittings. All pipes and fittings shall be classified according to their diameter, method of jointing and fixing substance, quality, and finish. The diameters shall be nominal diameter of internal bore. No allowances shall be made for the portions of pipe length entering the sockets of the adjacent pipe or fittings.

All supports required to support the pipes from slab/ceiling/i/c dash fasteners, M.S. structural, slotted angles/channels including support bolts and nuts embedded in masonry walls and hangers etc shall be included in the item rate of pipe including the item of work given below: -

Expandable anchor fasteners
Galvanizing of all supports and hangers
Cutting holes in walls, ceiling of floors and making good, where permitted
Nuts, bolts and washers for fixing and assembling
Wooden/PVC pipe saddles for vertical or horizontal runs

Cement concrete around pipes shall be measured along the center of the pipe line measured per linear meter and include any masonry supports, shuttering and centering cutting complete as described in the relevant specifications.

Fittings (excluding pipe fittings) (Unit of measurement by numbers)

Urinal traps, trap gratings, hoppers, cleanout plugs khurras shall be measured by number per piece and shall include all items described in the relevant Specifications and Bill of Quantities.

SPECIFICATION FOR WATER SUPPLY SYSTEM

SCOPE OF WORK

Work under this section consists of furnishing all labor, materials equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the Bill of Quantities.

Without restricting to the generality of the foregoing, the water supply system shall include the following: -

- Distribution system from main vertical stack to all fixtures and appliances for cold & hot water.
- Pipe protection and painting.
- Control valves

GENERAL REQUIREMENTS

All materials shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Engineer-in-charge.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

Short or long bends shall be used on all main pipe lines as far as possible. Use of elbows shall be restricted for short connections.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified.

Clamps, hangers and supports on RCC walls, columns & slabs shall be fixed only by means of approved made of expandable metal fasteners inserted by use of power drills.

All pipe clamps, supports, nuts, bolts, washers shall be galvanized MS steel throughout the building. Painted MS clamps & MS nuts, bolts & washers shall not be accepted.

Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

MATERIAL

CPVC pipes, fittings & valves

CPVC Pipes - All pipes within toilets, kitchen/ pantry (in Wall Chases) shall be CPVC. The pipes from 15mm to 50mm dia. (copper tube size) shall be as per ASTM D- 2846 requirements. They shall be of the nominal diameter (nominal bore) specified on the description of the item. The sockets shall be designated by the respective nominal bores of the pipes for which they are intended.

Pipe Fittings

Fittings for PVC pipes shall include couplings, tees, reducers, nipples, unions, bushes. The fittings shall be of perfect size and should be as per CTS (Copper tube size).

Jointing material

All-purpose cement solvents should not be used. Solvent cement manufactured as per ASTM F-493 only shall be used.

Pipe threaded joints will be made by applying suitable grade of TEFLON tape used for drinking water supply.

Pipe Fittings

The fittings shall be of perfect size and should be as per ITS (Iron tube size) the fitting should be as per the specifications of ASTM D 2467.

All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets. PVC pipes inside toilets shall be fixed in wall chases well above the floor. No pipes be run inside a sunken floor as far as possible. Pipes may be run under the ceiling or floors and other areas as shown on drawings

Pipe Supports

All pipes' clamps, supports, hangers, rods, pipe supports, nuts bolts & washers shall be factory made galvanized Mild Steel or alternatively galvanized after fabrication to suit site requirements.

Clamps

Galvanized iron pipes in shafts and other locations shall be supported by GI. clamps of design approved by Engineer-in-charge. Pipes in wall chases shall be anchored by iron hooks, Pipes at ceiling level shall be supported on structural clamps fabricated from M.S. structural as described above. Pipes in typical shafts shall be supported on slotted angles/channels as specified elsewhere.

Anchor Fasteners

All pipes support, hangers and clamps to be fixed on RCC walls, beams, columns, slabs and masonry walls 230mm thick and above by means of galvanized expandable anchor fasteners in drilled holes of correct size and model to carry the weight of pipes. Drilling shall be made only by approved type of power drill as recommend and approved by manufacturer of the anchor fasteners. Failure of any fastening devices shall be the entire responsibility and contractor shall redo or provide additional supports at his own cost. He shall also compensate the owner for any damage that may be caused by such failures.

Unions

Contractor shall provide adequate number of unions on all pipes to enable easy dismantling later when required. Unions shall be provided near each gunmetal valve, stop cock, or check valve and on straight runs as necessary at appropriate locations as required and/or directed by Engineer-in-charge.

Flanges

Flanged connections shall be provided on pipes as required or, where shown on the drawings, all equipment connections as necessary and required or as directed by Connections shall be made by the correct number and size of GI nuts, bolts & washers with 3 mm thick gasket. Where hot water or steam connections are made insertion gasket shall be of suitable high temperature grade and quality approved by Bolt hole dia. for flanges shall conform to match the specification for G.M. sluice valve to I.S. 778. And C.I. butterfly valve to IS: 13095.

Trenches

All water supply pipes below ground shall be laid in trenches with a minimum cover of 60 Cms. The width and depth of the trenches shall be as follows: -

Dia. of pipe	Width of trench	Depth of trench
-----	-----	-----
15 mm to 50 mm	30cms	75cms
65 mm to 100 mm	45cms	100cms

Joining Of CPVC/ UPVC Pipes

The procedures described in ASTM D-2855 shall be followed for making joints. The pipes and fittings shall be cleaned and cleared of all foreign matter before being laid. Care should be taken that all pipes and fittings are properly jointed so as to make the joints completely water tight and pipes are kept at all-time free from dust and dirt during fixing. Burr from the joint shall be removed while joining the pipes. After laying the open ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter. The tubing should make contact with the socket wall 1/3 to 2/3 of the way into the fitting socket. Avoid too much of cement coat otherwise it will clog the water. In case of cement joint allow to set for 10 to 20 min.

INSULATION

All hot water pipes shall be insulated with elastomeric closed shells circular pipes.

All insulation material shall be elastomeric closed shells foam has a high diffusion resistance factor that prevent excessive water diffusion that gives longer lifetime of material.

The insulation material having the property of resistance of fire i.e., in case of fire these materials do not drop and do not spread flames.

All insulation material as per din 1988/7 (standard for drinking water pipe installation and for avoiding corrosion damage and scale formation).

The thermal conductivity of material at 0 deg. C = 0.035 w/ (m.K). Temperature resistance of material between -45 deg. C to +116 deg. C. The Thickness of insulation pipes as follows:

Size of pipes	Application of pipes	Location	Thickness of Material (mm)	Type of Section
15 mm to 40mm	Hot water supply	Concealed	6 mm	Tube Section
15 mm to 100 mm	Hot water supply	Exposed	9 mm	Tube Section

VALVES:

BALL VALVES

Valves up to 40 mm dia. shall be screwed type Brass Ball Valves with stainless steel balls, spindle, Teflon seating and gland packing tested to a hydraulic pressure of 20 kg/cm², and accompanying couplings and steel handles. (to BS 5351)

Butterfly Valves: Valves 40 mm dia. and above shall be cast iron butterfly valve to be used for isolation. The valves shall be bubble tight, resilient seated suitable for flow in either direction and seal in both direction with accompanying flanges and steel handle.

Butterfly valve shall be of best quality conforming to IS: 13095.

Non-Return Valve (Slim Type)

Where specified non return valve (wafer type) shall be provided through which flow can occur in one direction only. Each Butterfly and Slim Type Swing Check (NRV) Valve shall be provided with a pair of flanges screwed or welded to the main line and having the required number of galvanized nuts, bolts and washers of correct length.

Air Relief Valve

Where specified air relief valve shall be provided through which air trapped in the system can be relieved automatically.

Each air relief valve shall be provided with an isolation ball valve used to the main line. The air relief valve shall be of Cast Iron body and conforming to IS 14845; single air valve small orifice type.

TESTING

All pipes, fittings and valves after fixing at site, shall be tested by hydrostatic pressure of 1.5 times the working pressure or 20 kg/cm² whichever is more.

Pressure shall be maintained for a period of at least two hours without any drop.

A test register shall be maintained and all entries shall be signed and dated by Contractor (s) and Engineer-in-charge.

In addition to the sectional testing carried out during the construction, Contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings, to the building, furniture and fixtures shall be made good by the Contractor during the defect's liability period without any cost.

After commissioning of the water supply system, Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves which do not effectively operate shall be replaced by new ones at no extra cost and the same shall be tested as above.

Measurement

All pipes above ground shall be measured per linear meter (to the nearest cm) and shall be inclusive of all fittings e.g., coupling, tees, bends, elbows, unions, flanges and U clamps with nuts, bolts & washers fixed to wall or other standard supports. No allowance shall be made for the portions of pipe length entering the sockets of the adjacent pipe or fittings.

All supports required to support the pipes from slab/ceiling/i/c dash fasteners. M.S. structural, slotted angles/channels including support bolts and nuts embedded in masonry walls and hangers etc. shall be incl. in the item rate of pipe including the item of work given below: -

- Expandable anchor fasteners
- Galvanizing of all supports and hangers
- Cutting holes in walls, ceiling of floors and making good, where permitted
- Nuts, bolts and washers for fixing and assembling
- Wooden/PVC pipe saddles for vertical or horizontal runs

Jointing with Teflon tape, white lead and insertion gasket of appropriate temperature grade. Cutting holes, and chases in walls, floors, any pipe support required for pipes below ground &

making good the same.

Excavation, back filling, disposal of surplus earth and restoring the ground & floor in original condition.

VALVES

Gunmetal, cast iron, butterfly and non-return valves and puddle flanges shall be measured by numbers and shall include wheels/caps, GI nuts, bolts, washers and insertion gasket.

Painting / Pipe Protection/Insulation

Painting / pipe protection / insulation for pipes shall be measured per linear meter over finished surface and shall include all valves and fittings for which no deduction shall be made. No extra payment shall be made for fittings, valves or flanges.

Water Supply System

Contractor should study the site plan and water supply system diagram for an overview of the system. It is proposed to provide dual flushing cistern/dual flush valve for all WCs.

UPVC/CPVC PIPES AND FITTINGS

UPVC/ CPVC Plain/Solvent Joint Pressure Pipes shall conform to IS 4985:2000 and IS: 15778 respectively, and Molded fittings as per IS:7834 & fabricated fittings IS: 10124.

Precautions: - Water Hammer:

All uPVC Plastic piping systems be designed and constructed to avoid excessive Water Hammer. Water hammer can cause damage and failure to pipe, valves and fittings within the piping system.

Threaded Connections:

Use a quality grade thread sealant. Do not use substances that could cause stress cracking to plastic. Major attention must be given while making plastic thread joints. 1 to 2 turns beyond finger tight is generally all that is required to make a sound plastic connection unnecessary over tightening will cause damage to both pipes & fittings. Also give proper attention while selecting the threaded fittings, as some fittings with NPT threads & some fittings with BSP threads are available, to give more versatility to customer NPT threads are not compatible with BSP threads.

Seal & Gasket Lubricants:

Some Lubricants, including vegetable oils are known to cause stress cracking in thermoplastics materials. A mild soap or commercially available pipe gasket lubricants suitable for uPVC is recommended where lubrication is required for installation or maintenance service (especially with Flange joints). Choice of lubricant is at the discretion of the installer.

Support System:

Adequate supports for any piping system is a matter of great importance. In practice, support spacing are a function of pipe size operating temperatures, the location of heavy valves or fittings and the mechanical properties of the pipe material. To ensure the satisfactory operation of a ASTRAL Aquarius+ uPVC piping system, the location and type of hangers should be carefully considered. Hangers should not compress, distort, cut or abrade the piping. All piping should be supported with an approved hanger at intervals sufficiently close to maintain correct pipe alignment and to prevent sagging or grade reversal. Pipe should also be supported at all branch ends and at all changes of direction. Support trap arms as close as possible to the trap.

(1) Concentrated loads should be supported directly so as to eliminate high stress concentrations. Should this be impractical then the pipe must be supported immediately adjacent to the load.

(2) In systems where large fluctuations in temperature occur, allowances must be made for expansion and contraction of the piping system. Since changes in direction in the system are usually sufficient to allow for expansion and contraction hangers must be placed so as not to restrict this movement.

(3) Since plastic pipe expands or contracts approximately five times greater than those of steel, hangers should not restrict this movement.

(4) Hangers should provide as much bearing surface as possible. To prevent damage to the pipe, file smooth any sharp edges or burrs on the hangers or supports.

(5) Support spacing for horizontal piping systems is determined by the maximum operating temperature the system will encounter. The piping should be supported on uniform centers with supports that do not restrict the axial movement.

(6) For vertical lines, it is recommended that an engineer should design the vertical supports according to the vertical load involved.

Bib cock and Stop cock:

A bib cock is draw off tap with a horizontal inlet and free outlet. A stop cock is a valve with a suitable means of connection for insertion in a pipe line for controlling or stopping the flow.

They shall be of screw down type and of brass chromium plated and of diameter as specified in the description of the item. They shall conform to I.S. 781-1977 and they shall be best Indian make. They shall be polished bright.

Ceramic Flushing Cistern:

The ceramic flushing cistern shall be of 15 liters capacity. It shall conform to I.S. 774-1971. The flushing cistern shall be of best quality free from any defects. The flushing cistern shall have outer dia. of 32 mm. The outlet shall be connected to lead pipe of 32 mm. diameter. The lead pipe shall conform to I.S. 404 (Part-I) 1962. For fixing G.I./uPVC inlet pipes and overflow pipe 20 mm dia. inlet and outlet shall be provided.

Tolerances:

The standard weights and thickness of pipes shall be shown in the following table: A tolerance up to minus 10 percent may however be allowed against these standard weights.

A tolerance up to minus 15 percent in thickness and 20 mm. in length will be allowed. For fittings tolerance in length shall be plus 15 mm. and minus 10 mm.

The thickness of fittings and their socket and spigot dimensions shall conform to the thickness and dimensions specified for the corresponding sizes of straight pipes. The tolerances in weights and thickness shall be the same as for straight pipes.

Nahni trap:

Nahni trap shall be of cast iron / pvc and shall be sound and free from porosity or other defects which affect serviceability. The thickness of the base metal shall not be less than 6.5 mm. The surface shall be smooth and free from craze, chips and other flaws or any other kind of defects which affect serviceability. The size of nahni trap shall be having inlet 100mm dia. & outlet 75 mm dia. or as specified and shall be of self-cleansing design.

The nahni trap shall be quality approved by the Engineer-in-charge and shall generally conform to the relevant Indian Standards.

The Nahni trap provided shall be with deep seal, minimum 50 mm. except at places where trap with deep seal cannot be accommodated. S.S./ PVC Perforated cover shall be provided on the trap of appropriate size.

Gully Trap:

Gully trap shall conform to I.S. 651-1980. It shall be sound free from defects such as fire cracks. The glaze of the traps shall be free from cracking. They shall give a clear note when struck with light hammer. There shall be no broken blisters.

The size of the gully trap shall be as specified in the item.

Each gully trap shall have one C.I. grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight C.I. cover with frame inside dimensions 300 mm x 300 mm. the cover with frame inside dimension, 300 mm x 300 mm. the cover weighting not less than 4.53 Kg and the frame not less than 2.72 Kg. The grating cover and frame shall be of sound and good casting and shall have truly square machined seating faces.

Glaze stone ware pipe and fittings:

The pipes and fittings shall be of best quality as approved by the Engineer-in-charge. The pipe shall be of best quality manufactured from stone ware of fire clay, salt glazed thoroughly burnt the whole thickness, of a close even texture, free from air blows, fire blisters, crack and other imperfections, which effect the serviceability. The inner and outer surfaces shall be smooth and perfectly glazed. The pipe shall be capable to withstand pressure of 1.5 m lead without showing sign of leakage. The thickness of the wall shall not be less than 1/12th of the internal dia. The depth of socket shall not be less than 38 mm. The socket shall be sufficiently large to allow a joint of 1 mm. around the pipe.

16.0 Technical specifications for Rainwater Harvesting

General Requirements

Scope of work

The works under this project shall consist of supplying all the components, installing, testing and handing over in good operating conditions complete Rainwater Harvesting systems detailed in the BOQ.

The Contractor shall provide all necessary components except otherwise specified, and accessories as well as manpower, scaffolding, etc. at the Contractor's own expense to install complete operational units.

The equipment furnished to these specifications must meet or exceed all requirements herein and the reference technical drawings. Modifications of or additions to basic standard equipment of less size or capability to meet these requirements will not be acceptable.

Bidders are cautioned to read the specifications carefully, as there may be special requirements not commonly offered by all manufacturers. Nevertheless, the technical specifications presented herein are not to be interpreted as necessarily defining a particular manufacturer's product, model or features. The equipment shall conform in capability, strength, quality and workmanship to the accepted industry standards and relevant international quality standards.

Technical requirements

Functional configuration

The functional description of the facility can be summarized as follows:

Collection and conveyance system (e.g., gutter and downspouts)

Pre-treatment

Storage tank

Overflow, filter path or secondary runoff reduction practice

The following basic material for rainwater harvesting systems and their specifications must be present and are summarized as follow:

Item Specification

Collection & conveyance system

Materials commonly used for gutters and downspouts include polyvinylchloride (PVC) pipe, HDPE pipes, vinyl, aluminum and galvanized steel.

The length of gutters and downspouts is determined by the size and layout of the catchment and the location of the storage tanks. Bends and tees have to be included too.

Pre-Treatment All harvested rainwater should pass through the following pre-treatment:

First flush diverter

Leaf screen (1 mm mesh size)

Baffle tank

Storage Tanks The storage tanks that will be installed are one layer above ground, PE Tanks.

Tanks should be placed in areas of the site where native soils can support the load associated with stored water.

Storage tanks should be water tight and sealed using a water-safe, non-toxic substance.

Tanks should be opaque to prevent the growth of algae.

The size of the rainwater harvesting system(s) is determined during the design calculations.

The technical requirement and specifications pertaining to tanks, manholes, pipes, fillers and all systems related to rainwater harvesting shall be as detailed in the Bill of quantities.

17.0 Technical specifications for External Development

17.1 Cement Concrete paver blocks of M-30 grade

Scope of work:

The work covered under this specification consists of providing and laying 60mm thick cement concrete paver blocks of grade M-30 all as per these specifications or as per instructions of Architect/ Engineer in charge.

Sub- Base:

60 mm thick Interlocking paver block to be fixed over the 50 mm bed of compacted coarse sand of approved specification and filling the joints with the sand of approved type and quality.

Interlocking Paver Block:

Factory made precast concrete molded paver blocks of M-30 grade to be used. Paver blocks to be of approved brand and manufacturer and of approved quality. Minimum strength as prescribed by manufacturer and as per direction of Engineer-in-Charge for the grade specified to be tested as per method mentioned in CPWD specifications.

Measurement & Rates:

Area provided with paver block to be measured in sqm. Correct up to two places of decimal. The rate includes the cost of all material, labor, tools etc. required in all the operations described above.

17.2Kerb Stones

Laying:

Trenches shall first be made along the edge of the wearing course of the road to receive the kerb stones of cement concrete of M25 grade. The bed of the trenches shall be compacted manually with steel rammers to a firm and even surface and then the stones shall be set in cement mortar 1:3 (1 cement: 3 coarse sand). The kerb stones with top 20 cm. wide shall be laid with their length running parallel to the road edge, true in line and gradient at a distance of 30 cm. from the road edge to allow for the channel and shall project about 12.5 cm. above the latter. The channel stones with top 30 cm. wide shall be laid in position in chamber with finished road surface and with sufficient slope towards the road gully chamber. The joints of kerb and channel stones shall be staggered and shall be not more than 5 mm. Wherever specified all joints shall be filled with mortar 1:3 (1 cement: 3 coarse sand) and pointed with mortar 1:2 (1 cement: 2 fine sand) which shall be cured for 7 days. The necessary drainage openings of specified sizes shall be made through the kerb as per drawings or as directed by the Engineer-in-Charge for connecting to storm water drains.

Finishing:

Kerbs and road edges shall be restored and all surplus earth including rubbish etc. disposed of as directed by the Engineer-in-charge. Nothing extra shall be paid for this.

Measurements:

It shall be measured in meters with length of the kerb edging of finished work (for specified width and height of stone) shall be measured in running meter along the edge of the area correct to a cm.

Rate:

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

17.3 Fabrication work for Parking Shed

Scope of Work:

The work covered by this specification consists of supplying, fabricating, assembling, and fixing in position of structural steel in grating, frames, guard bar, ladders, brackets, gates etc. complete in strict accordance with these specifications and the applicable drawings. This also includes fixing 6 mm the Poly Carbonate Shed using one side supported on 4" dia. M.S. Pipe, the Roof Is Supported On 3" X 1 1/2" MS fame Around the Peripheral in two layers forming a truss also at every 4' length & 2" X 1" Pipe at Every 2' C/C. 12 mm MS bar is fixed between two layers to form a truss as per details given.

Materials: All structural steel shall be of standard sections as marked on the drawings and shall be free of scale, blisters, laminations, cracked edges and defects of any sort. All structural steel and electrodes shall comply in all respects with relevant I.S. codes.

Workmanship:

All workmanship shall be of first-class quality in every respect to get greatest accuracy to ensure that all parts will fit together properly on erection. All ends shall be cut true to planes. They must fit the abutting surfaces closely. All stiffeners shall fit tightly at both ends. All holes in plates and section between 12mm and 20 mm thick shall be punched to such diameter that 3mm of metal is left all around the hole to be cleaned out to correct size by reamer. The base connection shall be provided as shown on drawings and the greatest accuracy of workmanship shall be ensured to provide the best connections. Figured dimensions on the drawings shall be taken.

Shop Drawing:

The shop drawings of structural steel based on contract drawings shall be submitted to the Engineer-in-charge. The necessary information for fabrication, erection, painting of structure etc. must be furnished immediately after acceptance of the Architect / Engineer in charge.

Painting:

Providing and applying Epoxy paint of approved make and desired shade, including the surface preparation (with emery paper 180 and wipe clean) by thoroughly cleaning all dust, dirt, applying red oxide oil primer and applying primer, again sand papering leveling rubbing the surface, to be free from undulation/ waviness, applying 1st coat of Epoxy paint & 2nd coat of Epoxy paint. Painting should be carried out on dry surfaces free from dust, scale etc. The paint shall be approved by the Engineer-in-charge.

Welding:

Welding shall be in accordance with IS 816-1969, IS 819-1957, IS 1024-1979, IS1261-1959, IS 1323-1982 and IS 9595-1980 as appropriate. For welding of any particular type of joint, welders shall give evidence of having satisfactory completed appropriate test as described in any of IS 817-1966, IS 1393-1961, IS 7307 (part-I) –1974, IS 7310 (part-I) 1974 and IS 7318 (part-I) 1974 as relevant.

Type of Welding:

Arc welding (direct or alternating current) or Oxyacetylene welding may use. Field welding may be used. Field welding shall be by D.C.

Note: On any straight weld the first run shall not ordinarily be deposited with a larger gauge electrode than No.8 S.W.G. For subsequent runs the electrode shall not be increased by more than two electrode sizes between consecutive runs.

Mode of Measurement: For payment purpose, polycarbonate sheet and fabrication work will be measured under separate items. Fabrication work will be measured in KG whereas area of polycarbonate sheet will be measured in Sqm. Overlapping of sheets will not be measured. No separate measurements shall be taken for welding, riveting, bolting, field connections etc. The rate shall include cost of all labor, materials, scaffolding, transport and also cost of welding, riveting and bolting, field connections if any all to complete the job as per specifications.

GENERAL LIST OF APPROVED MAKES FOR CIVIL WORKS

The following are approved brand makes/manufacture's makes listed below. However, approved equivalent material and finishes of any other specialized brand names/ manufacturer's makes may be used with the prior approval of the SBIIMS/ Architect. Permitting or not permitting such deviations from the approved make shall be the absolute discretion of the SBIIMS / Architect, and shall not be open to arbitration.

S.NO	PRODUCT	APPROVED BRAND
1	AAC Blocks	Ascolite (Ashwini Construction Pvt. Ltd-Surat), Brixo (Brixo Industries-Ahmadabad), Eco Green (Eco Green Products Pvt. Ltd-Gandhinagar), Wonder, Ercon.
2	Acoustic Panel /Tiles	Armstrong, Anutone, Tranquil.
3	ACP Cladding	Eurobond, Alucobond, Alstrong.
4	Acrylic Sheet	Perspex, Acrylic India.
5	Aluminum Section	Jindal, Hindalco. Indal,
6	Anti-skid Tape	3M, NITCO, Tapes India.
7	Anti-termite Emulsifiable Concentrate	Lindane 20% E.C., Chloropyriphos 20% E.C., of any ISI brand
8	Block-board (IS 303, IS 710)	Mayur, Euro, Century, Sonear,
9	Bricks	Good quality available from approved Local source.
10	Cement – Admixtures	Fosroc, Roff, Cico, Mc-bauchemie, Choksey,
11	Cement - O.P.C. (43/53 grade)	Ultratech, Ambuja, Lafarge, ACC, JK Laxmi, HI-Bond.
12	Cement - PPC	Ultratech, Ambuja, Lafarge, ACC, JK Laxmi, HI-Bond.
13	Cement - White	JK white, Birla white,
13	C.I Covers (heavy)	Bharat, Kaplesh
14	Coarse Aggregates	From approved local source
15	Concrete block – pavers	Alcock, Pavit, Vyara,
16	Concrete – Ready Mix	Ultratech, La Farge, ACC, RELCON or equivalent.

17	Doors –Flush(IS 2202)	Mayur, Euro, Century Sonear
18	Doors & Windows- PVC Section	Fenesta, Vensterplus, Superwin,
19	Doors & Windows - Pressed steel section	Steel plast, Agew, Jackson Engg.
20	Doors & Windows - Z section	AGEW
21	Door – Metal	Marin Door, Sehgal Door, Hormann (I) P. Ltd.
22	Door/Partition- Fire rated glass	Saint Gobain, AIS, FG Glass
23	Glass Film	Birla3M, GarwareLlumar, Covestro.
24	Geo Fabric	Geo textiles, Manas Geotech, Khator Technical textiles
25	G.I.Frame	Gyproc, India. Gypsum, Armstrong.
26	G.I. Sheet	Tata, JSW, Uttam
27	Glass – back painted	Saint Gobain, AIS,Glaverbel.
28	Glass – Float	Saint Gobain, Asahi, Modi, Tata, Gujarat Guardian
29	Glass – Laminated	Saint Gobain, Asahi, GSC Glass, AIS
30	Glass - Plain Sheet	Triveni, Modi, Haryana, Atul,
31	Glass – Mirror	Atul, Belgium, Commander, Patel, Rabbit, Globe
32	Gypsum Board	India. Gypsum. Saint Gobain, Gyproc
33	Hardware - Anodized Aluminum Matt finished Hardware fitting (Heavy)	Ebco, Belu, Paramount, Dia.mond
34	Hardware-Aluminum general	Aries, C.H. Aluminum, J.S. Enterprise
35	Hardware-Brass Hardware fittings (Heavy)	Rolex, Zodiac, from Jamnagar.
36	Hardware - Cylindrical Locks	Godrej, Europa, EG, EBCO
37	Hardware - Doors closer	Dorma, Hafele, Hettich, Ozone, EBCO.
38	Hardware - Floor Springs	Dorma, Hafele, Hettich, Ozone, EBCO.
39	Hardware – Handles	Dorma, Hafele, Hettich, Ozone, EBCO.
40	Hardware – Hinges	Dorma, Hafele, Hettich, Ozone, EBCO.
41	Hardware – Metallic	Dorma, Hafele, Hettich, Ozone, EBCO.
42	Hardware - Mortice Locks / Latch	Dorma, Hafele, Hettich, EBCO. Europa, EG,
43	Hardware – Patch fittings	Dorma, Hafele, Hettich,Ozone, Raccordi.
44	Hardware – Screws	GKW, RK, Nettlefold
45	Hardware – Self closing Hinges	Hafele, Hettich, EG, EBCO

46	Hardware - S.S. Hinges (Heavy duty)	Dorma, Hafele, Hettich, Ozone, EBCO.
47	Laminates	Vir, Formica, Sunmica, Greenlam, Decolam
48	MDF Boards	Decoboard, Ecoboard, Novopan
49	Mineral Fibre Boards/ False Ceiling	Armstrong, AMF, Daiken
50	Paint - Acrylic Emulsion	Asian, ICI, Nerolac, Berger
51	Paint - Cement Based	Snow-cem, Indo-cem
52	Paint - Cement Based wall putty	Birla white, NCL-Alltek ,
53	Paint - Distemper (Oil Bound & Acrylic)	Asian, ICI, Nerolac, Berger
54	Paint - Epoxy	Asian, Berger, Jotun
55	Paint - Exterior Texture	Asian, Unitex, NCL-Alltek, Sandtex matt, Nitco-tex,
56	Paint - Exterior Emulsion	Apex-Asian, Weathershield-ICI, Nerolac, Berger,
57	Paint - Texture	Asian, ICI, Berger, Unitex, NCL-Alltek
58	Paint - Plastic Emulsion	Asian, ICI, Nerolac, Berger
59	Paint – Primers	Asian, ICI, Nerolac, Berger, J&N, Shalimar
60	Paint - Red Oxide	Blundel-Eomite
61	Paint - Synthetic Enamel Paint/Flat/Semi-Gloss	Asian, Nerolac, ICI, Berger, J&N,
62	Particle Boards	Sitapur, Decoboard, Novopan, Ecoboard
63	Pipes & fittings - C.I.	Neco, Bic
64	Pipes & Fittings - C.P. Fittings (water supply)	Somany, Cera, Jaquar, Esco, ESS, Grohe, Hindware
65	Pipes & fittings - CPVC /UPVC	Astral, Supreme, Dutron
67	Pipes & Fittings- G.I. (B class Pipes)	Tata, Asian, Prakash
68	Pipes & Fittings - G.I. fittings	R- Brand
69	Pipes & Fittings - Gun Metal Wheel Valves	Zoloto
70	Pipes & Fittings - PVC (6 kg & above)	Supreme, Prince
71	Pipes - Stone ware	Sonya
72	Ply Wood	Mayur, Century, Archid, Anchor, Green, Euro
73	Pre-lam Particle Board	Novopan, Nuwud, Duratuf, or approved equivalent
74	PVC Tiles/Roll	Armstrong, Tusker,

75	PVC - Water tank	Sintex, National
76	Rolling Shutters	Gujarat, Sarvottam, Swastik, Gandhi automation
77	Sand	From approved local source
78	Sanitary Wares (First Quality)	Somany, Cera, Hindustan, Perryware, Duravit
79	Smoke/Fire Seal	3M barrier, Signum
80	Stainless Steel Sink	Nirali, Krishna.
81	Stainless Steel Railing	Kitch, Continental Steel, Jindal Steel, Columbus
82	Steel – Chequerred Plate	TISCO, BAO Steel, ZPSS, JSW or equivalent
83	Steel – Reinforcement	Tata, JSW, SAIL, Electrotherm, National, NRE
84	Steel – Structural Section	JSW, Electrotherm, Kamdhenu, Tata
85	Steel - Rectangular/Square Hollow Section	Tata, Jindal
86	Stone – Granite	Lakha Red, RBI Red, Telephone Black, Pearl blue, Panther
87	Stone – Marble	Kesariyaji Green, Rajnagar, Ambaji,
88	Stone - Sand stone	Jaisalmer yellow, Bansipahadpur Red
89	Stone	Green Kota, Black Kadappa
90	Sun Control Film	Garware, 3M
91	Tile – Adhesive	Bal-Endura, Fosroc, Roff, McBauchemie, Choksey, Cico.
92	Tiles - Glazed /Ceramic	Somany, Varmora, City, Asian, Kajaria, Johnson,
93	Tiles – Paver	Somany, Varmora, City, Asian, Kajaria, Johnson, Pavit.
94	Tiles – Mosaic	Royal-Rajlot, Alcock-Ahmedabad.
95	Tiles – Vitrified	Somany, Varmora, City, Asian, Kajaria, Johnson,
96	Veneer	Mayur, Euro, Century, Sonear
97	Vinyl Film	Birla 3M
98	Waterproofing Chemical	Dr. Fixit, Forsook, Roff, McBauchemie, Choksey, Cico.
99	Wood – Adhesive	Fevicol, Blucoat, Euro, Century.
100	Wood - Non-Teak	Red Saal, Kapoor, Steam Beach, Chill, Kail
101	Wood – Teak	Special Ghana, Ghana, Nigeria, C. P. Burmah