

## TECHNICAL SPECIFICATIONS FOR CIVIL WORKS

### GENERAL SCOPE

These Specifications establish and define the materials and constructional requirements for engineering construction works in brief.

### EQUIVALENCY OF STANDARDS AND CODES, MEASUREMENTS & MATERIALS

Wherever reference is made in the contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the contract. In case, no reference is made for any particular work, relevant IS/BIS Codes will be followed.

- 1.2.1 Providing and operating necessary measuring & testing devices and materials including all consumables are included in the Scope of Work. No separate measurement or payment for testing the work shall be made, but rates quoted for various items shall be deemed to include cost of such tests, which are required to ensure achievement of specified quality.
- 1.2.2 All materials shall be of standard quality, manufactured by renowned concerns, conforming to Indian Standards and shall have certification work from Bureau of Indian Standards as far as possible, unless otherwise approved by Engineer. The contractor shall get all materials approved by Engineer prior to procurement and use. The contractor shall furnish manufacturer's certificates, for materials supplied by him when asked for. Further to that he shall get material tested from an approved Test House, if asked for by the Engineer. Cost for all the tests and test certificates shall be borne by the contractor. No separate payment shall be made for the testing. The Engineer shall have the right to determine whether all or any of the materials are suitable. Any materials procured or brought to site and not conforming to specifications and satisfaction of the Engineer shall be rejected and the contractor shall have to remove the same immediately from site at his own expense & without any claim for compensation due to such rejection.
- 1.2.3 All goods and materials to be incorporated in the works shall be new, unused, of the most recent or current models and incorporate all recent improvements in design & materials, unless provided otherwise in the contract.
- 1.2.4 Wherever referred to in this tender document, only the latest revision of Specifications, Codes of Practice and other publications of the Indian Standards shall be applicable.

### **A. EXCAVATION:**

#### 1) CLASSIFICATION OF SOILS FOR EARTH WORK IN EXCAVATION

The earth work shall be classified under the following categories and measured separately for each category.

- i. **All kinds of soils:** Generally any strata, such as sand, gravel, loam, clay, mud, black cotton moorum, shingle, river or nallah bed boulders, siding of roads, paths etc. and hard core, macadam surface of any description (water bound, grouted tarmac etc.), lime concrete, mud concrete and their mixtures which for excavation yields to application of picks, showels, jumper, scarifiers, ripper and other manual digging implements.
- ii. **Ordinary rock:** Generally any rock which can be excavated by splitting with crow bars or picks and does not require blasting, wedging or similar means for excavation such as lime stone, sand stone, hard laterite, hard conglomerate and unreinforced cement concrete below ground level. If required light blasting may be resorted to for loosening the materials but this will not in any way entitle the material to be classified as „Hard rock“.
- iii. **Hard rock:** Generally any rock or boulder for the excavation of which blasting is required such as quartzite, granite, basalt, reinforced cement concrete (reinforcement to be cut through but not separated from concrete) below ground level and the like.

2) **Engineer- in- Charge** will furnish all necessary drawings showing the areas to be excavated, filled, sequence of priorities etc. Contractor shall follow such drawings strictly.

3) **Excavation Category:**

a) Excavation in Open area/ Wide Excavation:

- Excavation exceeding 1.5 m in width and 10 sqm on plan and exceeding 30 cm in depth.
- Excavation for basements, water tanks etc.
- Excavation in trenches exceeding 1.5 m in width and 10 sqm on plan

b) Surface Excavation.

- Excavations exceeding 1.5 m in width and 10 sqm. on plan but not exceeding 30 cm. in depth in all types of soils and rocks shall be described as surface excavation

c) Excavation in foundation & Trenches.

- This shall comprise excavation not exceeding 1.5 m in width or 10 sqm on plan and to any depth in trenches (excluding trenches for pipes, cables, conduits etc.)

4) **General**

Contractor shall provide all tools, plants, instruments, qualified supervisory personnel, labor, materials, and temporary works, consumables, any and everything necessary, whether or not such items are specifically stated herein, for completion of the Work.

Contractor shall set properly all lines and establish levels for various works such as earthwork in excavation for levelling, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines etc.

The area to be excavated / filled shall be cleared of fences, trees, plants, logs, slumps, bush, vegetation, rubbish slush etc. and other objectionable matter. If any roots or stumps of trees are found during excavation, they shall also be removed. The material so removed shall be burnt or disposed off as directed by Engineer. Where earth fill is intended, the area shall be stripped of all loose/soft patches, top soil containing deleterious matter/materials before fill commences. Final cleaning shall be done with removal of all rubbish up to the distance of 50.0 m all around outside the periphery of building.

5) **Relics, Objects of Antiquity, Etc.**

All gold, silver, oil minerals archaeological and other findings of importance, all precious stones, coins, treasures, relics, antiquities and other similar things which may be found in or upon the site shall be the property of Engineer- in- Charge and Contractor shall duly preserve the same to the satisfaction of Engineer- in- Charge and from time to time deliver the same to such person or persons as Engineer- in- Charge may from time to time authorize or appoint to receive the same.

6) **Site Clearance:**

Before the start of work, the area of the Site shall be cleared of all shrubs, vegetation, grass, bush wood, stumps, saplings etc of girth up to 30cm measured at a height of one metre above ground level. All the building shall be laid out to ensure that the layout plan fits at site. Trees if any live within construction site layout shall be shifted to other safe place as directed by Engineer in charge (at extra cost). After completion of the work, the entire area of the site shall be cleared from all debris, unwanted materials / equipment and level / slope of ground as required at site up to peripheral roads. The debris and unwanted material shall be disposed off away from the site without any extra cost.

7) **Site Levels:**

After site clearance and before commencement of excavation or filling, the contractor shall take levels in both longitudinal and transverse directions of the building at regular intervals as directed by Engineer in charge at site for the entire layout where the new work is to be executed. A record of these levels shall be signed jointly by Contractor and the Engineer- in- charge. These records shall be submitted to the Engineer- in- charge and shall be used in deciding the NGL, PL, FFL and measurement of earth work.

8) **Setting out of works:**

The contractor shall set out the works and shall provide & fix all setting out apparatus required and solely be responsible for the true and perfect setting out the same and for correctness of the position, levels, dimensions and alignment of all buildings as per the drawings. The contractor shall take in writing the approval of the Engineer- in- charge for setting out and levels before starting the construction works. These approvals shall be recorded and signed by the Engineer- in- charge and contractor.

A masonry pillar to serve as a bench mark will be erected at a suitable point in the area, which is visible from the largest area. This bench mark shall be constructed and connected with the standard bench mark as approved by the Engineer-in-Charge. Necessary profiles with strings stretched on pegs, bamboos or 'Burjis' shall be made to indicate the correct formation levels before the work is started.

9) **Surface Dressing:**

The surface area to be occupied by the building shall be cleared of all debris, shrubs and plants, grass etc. The roots of trees and saplings shall be removed to a depth of 60cm below ground level or 30 cm below formation level or 15 cm below sub grade level, whichever is lower, and the holes or hollows filled up with the earth, rammed and leveled. All roots and organic material shall be cleared from the filling area inside the building.

10) **Important Note:**

The works mentioned above viz Site clearance, site levels, setting out and Surface dressing are part of contractor scope and shall be done by Contractor without any extra cost or payment from CWC.

However, Major works like or large scale/Dense jungle clearance , Surface excavation, Shifting and /or Cutting of Trees (more than 300 mm dia in girth at height of 1 meter above ground) or any major clearance requiring shifting of CWC stored material, Existing structures and services such as old buildings, culverts, fencing, water supply pipe lines, sewers, power cables, communication cables, drainage pipes etc. within or adjacent to the area etc. , if required to be diverted/removed, shall be diverted/dismantled as per directions of the Engineer-inform site of work, and shall be payable extra as per agreed Bill of quantities and schedule of rates.

11) **Excavation in Trenches and Over Areas:**

- i. All excavation operations manually or by mechanical means shall include excavation and 'getting out' the excavated materials.
- ii. During the excavation the natural drainage of the area shall be maintained. Excavation shall be done from top to bottom. Undermining or undercutting shall not be done.
- iii. In firm soils, the sides of the trenches shall be kept vertical upto a depth of 2 metres from the bottom. For greater depths, the excavation profiles shall be widened by allowing steps of 50 cms on either side after every 2 metres from the bottom. Alternatively, the excavation can be done so as to give slope of 1:4 (1 horizontal: 4 vertical). Where the soil is soft, loose or slushy, the width of steps shall be suitably increased or sides sloped or the soil shored up as directed by the Engineer-in- Charge. It shall be the responsibility of the contractor to take complete instructions in writing from the Engineer-in-Charge regarding the stepping, sloping or shoring to be done for excavation deeper than 2 metres
- iv. The earth work in excavation shall be done as per the required depths, width & length shown in approved Excavation Plan /drawings and in line of site levels and alignments in all sorts of soils as directed by Engineer in charge. Nothing extra, from the dimensions shown in approved excavation plan, shall be payable for excavation done for working space for labor. Only neat line excavation as per drawing shall be payable. Roots or trees met with during the excavation shall be cut and removed. Excavated earth

- shall be stacked at least 3 m away from the trenches or as per the Engineer's instructions, so that it may not damage the sides of the excavated trenches. The sides of the excavated trenches shall be in straightline and bottom uniformly levelled watered, consolidated and ready for termite treatment. The maximum lead for stacking the earth shall be 200 m, unless otherwise categorically specified more in the item description.
- v. Earth work in excavation in any type of soil existing at site for foundations of rafts, columns and walls / half brick walls / from existing ground level shall be as indicated on the drawings. The finish floor level of building shall be as per drawings and shall be approved by the Engineer- in- charge after fixing of same at Site by Contractor. The work shall be executed at site as per the levels approved by the Engineer- in- charge.
  - vi. Immediately after the excavation of the foundation work, concreting therein and before covering the same the record of the levels as actually executed at site shall be recorded in the measurement books and jointly signed and dated by the Engineer- in- charge & Contractor -
  - vii. If trenches or foundations are excavated beyond the specified dimensions due to bad workmanship of contractor, the extra excavation shall be filled with selected good earth ensuring adequate compaction duly watered, consolidated and rammed at the cost of contractor.
  - viii. Explosives of any form shall not be used for any construction activity. Where hard rock is met with and blasting operations are considered necessary, the contractor shall obtain the approval of the Engineer-in-Charge in writing for resorting to blasting operation. In ordinary rock blasting operations shall not be generally adopted. However, the contractor may resort to blasting with the permission of the Engineer-in-charge, but nothing extra shall be paid for such blasting operations.
  - ix. From the date when the Contractor starts work under this contract, or from the required contract date, whichever is earlier, the Contractor shall assume all responsibilities for earth and rock banks. Such responsibility shall continue to the date when all work under the contract is completed and approved by Engineer- in- Charge. The contractor shall provide sheeting, shoring and bracing required for the support of earth and rock banks during construction. Sheeting, shoring and bracing shall be maintained in place until immediately before filling or backfilling then shall be removed by stages as the filling or backfilling progresses. Engineer- in- Charge reserves the right to specify shoring or bracing as may be deemed necessary by them.
  - x. Any settlement or washing away of filled or backfilled areas, and earth and rock banks, that may occur from the action of the elements, or any other cause, prior to acceptance of work, shall be repaired and grades re- established to the required elevations and slopes, at no additional cost.
  - xi. Excavation where directed by the Engineer-in- Charge shall be securely barricaded and provided with proper caution signs, conspicuously displayed during the day and properly illuminated with red lights and/or written using fluorescent reflective paint as directed by engineer in charge during the night to avoid accident.
  - xii. The Contractor shall take adequate protective measures to see that the excavation operations do not damage the adjoining structures or dislocate the services. Water supply pipes, sluice valve chambers, sewerage pipes, manholes, drainage pipes and chambers, communication cables, power supply cables etc. met within the course of excavation shall be properly supported and adequately protected, so that these services remain functional. However, if any service is damaged during excavation shall be restored in reasonable time.
  - xiii. Excavation shall not be carried out below the foundation level of the adjacent buildings until underpinning, shoring etc. is done as per the directions of the Engineer-in-Charge for which payment shall be made separately. Contractor will be responsible if he has not taken precaution for the safety of the people, property or neighbor's property caused by his negligence during the constructional operations or unsafe excavation.
  - xiv. Any damages done by the contractor to any existing work shall be made good by him at his own cost. Existing drains pipes, culverts, overhead wires, water supply lines and similar services encountered during the course of execution shall be protected against damage by the contractor. The contractor shall not store material or otherwise occupy any part of the site in manner likely to hinder the operations of such services.
  - xv. To the extent available, selected surplus spoils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, sulphates, and organic & other foreign material. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of moorum or earth to fill up the voids and the mixture used for filling.
  - xvi. As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches etc. shall be cleared of all debris and filled with earth in layers 15 cm to 20 cm, each layer being watered, rammed and properly consolidated before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer- in- Charge.

- xvii. Trench width in case of excavation in trenches for pipes, cables etc.
- Upto one metre depth the authorized width of trench for excavation shall be arrived at by adding 25 cm to the external diameter of pipe (not socket/ collar) cable, conduit etc. Where a pipe is laid on concrete bed/ cushioning layer, the authorized width shall be the external diameter of pipe (not socket/ collar) plus 25 cm or the width of concrete bed/ cushioning layer whichever is more.
  - For depths exceeding one metre, an allowance of 5 cm per metre of depth for each side of the trench shall be added to the authorized width (that is external diameter of pipe plus 25 cm) for excavation. This allowance shall apply to the entire depth of the trench. In firm soils the sides of the trenches shall be kept vertical upto depth of 2 metres from the bottom. For depths greater than 2 metres, the excavation profiles shall be widened by allowing steps of 50 cm on either side after every two metres from bottom.
  - Where more than one pipe, cable, conduit etc, are laid, the diameter shall be reckoned as the horizontal distance from outside to outside of the outermost pipes, cable, conduit etc.
  - Where the soil is soft, loose or slushy, width of trench shall be suitably increased or side sloped or the soil shored up as directed by the Engineer-in-Charge. It shall be the responsibility of the contractor to take complete instructions in writing from the Engineer-in-Charge regarding increase in the width of trench. Sloping or shoring to be done for excavation in soft, loose or slushy soils.

12) **FILLING**

- i. The excavated stacked earth (other than Black cotton soil or disposable soil as decided by Engineer in charge) shall be filled in trenches, sides of foundations and under floor in layers of 200mm thick and balance shall be disposed off by uniform spreading within the site as directed by the Engineer-in-Charge. The Filling with excavated earth shall be done in regular horizontal layers and all lumps and clods exceeding 8 cm in any direction shall be broken. Each layer shall be watered and consolidated with steel rammer or ½ tonne roller.
- ii. The Selected earth supplied and used for filling shall be free from all roots, grass, shrubs, rank vegetation, brushwood, tress, sapling and rubbish. Sand, supplied for filling shall be clean and free from dust organic and foreign matter and its grading shall be within the limits of grading zone IV or V as specified in Section 3 'Mortars' of CPWD specifications of work.
- iii. In case of filling under floor /open area with excavated available or supplied good earth etc., every third and top must layer shall also be consolidated with power roller of minimum 8 tonnes. Wherever depth of filling exceeds 1.5 metre vibratory power roller shall be used to consolidate the filing unless otherwise directed by Engineer-in-charge. The top and sides of filling shall be neatly dressed. The contractor shall make good all subsidence and shrinkage in earth fillings, embankments, traverses etc. during execution and till the completion of work unless otherwise specified.
- iv. Filling in trenches for foundations, pipes etc shall be commenced soon after the Concrete/Masonry works in foundations etc, joints of pipes, cables, conduits etc. have been tested and passed. The space around the footing, pedestals, foundation masonry, pipes, cables conduits etc. shall be cleared of all debris, brick bats etc. Where the trenches are excavated in hard/ soft soil, the filling shall be done with earth on the side and top of pipes in layers not exceeding 20 cm in depth. Each layer shall be watered, rammed and consolidated. All clods and lumps of earth exceeding 8 cm in any direction shall be broken or removed before the excavated earth is used for filling. In case of excavation trenches in ordinary/ hard rock, the filling upto a depth of 30cm above the crown of pipe, cable, conduits etc. shall be done with fine material like earth, moorum or pulverized/ decomposed rock according to the availability at site. The remaining filling shall be done with boulders of size not exceeding 15cm mixed with fine material like decomposed rock, moorum or earth as available to fill up the voids, watered, rammed and consolidated in layers not exceeding 30cm. Excavated material containing deleterious material, salt peter earth etc. shall not be used for filling. Ramming shall be done with iron rammers where feasible and with blunt ends of crow bars where rammers cannot be used. Special care shall be taken to ensure that no damage is caused to the pipes, Cables, Conduitsetc. laid in the trenches.

13) **Lead**

Lead for deposition/disposal of excavated material, shall be within a lead of 200m unless specifically mentioned in Tender items. The Deposition/disposal shall be as directed by Engineer- in- Charge. Only leads beyond 200m shall be considered as extra lead if not specifically mentioned in tender items and the Contractor shall be paid extra. 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 off shall be divided into suitable blocks and for each of the blocks, the distance between centerlines shall be taken as the lead which shall be measured, as far as practically possible, 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 materials had to be transported over marshy or katcha land/route.

**B. CONDITIONS FOR WATER:**

Contractor shall get the water tested from any laboratory approved by the Engineer-in-charge at regular interval as per the CPWD Specifications. All expenses towards collection of samples, packing transportation except testing charges etc. shall be borne by the contractor.

**C. FORM WORK**

- i. The supply, erection, workmanship, stripping, measurement, and scope of works covered under the rates etc. shall be in general as per CPWD Specifications unless specifically mentioned in tender document.
- ii. Rates in tender items shall be valid for all heights for carrying out Centering, and shuttering for all RCC /PCC works, wall finishing works etc wherever required for construction works in Warehouse and no extra cost shall be paid unless specifically mentioned in tender BOQ.
- iii. Where it is not specifically stated in the description of the item that form work shall be paid for separately, the rate of the RCC item shall be deemed to include the cost of form work.
- iv. No deductions from the shuttering due to the openings/ obstructions shall be made if the area of each openings/ obstruction does not exceed 0.4 square metre. Nothing extra shall be paid for forming such openings.
- v. Only M.S. Centering/shuttering and scaffolding material unless & otherwise specified shall be used to give an even finish of concrete surface. However, marine-ply shuttering in as per site requirement may be used on specific request from contractor to be approved by the Engineer-in-charge.
- vi. Centring and shuttering for all concrete and reinforced concrete wherever required shall be in steel and / or plywood to produce a smooth and uniform finish on all exposed surfaces. However, all props, bracings, scaffolding etc., shall be in steel. The entire responsibility of planning, design, erection and safety of formwork shall lie with the Contractor.
- vii. Extra for shuttering in curved profile: For shuttering curved in elevation the steel/ply shuttering shall be fabricated to achieve the curved profile as per the architectural drawings and nothing extra shall be payable on this account.
- viii. In order to keep the floor finish as per architectural drawings and to provide required thickness of the flooring as per specifications, the level of top surface of RCC shall be accordingly adjusted at the time of its centering, shuttering and casting for which nothing extra shall be paid to the Contractor.
- ix. As per general engineering practice, level of floors in toilets/bath, balconies, shall be kept 12 to 20mm lower than general floor as required. Shuttering should be adjusted accordingly. Nothing extra is payable on this account.

- x. Steel shuttering as approved by the Engineer-in-charge only shall be used by the contractor. Minimum size of shuttering plates shall be 600mm x 900mm except for the case when closing pieces required to complete the shuttering panels. Dented, broken, cracked, twisted or rusted shuttering plates shall not be allowed to be used on the work. The shuttering plates shall be cleaned properly with electrically driven sanders to remove any cement slurry or cement mortar or rust. Proper shuttering oil or de-bonding compound shall be applied on the surface of the shuttering plates in the requisite quantity before assembly of steel reinforcement.
- xi. For the execution of centring and shuttering, the contractor shall use propriety „Reebole” chemical mould release agent of FOSROC or equivalent as shuttering oil as approved by Engineer-in-charge and nothing extra shall be paid on this account.

#### **D. REINFORCEMENT STEEL.**

- i. The TMT bars shall conform to IS 1786 pertaining to Fe 415 D or Fe 500 D or Fe grade of steel as specified in Tender Item/ Drawing.
- ii. In case of Construction in seismic zone III and above, unless specifically mentioned in technical drawings, steel reinforcement of Grade Fe 415 D shall be used. However, high strength deformed steel bars, produced by thermo mechanical treatment process of grade Fe 415, Fe 500 and Fe 550 having elongation more than 14.5. % and conform to other requirements of Fe 415 D, Fe 500 D and Fe 550 D respectively of IS 1786 may also be used for reinforcement.
- iii. The supply, storage at site, assembly, erection, placement in position into formwork, workmanship including bend, hook, overlap, welding, anchoring, cover, testing, acceptable quality parameters and test results, permissible tolerance, measurement, and scope of rates etc. shall be in general as per CPWD Specifications unless specifically mentioned in tender document or Construction Drawings.
- iv. Reinforcement bars shall be placed in position as shown in the drawings or as directed by the Engineer-in-charge. The bars crossing one another shall be tied together at every intersection with two strands of annealed steel wire 0.9 to 1.6 mm thickness twisted tight to make the skeleton of the steel work rigid so that the reinforcement does not get displaced during deposition of concrete.
- v. Tack welding in crossing bars shall also be permitted in lieu of binding with steel wire if approved by Engineer-in-charge.
- vi. Reinforcement including authorized spacer bars and lappages shall be measured in length of different diameter, as actually (not more than as specified in the drawings.) used in the work nearest to a centimeter and their weight calculated on the basis of standard weight given in clause 6.2 of IS 1786 . In case actual unit weight of the bars is less than standard unit weight, but within variation, in such cases weight of reinforcement shall be calculated on the basis of actual unit weight. Wastage and unauthorized overlaps shall not be paid for.
- vii. Annealed steel wire required for binding or tack welding shall not be measured, its cost being included in the rate of reinforcement.
- viii. The contractor shall provide approved type of support for maintaining the bars in position and ensuring required spacing and correct cover of concrete to reinforcement as called for in the drawings, spacer blocks of required shape and size. Chairs and spacer bars shall be used in order to ensure accurate positioning of reinforcement. Spacer blocks shall be cast well in advance with approved proprietary pre-packed free flowing mortars (Conbextra as manufactured by M/s Fosroc Chemicals India Ltd., or equivalent as approved by the Engineer-in-charge at his discretion) of high early strength and same colour as surrounding concrete, Pre-cast cement mortar / concrete blocks / blocks of polymer shall not be used as spacer blocks unless specially approved by the Engineer-in-charge, rate of RCC items is inclusive of cost of such cover blocks.

#### **E. RCC WORK**

- i. All mixed design concrete shall be executed by Concrete Batch Mix Plant of suitable capacity, to be installed by Contractor at site. In special cases RMC shall be allowed by Engineer on written request of the contractor but the RMC should also be from a plant of appropriate capacity. No extra payment shall be allowed on account of Concrete from batch mix plant or RMC.
- ii. In case of Nominal Mix concrete also, weight basis batching shall only be allowed.

- iii. Mixer having arrangement of weighing water for controlling W.C. ratio should only be used in all PCC and RCC works where there is no provision for Ready Mix Concrete in tender items.
- iv. Any cement slurry if added over base surface (or for continuation of concreting) for bond, its cost shall be deemed to have been included in the respective items, unless otherwise, explicitly stated and nothing extra shall be payable nor extra cement considered in the cement consumption on this account.
- v. Unless otherwise specified for the item, the maximum water cement ratio for any grade of concrete shall not be more than 0.5. The contractor shall within 15 days of issue of letter for commencement of the work, submit the mix design for various grades of concrete along with 7 days crushing strength reports and within 40 days submit 28 days crushing strength reports, for the samples for the mix. Nothing extra shall be payable on account of admixing any chemical admixture for achieving any characteristic for the concrete. Concreting shall be commenced only after the approval of the mix design by the Engineer-in-Charge.
- vi. Wherever required the M.S. inserts shall be provided during the casting of RCC / PCC for which nothing extra shall be payable. As far as possible the contractor shall plan that the concreting is carried out during day shift.
- vii. It is important to maintain the water cement ratio constant at its correct value. To this end, determination of moisture contents in both fine and coarse aggregates shall be made as frequently as possible, the frequency for a given job being determined by the Engineer-in-Charge according to weather conditions. The amount of the added water shall be adjusted to compensate for any observed variations in the moisture contents. For the determination of moisture content in the aggregates, IS 2386 (Part 3) may be referred to. To allow for the variation in mass for aggregate due to variations in their moisture content, suitable adjustments in the masses of aggregates shall be made.
- viii. The concrete shall be deposited in its final position in a manner to preclude segregation of ingredients. In deep trenches and footings concrete shall be placed through chutes or as directed by the Engineer-in-Charge. In case of columns and walls, the shuttering shall be so adjusted that the vertical drop of concrete is not more than 1.5 metres at a time.
- ix. The surface which is to receive plaster or where it is to be joined with brick masonry wall, shall be properly roughened immediately after the shuttering is removed, taking care to remove the laitance completely without disturbing the concrete. The roughening shall be done by hacking. Before the surface is plastered, it shall be cleaned and wetted so as to give bond between concrete and plaster.
- x. On the basis of mandatory lab tests, in case of actual average compressive strength being less than specified strength but upto 70% of specified strength, the rate payable shall be in the same proportion as actual average compressive strength bears to specified compressive strength. In case average compressive strength is less than 70% of the specified strength, the work represented by the sample shall be rejected.
- xi. However, on the basis of mandatory field tests, where they prevail, the rates of the work represented by samples showing actual compressive strength less than specified strength shall be worked out as per relevant guideline of CPWD Specifications. In addition, Engineer-in-charge may order for additional tests (see Appendix 'B' of chapter 5 of CPWD Specifications) to be carried out at the cost of contractor to ascertain if the portion of structure where in concrete represented by the samples had been used, can be retained on the basis of these tests. Engineer-in-Charge may take further remedial measures as necessary to retain the structure at the risk and cost of the contractor.
- xii. If at any stage of the work, during or after placing the concrete in the structure the work is found defective such concrete shall be removed and work be done with fresh concrete and adequate rigid forms at the cost of the contractor. The contractor shall be liable to bear the cost for the cement concrete thus dismantled.
- xiii. The construction work shall be done with proper and assured system of curing duly identified areas with dates marked in paint. In hot weather the contractor shall take relevant care to cover the work with wet gunny bags/hessian cloth or use continuous ponding of water on surface so as to keep the surface wet.
- xiv. Hard stone aggregate of different sizes shall be crushed or broken from hard stone conforming to CPWD Specifications for work subject to Para below. Where CPWD Specifications for R.C.C. or any item or work are silent, the provisions of the latest Code of BIS for plain and reinforced cement concrete for general building construction I.S. 456-2000 or the concerned I.S. specifications or Code of practice shall apply.
- xv. When an R.C.C. slab or a flat slab is projected beyond the wall/beam line, the payment for such



projected part of the R.C.C. work shall be made under the corresponding item of R.C.C. slab/flat slab. Payment for centering & shuttering of the projected portion shall also be made under the item of centering & shuttering for the slab/flat slab. Nothing shall be paid for the edge shuttering of the slab/flat slab projection or otherwise. All exposed edges shall be finished as per specifications without extra payment.

#### **F. BRICK WORKS**

- i. Type of the Bricks to be used in Masonry works in foundation and superstructure i.e Common Burnt Clay Bricks/ Fly Ash Lime Bricks / Clay Fly Ash Bricks/ Tile Brick/ Brick Bats Calcium Silicate Bricks/CC Block/AAC Block etc. shall be strictly as mentioned in Tender Item and Construction drawings.
- ii. Unless specifically mentioned in Construction Drawing or Tender Item, Bricks used shall have compressive strength not less than 7.5 MPa. In case bricks of compressive strength 7.5 MPa are not available and the structure is not of load bearing nature, then use of less compressive strength bricks can be relaxed as per CPWD specification, at reduced rate as worked out by the Engineer in-charge.
- iii. All brick Masonry work shall be done with the available size of F.P.S. Bricks. The measurement of the brick work would be done in the multiples of the half brick. Above three bricks, the brick work would be measured as per the actual thickness.
- iv. The 'Modular bricks' shall only be used where use of same is specifically mentioned in the relevant items.
- v. The material Specifications, dimensions, permissible tolerance, testing, acceptable quality parameters, test results, workmanship, erection and placement procedures, measurement of works and scope of works covered under rates etc all in general shall be as per CPWD Specifications with up to date correction slips unless specifically mentioned in tender documents.
- vi. Top courses of all plinths, parapets, steps and top of walls below floor and roof slabs shall be laid with brick on edge, unless specified otherwise. Brick on edge laid in the top courses at corner of walls shall be properly radiated and keyed into position to form cut (maru) corners. Where bricks cannot be cut to the required shape to form cut (maru) corners, cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) equal to thickness of course shall be provided in lieu of cut bricks.
- vii. No deductions or additions shall be done and no extra payment made for the following :  
Where minimum area is defined for deduction of an opening, void or both, such areas shall refer only to opening or void within the space measured.
  - a. Ends of dissimilar materials (that is, joists, beams, lintels, posts, girders, rafters, purlins, trusses, corbels, steps, etc.); up to 0.1 m<sup>2</sup> in section;
  - b. Opening up to 0.1 Sqm in area (see Note);
  - c. Wall plates, bed plates, and bearing of slabs, chajjas and the like, where thickness does not exceed 10 cm and bearing does not extend over the full thickness of wall;
  - d. Cement concrete blocks as for hold fasts and holding down bolts;
  - e. Iron fixtures, such as wall ties, pipes upto 300 mm diameter and hold fasts for doors and windows; and
  - f. Chases of section not exceeding 50 cm in girth.
  - g. Bearing portion of drip course, bearing of moulding and cornice.

**Note:** In calculating area of an opening, any separate lintel or sills shall be included with the size of the opening but end portions of lintel shall be excluded. Extra width of rebated reveals, if any, shall also be excluded.

#### **G. FLOORING**

- i. Final finished flooring with Marble/Granite/Stone/Ceramic/Vitrified/CC etc shall be done in pattern, layout out, sizes, thickness as shown in Construction drawings and Tender items other wise as directed by Engineer in charge.
- ii. The supply, material Specifications, dimensions, permissible tolerance, testing, acceptable quality parameters, test results, workmanship, erection and placement procedures, measurement of works and scope of works covered under rates etc all in general shall be as per CPWD Specifications with up to date correction slips unless specifically mentioned in tender documents.
- iii. Sample of Marble /Granite/Ceramic/Vitrified/CC Tile or any other material to be used in finish floorings shall be got approved by Contractor from Engineer in charge.
- iv. Gang saw cut granite floor slabs.

- v. Wherever the tender schedule provide for mirror polished granite slab flooring using Gang saw cut granite slabs. The size of such gang saw cut granite slabs shall not be less than 1.5m x 2.4m. The granite block shall be gang saw cut using water cutting process. The polishing of the cut stone slabs should be automatic machine polished to highly even surface without any undulations. Manual polished and kerosene cutting process slabs shall not be accepted and shall be rejected.
- vi. Proper gradient shall be given to flooring for toilets, verandah, kitchen, courtyard etc. so that the wash water flows towards the direction of floor trap. Any reverse slop if found, these shall be made good by the contractor by ripping open the floor/grading concrete and nothing extra shall be paid for such rectifications. Slope in Office, warehouse floor shall be as indicated in drawings otherwise as directed by Engineer in charge.
- vii. Final Finish flooring shall be laid over a well prepared base and sub base flooring of material & specifications as mentioned in tender items and shown in Construction Drawings.
- viii. Sub base floor shall be laid over well prepared sub grade.

#### **H. SUBGRADE**

- i. Where the pavement / Warehouse Floor is to be laid on surface obtained after cutting the soil, the sub-grade for pavement shall be prepared as per specifications relevant to item in BOQ for achieving not less than 97% of dry density as per IS : 2720 Part VIII at no extra cost or otherwise as per the procedure mentioned hereafter.
  - The sub-grade shall be excavated to a depth of 0.5 meter, watered and compacted in layers not exceeding 250mm thickness, dressing to required camber and profile and consolidation with vibratory roller of 80 to 100 KN static weight so as to achieve not less than 97% of dry density as per IS : 2720 Part VIII. However, before relaying and compacting the loosened material the surface below this level shall be suitably consolidated as directed by the Engineer but with a minimum six passes of vibratory roller. If the next 15 cm below this level does not have a relative compaction of 90%, it shall be compacted until not less than 95% dry density is obtained. Rate for work of this nature shall be covered in the item of preparation of sub-grade.
- ii. Where the pavement is to be laid on fill and height of proposed fill is less than 0.5 meter, the procedure for sub-grade preparation as mentioned above shall be followed.
- iii. Where the pavement is to be laid on fill and the height of proposed fill is more than 0.5 meter, preparation of sub-grade is not required at these locations, however, in such locations original ground level shall be compacted by rolling as directed by the Engineer as much as possible but with a minimum of six passes of vibratory roller of 80 to 100 KN static weight. No separate payment shall be made for this, as same shall covered in item of earth work in excavation and /or filling.
- iv. **Control Tests on Borrow Material**

Soil suitable for consolidation under O.M.C. conditions should preferably have the following characteristics:

  - Minimum percentage of clay -10%; Liquid limit- 14; Plasticity index-4; Percentage of silt should not exceed-50%; free from Peat, muck and organic soils which are unsuitable.

The Engineer-in-Charge may, however, relax these requirements taking into account availability of materials, cost of transportation and other relevant factors.

#### **I. WBM /WMM**

WBM/WMM wherever to be used as sub base/base course in road/warehouse floor etc. shall be laid in proper gradient, compacted thickness as shown in construction drawings. The supply, stacking, procedure for laying in position, testing, acceptance within tolerance limit, measurement and scope of work covered under rates shall be as per the guideline of relevant CPWD specifications for these works.

#### **J. STRUCTURAL STEEL WORKS IN COLUMN-BEAM FRAMES/ROOF TRUSS/MEZZANINE FLOOR**

- i. The scope of work also includes preparation & submission of shop Drawings/ Fabrication drawings, connection details of joints including all bolted / welded and riveted joints as per

- design and obtaining approval for all the drawings from Engineer in charge. The agency shall prepare all the required shop drawings needed for correct and accurate erection of Steel Structure work. The design shall be strictly in accordance with the "Design Specifications" and building drawings.
- ii. Engineer in charge reserves the right to review any/all or none of the drawings, Review by Engineer in charge shall not relieve the contractor of his responsibility for correct drawing and execution of the works.
  - iii. The Final GFC drawings shall directly adhere to the reviewed comments and general arrangement and shall incorporate all the comments/suggestions given by Department/Engineer In charge without any extra cost to the department and any implication on the time schedule for the completion of the work.
  - iv. If there is any difference in opinion or changes to be made with regard to drawings/specifications as per the recommendation of Engineer in Charge, The Contractor shall agree to be bound by the same without any extra cost.

#### **Specification for steel works**

- i. The work in general shall be carried out as per CPWD specifications and the relevant Indian Standards a list of which are mentioned in the particular specifications.
- ii. The fabrication and erection of the steel members shall be as per General Specification IS : 800 and stipulations contained in the other relevant standards.
- iii. The contractor shall prepare and submit the fabrication drawings, indicating the complete details of all members, detail of joints, weld sizes, length of welds, cleats holes etc. The fabrication work shall be commenced only after the fabrications drawings are approved. A scheme for fabrication and erection of the various members shall also be furnished and got approved. However such approval shall not absolve the contractor for the safety of the structure and its components during fabrication, erection and service.
- iv. The contractor shall submit manufacturer's test certificate for all the material procured by him indicating clearly the identification marks etc. The Engineer-in-charge may get samples of the materials tested for their conformity to the standards. No payments shall be made for the materials, which are used for testing.
- v. Normally Fabrication shall be carried at site of work but To advance the progress, Contractor may do fabrication works at their shop with approval of Engineer in charge. The fabrication shop of the contractor, shall have all facilities required for carrying out the fabrication work.
- vi. The material shall conform to the following specifications.
  - Structural steel rolled sections: IS 2062 Grade „A“ up to 20 mm thickness, IS 2062 Grade „ B“ above 20 mm thickness.
  - Pipes etc. : IS 1161/1233
  - Chequered plates : IS 3502
- vii. Steel sections from the main manufacturers such as SAIL, TISCO, RINL or JINDAL only shall be permitted to be used. **The steel members shall be in single piece end to end without any intermediate joints unless specifically approved by the Engineer-in- charge.** The contractor shall get the name of manufacturer approved before placing the order. The material should be free from defects. If any defect is noticed at the time of manufacturing the same should be rejected. Re-rolled material shall not be permitted.
- viii. Welding materials shall conform to IS : 814 & AWS E 6013 for thickness upto 20 mm and MWSE7018 above 20 mm.
- ix. Bolts and nuts shall be as per IS : 1363 & IS : 1367. Washers shall be as per IS : 2016, IS : 5372 and IS : 5374.
- x. The bending of plates and sections shall be carried out on appropriate machines.
- xi. Cutting may be effected by sheering, cropping, sawing or by gas cutting by mechanically controlled torch. Gas cutting by hand and electric arc cutting shall not be permitted.
- xii. All cut edges shall be ground before they are welded.

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- xiii. The accuracy at contact surfaces and tolerances shall be as per relevant IS standards.
- xiv. Bolt – holes shall be drilled. Enlarging the holes by filling, hand drilling using flame etc. are not permitted.
- xv. The welders qualified as per procedure given in the IS standards shall only be engaged for doing the welding work.
- xvi. The welding procedure as proposed by the contractor shall be got approved in advance from the Engineer-in-charge.
- xvii. The welds shall be subjected to visual examination, mechanical tests on samples, dye penetration tests, other non-destructive tests like radiographic/ ultrasonic tests etc.
- xviii. Internal surfaces of boxed / back-to-back members should be treated with primer.
- xix. The edges of chequered plate shall be made smooth and no burrs or jagged ends shall be left.
- xx. The structural steel required conforming to IS: 2062 shall normally be procured from the main steel producers viz. TATA, SAIL and RINL (Vizag). Tubes to be supplied by Contractor, conforming to IS 1161, shall normally be of Make TATA, APPOLO.
- xxi. In case of difficulties in getting required quantities of materials from the main producers, permission may be given as a special case to procure the materials from the secondary producers having ISI registration by Engineer in charge if the contractors approach the Engineer-in-charge with the efforts made by them in getting the materials with full justification details.
- xxii. Fabricated structural member's viz., columns, beams and purlins along with the base plates and cleats etc. shall be provided with zinc chromate steel primer coating after fabrication unless specifically mentioned otherwise in Tender Items and Specifications.
- xxiii. The quantity of the steel for structural members for the purpose of payment shall be worked out by adopting the unit weight given in the relevant IS code for tubes, angles, Channels, flats and plates etc. If the actual weight of the member is less than that specified in the code beyond the minus tolerance permissible then the materials shall be rejected. Payment on weight basis would be made as per the theoretical or actual weight whichever is less.
- xxiv. Weight of cleats, brackets, packing pieces bolts nuts, washer's distance pieces separators diaphragm gussets (taking overall square dimensions) fish plates etc. shall be added to the weight of respective items unless otherwise specified. No deduction shall be made for skew cuts.

### **K. ADDITIONAL CONDITIONS FOR PRE-FAB STRUCTURE IN STEEL:**

- i. Wherever Tender Items mentioned the Prefab Structures or **Pre-Engineered Building System (PEB)**, The scope of work for **Fabrication, Supply and Erection of Pre-Engineered Building System (PEB)** is as defined in the following sections under the contract which includes manufacture, supply and erection of Structural Steel System and all accessories as per design, drawings and as per direction of Engineer-in- Charge.
- ii. **Condition for Specialized Agency for PEB Structure:**  
In case the Main contractor is himself not a PEB Manufacturer, He will obtain the approval of Engineer in charge for selection and appointing the PEB Manufacturer/Supplier for this contract. The Engineer-in-Charge or his authorized representative shall visit the factory of PEB manufacturer and will grant the approval for Supply of PEB system based on the experience, availability of CNC machines for fabrication, cutting/welding etc and production capacity of the manufacturer. EIC or his representative will also visit the factory of PEB Manufacturer during manufacturing of PEB components for quality checks. The PEB components shall be brought to site from factory only after the satisfactory test results and quality checks as per the direction of Engineer in Charge.
- iii. Before commencement of procurement, the contractor, if mentioned in tender drawings or item specifications, shall make detail design drawings based on models and suggested loading, framed drawings provided by CWC and will prepare fabrication & erection drawings for steel structure and detail fabrication and erection drawings for roofing and cladding indicating the positions of overlap, joints, Louvers, Flashings, cutouts etc. He shall make all drawings available all worksheets/supporting data/design details to Engineer in Charge as so desired. After the

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completion of work, the contractor shall submit to the Engineer-in-Charge. 3 sets of "As Built" drawings along with CAD copies as specified elsewhere.

- iv. The contractor shall clarify to Engineer In Charge any queries regarding specifications, rates, etc as and when requested/ required. Rate of analysis for the rates quoted shall also be furnished by the Tenderer If desired by Engineer In Charge.
- v. **The following are the minimum requirements of tests on welds.**
  - Visual examination: 100%
  - Dye penetration test: 30 % after back gouging and after final finish.
  - Mechanical test: 1 test each on a column and beam members.
  - Radiography test: 2% of welds.

Where radiography test is not possible ultrasonic test shall be carried out. The acceptance criteria shall be as per IS specifications and as decided by the Engineer-in- charge.

- vi. Apart from the IS Codes mentioned above, all other relevant codes such as American standards (AISC, MBMA, AISI & AWS specifications) related to the specific job under consideration and / or referred to in the above-mentioned codes may be followed wherever applicable, if the specifications for the same are not available in the relevant IS codes.
- vii. When Contractor scope of works includes supply of Prefab/PEB structural steel system, NO Fabrication at site shall be allowed except erection works and minor steel works like nonstructural steel works.

### L. DOOR/WINDOWS/VENTILATOR WORKS

- i. The supply of materials viz Rolling Shutters/Mild Steel doors/T sections doors/windows/ Aluminum/UPVC Sections for doors / windows/ ventilators/ partitions, Wooden paneled/ flush doors/ cupboard shutters/ PVC /FRP shutters/ frames/ Pressed steel frames/ all type of fittings/glazing/paneling /decorative polish/veneering/Wire gauge/expanded metal mesh/MS grills/Chqd plate/Handrails etc including their storage at site, procedure of installations, workmanship, testing, acceptance within tolerance limit, measurement and scope of work covered under rates for these works shall be as per relevant CPWD specifications unless specifically mentioned otherwise in tender documents, drawings.
- ii. Wood work shall not be painted, oiled or otherwise treated before it has been approved by the Engineer-in-Charge.
- iii. Aluminum Fittings shall be anodized to natural matt finish or dyed anodic coating not less than grade AC 10 of IS 1868. Mild steel Fittings shall be bright finish black stone enameled or copper oxidized (black finish), nickel chromium plated or as specified. Brass Fittings shall be finished bright satin finish or nickel chromium plated or copper oxidised or as specified.
- iv. All fittings and fixtures of doors, windows, ventilators shall be got approved from the Engineer-in-Charge before procurement well in advance and the approved samples shall be kept at site till completion of the work.
- v. Wooden flush door shutter/ PVC/FRP /Fire rated door shutters, as specified shall be obtained from factories to be approved by the Engineer- in-charge. The contractor shall inform well in advance to the Engineer- in-charge the name and address of the factory where from he intends to get the shutters manufactured. The contractor will place order for manufacturing of shutters only after written approval of the Engineer- in- charge in this regard is given. The contractor is bound to recommend name(s) of another factory from the approved list in case the factory already proposed by the contractor is not found competent to manufacture quality shutters.
- vi. Shutters samples shall be first submitted and got approved by Engineer in charge Shutters will however, be accepted only if they meet the specified tests/technical requirements
- vii. Rolling Shutters: The shaft of rolling shutters shall be of M.S. Pipe heavy duty 40 mm. nominal bore, 48.3 mm outer dia, thickness 4.05 mm and weight of pipe shall be 4.43 Kg./metre. At least three springs made of H.T. steel grade 2 of I.S. 4454/1967 of 27.5 mm. length shall be used in each shutter. The guide channels of minimum 60 mm depth shall be made of 3.15 mm thick M.S. strips Lock rail at bottom shall be of 3.15 mm thickness with M.S. angle 35 mm x 35 mm x 5 mm welded at the bottom and brackets for fixing the M.S. pipe on wall shall be of M.S. plate 3.15 mm thick. Top cover of shutters shall be made out of M.S. Plate 1-25 mm thick sliding bolt for lock rail

shall be made of M.S. flats not less than 50 mm x 6 mm size at both ends with inside and outside locking arrangement. Further details if any not covered by general specifications of Delhi CPWD specifications 2009 Volume I and details described above shall be as per IS specifications No.6248 of 1971/revision (latest)

The contractor shall arrange one more spring than the total required number, for testing purpose. The Engineer-in-Charge shall select at random one spring to be sent for test regarding grade of H.T. steel wire used in the springs. No extra payment shall be made for the additional spring arranged.

The rates to be quoted for supplying and fixing rolling shutter should include making necessary chases in masonry and making good the same for fixing of side guide etc.

## **M. FINISHING**

- i. The work shall be carried out to provide a smooth finish with pleasing appearance in high standards of workmanship and quality of material up to the satisfaction of Engineer in charge.
- ii. The supply of materials for finishing works and their storage, procedure of applications, testing, acceptance within tolerance limit, measurement and scope of work covered under rates for these works shall be as per relevant CPWD specifications unless specifically mentioned otherwise in tender documents, drawings.
- iii. For all exposed brick work or tile work 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. For all other work in buildings, single scaffolding shall be permitted. In such cases the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/columns less than one metre in width or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.
- iv. For external and under coat plaster work, the fine aggregate shall conform to grading IV. For finishing coat Plaster work the fine aggregate conforming to grading zone V shall be used unless specified otherwise.
- v. The plaster shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages at the contractor's expense by such means as the Engineer-in-Charge may approve. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched.
- vi. Wherever scaffolding is necessary for Whitewash /Painting works, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being white washed. Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.
- vii. For White wash /waterproofing cement paint on new work, three or more coats shall be applied till the surface presents a smooth and uniform finish through which the plaster does not show. The finished dry surface shall not show any signs of cracking and peeling nor shall it come off readily on the hand when rubbed. For old work, after the surface has been **prepared**, a coat of white wash/cement paint shall be applied over the patches and repairs. Then a single coat or two or more coats of white wash/cement paint as stipulated in the description of the item shall be applied over the entire surface. The white washed surface should present a uniform finish through which the plaster patches do not appear.
- viii. Distemping: If the wall surface plaster has not dried completely, cement primer shall be applied before distemping the walls. But if distemping is done after the wall surface is dried completely, distemper primer shall be applied. Oil bound distemper is not recommended to be applied, within six months of the completion of wall plaster. However, newly plastered surfaces if required to be distemped before a period of six months shall be given a coat of alkali resistant priming Paint conforming to IS 109 and allowed to dry for at least 48 hours before distemping is commenced.
- ix. The color code and make of Painting material on exterior or interior finish shall be first approved by Engineer in charge. Contractor shall submit all possible combinations, physical samples on size 300x300 mm over wall for approval of color without any extra cost.
- x. The Primer, Synthetic Enamel paint, distemper etc., of as approved by the Engineer- in- charge and of low VOC (unless specified otherwise), shall only be used and brought to the site of work in the

- original sealed containers.
- xi. The material brought to the site of work shall be sufficient for at least 30 days of work.
  - xii. The material shall be kept under the joint custody of contractor and representative of the Engineer-in-charge. The empty containers shall not be removed from the site till the completion of the work without permission of the Engineer-in-charge.
  - xiii. Contractor shall submit the copies of invoices of Painting material purchased by them for incorporation in to the contract works.

**N. WATER SUPPLY, INSTALLATIONS AND DRAINAGE**

- i. The contractor shall furnish all labor, material and equipment, transportation and incidental necessary for supply, installation, testing and commissioning of the complete Plumbing / system as described in the Specifications, Tender Items and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract.
- ii. The Plumbing / Sanitary system shall comprise of following:
  - a. Sanitary and water supply Fixtures and Fittings.
  - b. Internal and External Water Supply.
  - c. Internal and External Drainage
  - d. Approval from Local Authorities
  - e. Balancing, testing & commissioning.
  - f. Test reports and completion drawings
- iii. The contractor shall procure and install all pipes, its fittings, joints/bends/tees /sockets /nipples including shut-off valve etc as specified.
- iv. The contractor shall ensure that senior and experienced plumbers are assigned exclusively for this work. Such plumber(s) should have valid license from the local authorities. The project management shall be done through modern technique. For quality control & monitoring of workmanship, contractor shall assign at least one engineer who would be exclusively responsible for ensuring strict quality control, adherence to specifications and ensuring top class workmanship for the installation.
- v. The work shall be in conformity with the Bye-laws, Regulations and Standards of the local authorities concerned. But if these Specifications and drawings call for a higher standard of materials and / or workmanship than those required by any of the above regulations and standards, then these Specifications and drawings shall take precedence over the said regulations and standards. However, if the drawings and specifications require something which violates the Bye-laws and Regulations, then the Bye-laws and Regulations shall govern the requirement of this installation.
- vi. The contractor shall obtain all permits/ licenses and pay for any and all fees required for the inspection, approval and commissioning of their installation. However, all receipted amount shall be reimbursed on production of proof of payment.
- vii. The Plumbing drawings are to be given by the contractor for obtaining approval from Engineer-in-charge. The Plumbing / Sanitary Drawings given by the Engineer in- Charge or issued with tenders are diagrammatic only and indicate arrangement of various systems and the extent of work covered in the contract. These Drawings indicate the points of supply and of termination of services and broadly suggest the routes to be followed. Under no circumstances shall dimensions be scaled from these Drawings. The contractor shall follow these drawings in preparation of his shop drawings, and for subsequent installation work.
- viii. The contractor shall examine all architectural, structural, plumbing, electrical and other services drawings and check the as-built works before starting the work, report to the Engineer In-Charge any discrepancies and obtain clarification. Any changes found essential to coordinate installation of his work with other services and trades, shall be made with prior approval of the Engineer In-Charge without additional cost to the department.
- ix. All the shop drawings shall be prepared on computer through AutoCAD System based on Architectural drawings and site measurements. Contractor shall furnish, for the approval of Engineer-in-charge, the two sets of detailed shop drawings of complete work and materials including layouts / Typical toilets drawings showing exact location of supports, flanges, bends, tee connections, reducers, detailed piping drawings showing exact location and type of supports, valves, fittings etc; external insulation details for pipe insulation etc.

- x. These shop drawings shall contain all information required to complete the work. These drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all items of equipment, also the details of all related items of work by other contractors. Each shop drawing shall contain tabulation of all measurable items of equipment/materials/works and progressivecumulative totals from other related drawings to arrive at a variation-in-quantity statement at the completion of all shop drawings. Minimum 3 sets of drawings shall be submitted after final approval along with CD. When he makes any amendments in the above drawings, the contractor shall supply two fresh sets of drawings with the amendments duly incorporated along with check prints, for approval. The contractor shall submit further 3 sets of shop drawings to the Engineer In-charge for the exclusive use by the Engineer In-charge and all other agencies. No material or equipment may be delivered or installed at the job site until the contractor has in his possession, the approved shop drawing for the particular material/equipment / installation.
- xi. Shop drawings shall be submitted for approval four weeks in advance of planned delivery and installation of any material to allow the Engineer-in-charge ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved programme.
- xii. Samples of all materials like valves, pipes and fittings etc. shall be submitted to the Engineer In-Charge prior to procurement for approval and retention by Engineer In-Charge and shall be kept in their site office for reference and verification till the completion of the Project. Wherever directed, a mockup or sample installation shall be carried out for approval before proceeding for further installation without any extra cost.
- xiii. Approval of shop drawings shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are approved, said approval does not mean that the drawings supersede the contract requirements, nor does it in any way relieve the contractor of the responsibility or requirement to furnish material and perform work as required by the contract.
- xiv. All materials and equipment shall conform to the relevant Indian Standards and shall be of the approved make and design. Makes shall be in conformity with list of approved manufacturers.
- xv. Balancing of all water systems and all tests as called for the CPWD Specifications shall be carried out by the contractor through a specialist group, in accordance with the Specifications and ASPE / ASHRAE Guidelines and Standards. The installation shall be tested and shall be commissioned only after approval by the Engineer-in-charge. All tests shall be carried out in the presence of the representatives of the Engineer-in-charge and nothing extra shall be payable on this account.
- xvi. The contractor shall submit "completion plans of services" for water supply, internal installations and building drainage work within 15 days of the date of completion. These drawings shall be submitted in the form of two sets of CD's and four portfolios (300 x 450 mm) each containing complete set of drawings on approved scale indicating the work as - installed. These drawings shall clearly indicate complete plant/toilet room layouts, piping layouts and sequencing of automatic controls, location of all concealed piping, valves, controls and other services. In case the contractor fails to submit the completion plans as aforesaid, security deposit shall not be released and these shall be got prepared at his risk and cost
- xvii. The CCI/CI/PVC pipe and GI pipe etc. wherever necessary shall be fixed to RCC columns, beams etc. with rawl plugs and nothing extra shall be paid for this.
- xviii. The variation in consumption of material shall be governed as per CPWD Specification and clauses of the contract to the extent applicable.
- xix. Rates quoted shall be inclusive of all work and items given in the above mentioned specifications and Schedule of Quantities and applicable for the work under floors, in shafts or at ceiling level at all heights and depths. All rates are inclusive of cutting holes and chases in RCC and masonry work and making good the same unless specifically mentioned otherwise. Rates are inclusive of pre testing and on site testing of the installations, materials and commissioning
- xx. **Cleaning and Disinfection of Pipelines:** - On completion of hydraulic tests and before a pipe is disinfected, it shall be proved to be free from obstruction, debris and sediment by scouring or by any other process which the Engineer-in-charge may prescribe. Upon satisfactory completion of testing and cleaning, the pipelines shall be disinfected as order. Chlorine solution shall be applied at the charging point as the pipeline is being filled and dosing shall be continued until the pipeline is full and at least 50 parts of chlorine per million parts of



water have been made available and distributed evenly. If ordinary bleaching powder is used, proportions will 150 gms of power to 1000 litre of water. If a proprietary brand is used, the proportion shall be as specified by the manufacturer. The treated water shall be left in pipeline for a period as directed but not exceeding 24 hours chlorine residual tests shall be taken at various points along the pipeline. The disinfection process shall be repeated until the sample of water taken from the pipeline are declared fit for human consumption by a recognized laboratory.

- xxi. The supply of Input materials and their storage, procedure for laying in position, testing, acceptance within tolerance limit, measurement and scope of work covered under rates for water supply, sanitation, drainage works shall be as per the guideline of relevant CPWD specifications unless specifically mentioned otherwise in tender documents, drawings.

#### **O. CONSTRUCTION & EXPANSION JOINTS**

- i. Construction joints in PCC, RCC and Light Weight Concrete works etc., shall be provided only at places as per approved structural drawings. It shall not in any manner structurally or functionally affect the structure. If, any additional construction joint is required to be provided, it shall be done with approval of the Engineer-in-Charge. The centering, shuttering, strutting etc., required for the construction joint shall be provided as per the CPWD Specifications. Nothing extra shall be payable on this account.

#### **TREATMENT TO THE CONSTRUCTION JOINTS AND RECTIFICATION OF DEFECTS.**

- ii. All care shall be taken to minimize the number of construction joints in the rafts, floors, and walls as well as in the levelling course of PCC at base. Still, wherever the construction joints are provided, these shall be slightly opened up and then suitably filled with cement mortar 1:3 (1 cement: 3 fine sand) after applying a bond coat of cement slurry. The aluminum nipples shall be fixed in the cavity and crevices, if required. Then cement slurry of w/c ratio 0.5 shall be pressure grouted through these nipples as required, which shall then be suitably cut. Nothing extra shall be payable on this account.
- iii. All care shall be taken to avoid any honey combed concrete or any cavity. Still, if any honey combed concrete or cavity in RCC/CC works is encountered the same shall be rectified by removing all loose concrete by chiselling. The chipped concrete surface shall be cleaned and made dust free by blowing compressed air and then washed clean with water (but without excess water). Then a bond coat of polymer modified cement slurry @ 2.2 kg of cement per sq. m. of concrete surface, in two coats, shall be applied as specified. The second coat shall be applied immediately within 15-20 minutes of application of the first coat. A coat of polymer modified cement plaster of mix 1:3 (1 cement: 3 fine sand) of the required thickness shall be applied as specified to fill the cavity if the required thickness is less than 20 mm. If the required thickness is more than 20 mm. the cavity shall be filled by concrete of relevant grade after providing the required centering and shuttering. The surface shall then be moist cured for minimum 7 days. Nothing extra shall be payable on this account.

#### **Expansion Joint**

- i. General Seismic / separation joints shall be provided where shown on the drawings. They shall be constructed with in gap between the adjoining parts for the works of the width specified in the drawings.
- ii. The contractor shall ensure that no debris is allowed to enter and be lodged in seismic and separation joints.
- iii. Seismic or separation joints shall be provided with approved 50mm thickness of compressible filler board, backer rod and polysulphide sealant compound etc.,
- iv. Board to be used in expansion joint shall be of best approved quality and shall be got approved before use. It shall have minimum density of 95 kg/cum, Non staining with less than 1% water absorption and compression recovery of 93% minimum as per the specifications.

### Method of Application

- v. 50mm thick expansion board having sufficient width directed by Engineer-in-charge shall be provided in expansion joint before filling and finishing the expansion joint with sealant.
- vi. The expansion joint shall be cleaned and made dry completely. All loose materials shall also be removed. The joints gap shall be made uniform in width and depth after cleaning the joints. The backup materials of best quality shall be provided in position in order to produce the size of joint i.e. width and depth. The primer part of I and II shall be mixed thoroughly together in required proportion as prescribed by manufacture specification, so that a uniform mixture obtained. The mixed solution shall be applied to two sides of the joint that it covers the sides completely.
- vii. Disturbed edges of RCC members near expansion joints shall be finished with rich mortar without any extra work includes providing required width of expansion board in the joints and measurement of expansion board only shall be taken.

Sampling criteria

Following test carried out at every 100 sqmt.

- (i) Density
- (ii) Water absorption
- (iii) Compression recover

### P. CONSTRUCTION SITE LAB:

- i. The contractor shall arrange and provide at the site of work all the equipments for field testing as required like :-
  - balances, sieves, slump cone , dial gauges,
  - graduated measuring cylinders, steel tapes, vernier calipers, micrometer screw gauges, plumb bobs, spirit levels ,
  - Total station survey equipment, magnifying glass, screw drivers, plastic bags for samples, etc.
- ii. Allowing establishing the site laboratory by the contractor shall not absolve the contractor from fulfilling the criteria of getting the tests done in an independent laboratory. The decision of the Engineer-in-Charge of allowing any test in the site laboratory or any other laboratory shall be final and binding on the contractor and no claim of any kind whatsoever shall be entertained from the contractor on this account.

### Q. OTHER IMPORTANT-MISCELLANEOUS

- (i) Even if the certain items of work are carried out by the specialized sub-contractors the responsibility for the work shall however rest with the main contractor only.  
**Procurement, Storage and Payment of Cement, Steel, Bitumen etc.**
- (ii) The contractor shall procure Portland Pozzolana Cement (PPC) as per IS-1489 Part-I in all the works except Cement Concrete Pavement works, wherein Ordinary Portland Cement (OPC) of Grade 43 (IS:269:2015) and/or 53 Grade (IS: IS:269:2015) shall be used. The PPC & OPC to be used shall be of approved make, as specified in the list of Approved Makes (enclosed with Technical Specifications).
- (iii) The contractor shall procure steel reinforcement bars conforming to IS 1786:2008 pertaining Fe415D or Fe500D, structural steel conforming to IS-808 and bitumen should conform to IS : 702 and 703 as per the item/drawing from manufacturers of approved make, as specified in the list of Approved Makes (enclosed with Technical Specifications).
- (iv) The storage of cement should be done by contractor as per IS:4082-1996 (recommendation on stacking & storage of construction materials at site). Sheds having capacity as decided by Engineer-in-Charge to store the cement shall be provided by contractor for which no extra payment shall be made. All such sheds/store, after

- completion of work shall be removed by contractor at its cost and site shall be cleared.
- (v) Cement & steel reinforcement shall be brought at site in bulk supply of approx. 50 tonnes & 10 tonnes respectively or more or as decided by the Engineer-in-charge. Each bag of cement must weigh 50 kg, subject to variation as per BIS code, bearing manufacturer's name & ISI marking.
  - (vi) The contractor shall be responsible for the watch & ward, safety of the Cement store/shed, Bitumen & Steel. The contractor shall facilitate inspection of the same by the Engineer-in-charge at any time. Materials supplied by the contractor should be in countable position and properly stacked.
  - (vii) Steel reinforcement shall be stored by the contractor at site of work in such a way as to prevent distortion & corrosion and nothing extra shall be paid on this account. Bars of different sizes & lengths shall be stored separately to facilitate easy counting & checking.

For checking nominal mass, tensile strength, bend test, re-bend test etc. specimen of sufficient length shall be cut from each size of the bar at random at frequency not less than that specified below:

Size (dia.) of Bar	For Consignment below 100 T	For Consignment over 100 T
Under 10 mm	One sample for each 25 tonnes or part thereof	One sample for each 40 tonnes or part thereof
10 mm to 16 mm	One sample for each 35 tonnes or part thereof	One sample for each 45 tonnes or part thereof
Over 16 mm	One sample for each 45 tonnes or part thereof	One sample for each 50 tonnes or part thereof

- (viii) Proper daily record of cement, steel, paint and bitumen consumption shall be maintained at site by the Contractor. The register shall be duly signed by the Contractor/authorised representative of contractor and the same will be checked by the Site Engineer / Engineer-in-charge from time to time. In case, concrete is being obtained from RMC plant, record of cement of the same shall be kept, based on the computerized receipt of mix proportion of each lot. Actual issue and consumption of cement & steel on work shall be regulated and proper accounts maintained, as per provision of the Terms and conditions of the contract. The theoretical consumption of cement shall be worked out as per procedure prescribed in Clause 38 of the General conditions of contract and shall be governed by conditions laid therein.
- (ix) Payment for steel reinforcement shall be made on the basis of standard weight of the bars used as per approved drawings. In case weight of bars is more than or less than the standard weight, but within the tolerance limits, as specified in BIS; the payment will be restricted to lesser weight in case of steel having less weight than the specified & standard weight, in case steel having more weight than specified.
- (x) Cement, Steel & Bitumen brought to site and remaining unused after completion of work shall not be removed from site without written permission of the Engineer-in-charge.
- (xi) No claim whatsoever shall be entertained by CWC on account of delay in non-availability of these materials in the market.
- (xii) Cladding of cement and rusting of steel should be avoided to the maximum extent possible. For such cladding of cement and/or rusting of steel, which may render the same unusable, the contractor shall be responsible to make good such quantities, the loss at his own cost.

#### **R. Theoretical Consumption of Material**

After completion of the work and also at any intermediate stage in the event of non-reconciliation of materials issued, theoretical quantity of materials used in the work shall be calculated on the basis and method given hereunder:

- i. Quantity of cement & bitumen shall be calculated on the basis of quantity of cement & bitumen required for different items of work as shown in the Schedule of Rates mentioned in **Schedule I: Appendix-7**. In case any item is executed for which standard constants for the consumption of

cement or bitumen are not available in the above-mentioned schedule or cannot be derived from the same, it shall be calculated on the basis of standard formula, to be laid down by the Engineer-in-Charge.

- ii. Theoretical quantity of steel reinforcement or structural steel sections shall be taken as the quantity required as per design or as authorized by Engineer-in-Charge, including authorized lappages, chairs etc. plus 3% wastage due to cutting into pieces, such theoretical quantity being determined and compared with the actual issues each diameter wise, section-wise and category wise separately.
- iii. Theoretical quantity of G.I. & C.I. or other pipes, conduits, wires and cables, pig lead and G.I./M.S. sheets shall be taken as quantity actually required and measured plus 5% for wastage due to cutting into pieces (except in the case of G.I./ M.S. sheets it shall be 10%), such determination & comparison being made diameter wise & category wise.
- iv. For any other material, as per actual requirements.
- v. For Non-Scheduled items, decision of the Engineer-in-Charge regarding theoretical quantities of materials which should have been actually used, shall be final and binding on the contractor.

Over the theoretical quantities of materials so computed a variation shall be allowed as specified in **Schedule I: Appendix-7**.

## TECHNICAL CONDITIONS AND SPECIFICATIONS FOR ELECTRICAL WORKS

### 1. Tender Drawings and Construction Drawings :

- 1.1 These drawings are meant for Tenderer's guidance only. "Approval for Construction" drawings will be furnished to the contractor during the progress of work to supplement the bid drawings. Construction drawings will be revised and fresh copies issued to the contractor from time to time to incorporate any change to be adopted in the work as per final design to suit any change to be adopted in the work as per final design to suit any condition encountered during the progress of work. Hence, "Approved for Construction" drawings will be furnished progressively during the progress of work, broadly conforming to construction schedule.
- 1.2 HT/LT main panel, other major equipments, other Distribution Board drawings and cable route shall be submitted by the contractor for approval of CWC / Consultant before starting fabrication, manufacture.
- 1.3 Details shown either on the drawings or stated in the Specification shall prevail upon drawings in case of doubts. However, in case of ambiguity, the more stringent shall be applicable.
- 1.4 **Conformity to IE Act, IE Rules and Standards:** All Electrical works shall be carried out in accordance with the provisions of Indian Electricity Act, 2003 and Indian Electricity Rules, 1956 amended up-to-date (date of call of tender unless otherwise specified).

### 1.5 Earthing

Earthing shall be carried out as per IS rules 3043 code of practice for earthing with latest amendments and as per specification and site requirement.

### 2. Guarantee

The tenderer shall guarantee the equipments offered for satisfactory performance for a period of 12 months from the date of commissioning and handing over the installation to the employer against defects arising out of faulty design, material & workmanship. The tenderer should make good all the defects free of costs during the guarantee period and replace or repair the defective equipments/parts free of cost promptly and satisfactorily.

### 3. Inspection & Testing

The purchase representative shall be free to visit the manufacturer's work at all reasonable times to witness and inspect the testing of equipments. It is the duty of the tenderer to see all the equipments supplied are tested as per relevant IS/BS specifications. The contractor shall furnish three copies of manufacturer's test certificate for the routine and type test conducted on the equipments offered. If necessary the contractor shall arrange to conduct all the routine tests at the manufacturer's premises in presence of CWC representative. On receipt of the equipments/materials at site, the tenderer shall offer equipments/materials for inspection of electrical engineer and get approved before installation.

### 4. Pre-Commissioning Tests of Equipment

HT/LT switchgear, Transformer LT cables and DG set shall be subjected to the pre-commissioning tests as per approved Performa by employer. The pre-commissioning test report shall be sent to the Consultant/CWC for approval for electrical installation/license for release-sanctioned load.

### 5. Approval of Drawings

The drawings for HT Panels and LT Panels, High Mast, DG set and cable layout shall be offered by the tenderer for approval of CWC and manufacturing/laying of these items can be taken in hand only after approval of the drawings by CWC. The tenderer shall also supply three copies of approved drawings for LT switchgear and transformers (both the dimensional and schematic) along with 3 copies route drawings & earthing positions etc.

6. The contractor shall provide all kinds of facilities for inspection of the works by the Engineer of CWC.

**Volume II : Schedule II- Appendix -IV (Technical specifications of works)**

7. The electrical work shall conform to CPWD General Specifications for external with up-to-date amendments and for internal electrification works with up-to-date amendments.

7.1 The electrical works other than internal & external electrification like DG Set, Substation, High Mast, Fire Detection & Alarm system, Heating, Ventilation & Air Conditioning System (HVAC) and Lifts & Escalators shall conform to latest CPWD's General Specifications with up-to-date amendments.

**8. Liaisoning / Approval Work with Statutory Authorities**

**It will be responsibility of the contractor to do liaisoning work for obtaining necessary approvals / clearances for electrical load sanction and power supply connection etc. to energizing the terminal, the statutory charges as per the State Electricity Board demand note will be paid by the CWC.**

**MINIMUM TECHNICAL SPECIFICATION OF ELECTRICAL LUMINAIRES –**

<b>Sr. No.</b>	<b>Item description</b>	<b>Specification</b>	<b>Required rating</b>
1	LED High Bay light fixture	Input voltage	220V AC +- 5%, Single phase
		Power factor	0.9 or more
		System lumen efficacy	110 Lm/watt or more
		Correlated Color Temperature (CCT)	5000K - 6500K
		Color Rendering Index (CRI)	70 or more
		Total Harmonic Distortion (THD)	20% or less
		Optics	Integrated optics having high spread beam angle of 90 degree or more
		Electrical Protection	surge voltage
		Housing	Pressure die cast aluminium housing with heat resistant toughened glass cover and efficient heat sinking material
		Ingress Protection	IP 65 or greater
		Mounting	Roof mounting with single point mounting arrangement with eye bolt or J-Hook. All items required for mounting to be supplied by the party
		Driver	Constant current output integrated driver built into fitting/fixture and should be field replaceable
2	LED flood light fixture	Input voltage	220V AC +- 5%, Single phase
		Power factor	0.9 or more
		System lumen efficacy	110 Lm/watt or more
		Correlated Color Temperature (CCT)	5000K - 6500K
		Color Rendering Index (CRI)	70 or more
		Total Harmonic Distortion (THD)	20% or less
		Optics	Integrated optics having high spread beam angle of 90 degree or more
		Electrical Protection	surge voltage

**Volume II : Schedule II- Appendix -IV (Technical specifications of works)**

		Housing	Pressure die cast aluminium housing with heat resistant toughened glass cover and efficient heat sinking material
		Ingress Protection	IP 65 or greater
		Mounting	Truss mounting with clamp, or, wall mounting with fastener. All items required for mounting to be supplied by the party
		Driver	Constant current output integrated driver built into fitting/fixture and should be field replaceable
3	LED Street Light	Operating voltage	140 V - 270 V, AC Single phase
		Power factor	0.9 or more
		System lumen efficacy	110 Lm/watt or more
		Correlated Color Temperature (CCT)	5000K - 6500K
		Color Rendering Index (CRI)	70 or more
		Total Harmonic Distortion (THD)	20% or less
		Optics	High efficiency polycarbonate UV stabilized cover with Integrated lens having high spread beam angle of 90 degree or more
		Electrical Protection	Output open/ short circuit protection, phase to phase protection, over voltage protection, 10 KV surge voltae protection
		Housing	Pressure die cast aluminium housing with efficient heat sinking material
		Ingress Protection	IP 65 or greater
		Mounting	GI Pole mounting
		Driver	Constant current output integrated driver built into fitting/fixture and should be field replaceable
4	LED Wellglass light	Operating voltage	140 V - 270 V, AC Single phase
		Power factor	0.9 or more
		System lumen efficacy	100 Lm/W or more
		Correlated Color Temperature (CCT)	5000K - 6500K
		Color Rendering Index (CRI)	70 or more
		Total Harmonic Distortion (THD)	10% or less
		Optics	High efficiency polycarbonate UV stabilized cover with Integrated lens having high spread beam angle of 90 degree or more
		Electrical Protection	Output open/ short circuit protection, phase to phase protection, over voltage protection, 10 KV surge voltae protection

**Volume II : Schedule II- Appendix -IV (Technical specifications of works)**

		Housing	Pressure die cast aluminium housing with efficient heat sinking material
		Ingress Protection	IP 65 or greater
		Mounting	GI Pole mounting
		Driver	Constant current output integrated driver built into fitting/fixture and should be field replaceable
5	LED Bulb/lamps/ batten	Wattage	As mentioned in schedule
		Frequency	50 Hz
		Operating temperature	0-35 degree Cel.
		Color Rendering Index (CRI)	80
		Color Temperature	Shall be as per instruction of Engineer-in-charge
		Rated lumen efficacy	90 Lm/Watt (for Warm lights) 95 Lm/Watt (for Cool lights)
		Base cap (in case of lamps)	E27/E40/B22 (as required)
		Voltage withstanding range	140-270 V
		In built surge protection	3.0 KV (for lamp/bulb) 2.5 KV (for batten)
		BEE Rating (for lamps)	3 star
6	LED Recessed panel/ downlight	Wattage	As mentioned in schedule
		Frequency	50 Hz
		Operating temperature	-10 to 45 degree Cel.
		Color Rendering Index (CRI)	80
		Color Temperature	Shall be as per instruction of Engineer-in-charge
		Rated lumen efficacy	110 Lm/Watt
		Voltage withstanding range	140-270 V
		In built surge protection	Yes
		LED Driver	Electronic
		Housing	CRCA Powder coated
		Size	As per instructions of Engineer-in-charge
7	LED round recessed light	Wattage	As mentioned in schedule
		Frequency	50 Hz
		Operating temperature	0-35 degree Cel.
		Color Rendering Index (CRI)	80
		Color Temperature	Shall be as per instruction of Engineer-in-charge
		Rated lumen efficacy	100 Lm/watt
		Voltage withstanding range	140-270 V
		In built surge protection	Yes
		Housing	Round aluminium Powder coated white with Pressure Die cast housing
		Size	As per instructions of Engineer-in-charge



**List of Approved Makes**

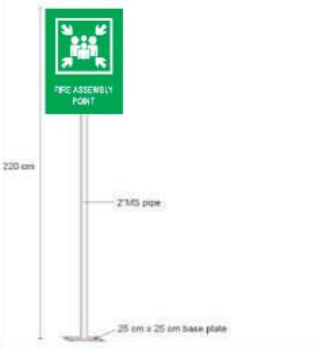
















**Civil /Electrical Work Item**

- **Items of make as approved by CWC /CE and notified list time to time and enclosed in Appendix be considered applicable in this contract.**

**Note:**

- The brands /make mentioned in such above list shall be used & incorporated in work instead of any other but in case these make are not available in local city/distt/state etc then Contractor may use other make with prior approval of Engineer. Unapproved Brand/Make shall not be accepted.
- Items that are not covered in the such above list and are required for execution shall be procured with the approval of Engineer.
- The decision of Engineer be final and binding on the contractor in this respect.

**Indicative list of signage in CW Complex**

<p>1.8 mm aluminum powdercoated panel with vinyl graphics fixing on 2.4MS pipe with base plate Size : 50 cm x 70 cm</p> 	<p>vinyl graphics Only Size : 30 cm x 45 cm</p> 	<p>3 mm thick ACP Panel with vinyl graphics Size : 30 cm x 45 cm</p> 	<p>1.8 mm aluminum powdercoated panel with vinyl graphics Size : 40 cm x 60 cm</p> 
<p>3 mm thick ACP Panel with vinyl graphics Size : 40 cm x 60 cm</p> 	<p>3 mm thick ACP Panel with vinyl graphics Size : 30 cm x 45 cm</p> 	<p>3 mm thick ACP Panel with vinyl graphics Size : 40 cm x 30 cm</p> 	<p>1.8 mm aluminum powdercoated panel with vinyl graphics Size : 60 cm x 100 cm</p> 
<p>3 mm thick ACP Panel with vinyl graphics Size : 50 cm x 15 cm</p> 	<p>3 mm thick white acrylic Panel with vinyl graphics Size : 30 cm x 10 cm</p> 	<p>1.8 mm aluminum powdercoated panel with vinyl graphics Size : 30 cm x 30 cm</p> 	
<p>1.8 mm aluminum powdercoated panel with Reflective vinyl graphics Size : 45 cm x 45 cm</p> 	<p>1.8 mm aluminum powdercoated panel with vinyl graphics Size : 30 cm x 15 cm</p> 	<p>vinyl graphics Only Size : 30 cm x 15 cm</p> 	
<p>vinyl graphics Only Size : 30 cm x 15 cm</p> 	<p>1.8 mm aluminum powdercoated panel with vinyl graphics Size : 40 cm x 30 cm</p> 	<p>3 mm thick ACP Panel with vinyl graphics Size : 40 cm x 30 cm</p> 	



### WAREHOUSE SAFETY





Contact: 9818100883 DELHI Sadar Bazar www.vsgsignage.com




Contact: 9818100883 DELHI Sadar Bazar www.vsgsignage.com







Contact: 9818100883 DELHI Sadar Bazar www.vsgsignage.com



# Fire action

Any person discovering a fire

- 1 Sound the alarm.
- 2   to call fire brigade.
- 3 Attack the fire if possible using the appliances provided.

On hearing the fire alarm

- 4 Leave building by   route.
- 5 Close all doors behind you.
- 6 Report to assembly point.



Do not take risks  
Do not return to the building for any reason until authorised to do so.

Do not use lifts.

**SITE ORDERS BOOKS**

NAME OF WORK \_\_\_\_\_  
 DATE OF COMMENCEMENT / PERIOD FOR COMPLETION \_\_\_\_\_

SL	REMAKRS OF THE INSPECTING OFFICER OR CONTRACTOR	ACTON TAKEN AND BY WHOM	REMARKS
1	2	3	4

**HINDRANCE REGISTER**

SL	Nature of Hindrance	Items of Work that Could Not be Executed Due to this Hindrance	Date of Start of Hindrance	Date of Removal of Hindrance	Over-Lapping Period if any	Net Hindrance in Days	Sign of AE	Weightage of the Hindrance	Net Effective Days of Hindrance	Sign of EE	Remarks of Reviewing Officer
1	2	3	4	5	6	7	8	9	10	11	12

**MATERIAL AT SITE ACCOUNTS**

- ❖ Region \_\_\_\_\_
- ❖ Name of Work \_\_\_\_\_
- ❖ Name of Article \_\_\_\_\_
- ❖ Estimate Requirements \_\_\_\_\_
- ❖ Issue Rate \_\_\_\_\_

SL	Date of Receipt	Received From	Unit	Qty. Received	Progressive Received Qty.	Date of Issue	To Whom Issued	Qty. Issued	Progressive Issued Qty.	Balance	Remarks
1	2	3	4	5	6	7	8	9	10	11	12



**CEMENT REGISTER**

Date of Receipts	Quantity Received	Progressive Recd. Quantity	Date of Issue	Quantity Issued	Items of Work For Which Issued	Quantity Returned at the End of The Day	Total Issue	Progressive Total	Daily Balance at Hand	Contractor's Initial	Site Engineer's Initial	Remarks of AE/EE at Periodical Checks
1	2	3	4	5	6	7	8	9	10	11	12	13

REGISTER FOR RECORDING LEVELS

SL	Changes	Back Sight	Intermediate Sight	Fore Sight	Height of the Instrument	Reduced Level	Remarks
1	2	3	4	5	6	7	8



REGISTER FOR SLUMP TEST

SL	Date of Testing	Item of Work & Location	Vibrator Used Yes/No	Quantity of Water Added per Bag of Cement (Litre)	Height of Specimen After Removal of Mould (mm)	Slump (mm)	Acceptability of Result or Action Taken	Sign of Site Engineer With Date	Sign. of Contractor With Date	Remarks
1	2	3	4	5	6	7	8	9	10	11

**APPENDIX T-VIII**

**SAMPLE REGISTER**

Material & Identification Mark	No. of Samples Collected	Sl. No. of Sample	Place From Where Sample Collected	Qty. of Work/Lot Represented By Each Sample	Test	Field /Lab	Letter No. & Date By Which Sample Sent For Testing	Signature of Official Drawing Sample	Signature of the Contractor	Reference for the Results Received	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

**REGISTER FOR PARTICLE SIZE DISTRIBUTION FOR COARSE AGGREGATE & FINE AGGREGATE**

SL	Date	Weight of Sample (Gram)	Size of Sieves	Weight Retained on Each Sieve	%Age of Weight Retained	Cumulative %Age of Weight Retained	%Age of Weight Passing	Specified %age of Weight Passing	Sign. of Contractor With Date	Sign. of Site Engineer With Date	Remarks / Action Taken
1	2	3	4	5	6	7	8	9	10	11	12

Note : Size of Sieve should be as per CPWD Manual / BIS Specifications

**PHYSICAL WEIGHMENT REGISTER**

**Tor Steel Bars / Truss Members / Other Misc. Items**

SL	Date	Description of Sample	Actual Weight perUnit	Theoretical Weight perUnit	Actual Thickness (Outer Dia.)	Theoretical Thickness (Outer Dia.)	Remarks Accepted /Rejected	Initials of Site Engineer	Contractor Signature
1	2	3	4	5	6	7	8	9	10

**Volume II : Schedule II- Appendix -IV (Technical specifications of works)**

									1	SL
									2	Date of Collection
									3	Grade of Mix
									4	Mark of Specification
									5	Date of Testing
									6	Load in KN
									7	Compressive Strength (KN/mm <sup>2</sup> )
									8	Average Compressive Strength (KN/mm <sup>2</sup> )
									9	Date of Testing
									10	Load in KN
									11	Compressive Strength (KN/mm <sup>2</sup> )
									12	Average Compressive Strength (KN/mm <sup>2</sup> )
									13	Required Specified Strength
									14	Approx. Qty. Represented By Specimen
									15	Item of Work from Where the Sample is Collected
									16	Sign. of Site Engineer With Date
									17	Contractor's / Contractor's Rep. Sign. With Date

**CUBE TEST**

**APPENDIX T-XI**



						1	SL
						2	Location (C.H.) / Area Represented by the Test
						3	Core Cutter Nos.
						4	Weight of Core Cutter + Weight of Soil (gram) (W1)
						5	Weight of Empty Core cutter (gram) (W2)
						6	Weight of Wet Soil (gram) $W = W1 - W2$
						7	Volume of Core Cutter (in CC) V
						8	Bulk Density (gram/cc) $W3 = W/V$
						9	Moisture Content of compaction layers (M)
						10	Dry Density gram/cc $W4 = W3 / (1 + M)$
						11	Degree of compaction $W4/W5$
						12	Acceptability Limit
						13	Sign. of Site Engineer with Date
						14	Contractor / Contractor's Representative Signature with Name & Date

MDD As Per Lab. Test W5

Density Test by Core Cutter Method

APPENDIX T-XII

**TEST FOR THICKNESS AND DENSITY OF THE COMPACTED LAYER**

(BY SAND REPLACEMENT METHOD)

**For Asphalt Concrete / Bitumen Macadam / CC Pavement**

**APPENDIX T-XIII**

Lab Test Density in gm/CC \_\_\_\_\_

1	SL																		
2	Date of Test																		
3	Qty. Represented by the Test																		
4	Location of Holes																		
5	Thickness of Layer	Individual l(mm)																	
6		Average e(mm)																	
7	A Gm	Weight of Materials Removed from the Carpet Hole																	
8	W Gm	Initial Weight of Sand taken in Cylinder																	
9	W1 Gm	Weight of Sand Filling in Cone of Cylinder																	
10	W2 Gm	Weight of Sand Remaining in Cylinder																	
11	d gm/CC	Predetermined Bulk Density of Sand																	
12	gm/CC	Density = $\frac{A*d*W}{W1+W2}$																	
13	Remarks / Acceptability																		
14	Sign. of Site Engineer																		
15	Contractor / Contractor's Representative Signature with Name & Date																		
16	Action Taken																		

				1	SL
				2	Date of Test
				3	Qty. Represented by the Test
				4	Location of Holes
				5	Individual
				6	Average
				7	(W) gm
				8	(Y)
				9	(W1)
				10	(W2)
				11	(W3) = W1-W2
				12	(W4)
				13	W5 = (W3-W4)
				14	(W7) = W5/W6
				15	(W8) = W/W7
				16	(W9) = W8/Y
				17	W9/W10 x 100
				18	W9/W10 x 100
				19	Sign. of Site Engineer with Date
				20	Contractor's / Contractor's Representative Signature with Name & of Date
				21	Action Taken

**DENSITY TEST REGISTER FOR SOIL - BY SAND REPLACEMENT METHOD**

**APPENDIX T-XIV**

Wt. of Standard Sand in gram/cc (W6) = \_\_\_\_\_  
 Unit Lab Test MDD in gram/cc (W10) = \_\_\_\_\_



**APPENDIX T-XVI**

**ROAD ROLLER REGISTER**

SL	Date	Period		Hours	Description of Item Rolled	Qty. of Area Rolled	Theoretical Qty. / Area to be Rolled	Signature of Site Engineer	Signature of Contractor	Remarks
		From	To							
1	2	3	4	5	6	7	8	9	10	11

**REGISTER FOR DISMANTLED MATERIAL**

Name of Work \_\_\_\_\_

Name of Division \_\_\_\_\_

SL	Date of Receipt	Ref. to No. & Page of MB	Full Particulars of Material giving Size etc. if any	Opening Balance	Qty. Recd.	Total	Ref. to its Disposal Whetherby Write off Sale of Transfer to Other Works	Qty. Issued or Disposed off	Closing Balance	Dated Initial of the Site Engineer	Date of Verification of Balance by Whom Verified	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13

**APPENDIX T-XVIII**

**REGISTER FOR BULKING OF SAND**

SL	Date Of Testing	Particulars of Work Represented by Sample	Qty. of Lot/Qty. of Material	Height of Dry Sand (X)	Height of Sand after Mixing Water (Y)	Bulking of Sand $(\frac{X}{Y}-1) \times 100$	Action Taken for Bulkage	Signature of Site Engineer	Signature of Contractor	Remarks
1	2	3	4	5	6	7	8	9	10	11

**BILL PROFORMA**  
{On Letter Head Of Contractor}

Name of Work \_\_\_\_\_ Date of Start \_\_\_\_\_

Agreement No. \_\_\_\_\_ Due Date of Completion \_\_\_\_\_

Date of Preparation of Bill \_\_\_\_\_

Details of Service Provider	Details of Service Receiver
-----------------------------	-----------------------------

Name _____	Name _____
Address _____	Address _____
City _____	City _____
State _____	State _____
State Code _____	State Code _____
GSTIN _____	GSTIN (if Registered) _____

Invoice Serial No. \_\_\_\_\_ HSN \_\_\_\_\_

Date of Invoice \_\_\_\_\_ Description of Services \_\_\_\_\_

SL	Item No.	Description of Items	Unit	Qty. as per Agt.	Rate as per Agt.	Qty. as per Pre. Bill	Qty. as per this Bill	Cumulative Qty.	Amt. as per Previous Bill	Amt. as per this Bill	Cumulative Amount
1.											
								Total			
								Grand Total			

Total Invoice Value (in figures) Total Invoice Value (in words)  Amount of Tax Subject to reverse Charge : Nil	Total Taxable Value		
	Tax	Rate	
	CGST	____%	
	SGST	____%	
	IGST*	____%	
Total Invoice Amount			

Signature \_\_\_\_\_ Name of the Signatory \_\_\_\_\_

Designation / Status \_\_\_\_\_



LIST OF MANDATORY TESTS- CWC Field Quality Plan

SL	Description of Material	Test	Ref. of IS Code/Specs for Testing	Field / Laboratory Test	Frequency of Testing
1.	<b>Cement</b> (Approved Brand)	Physical & Chemical Properties	IS : 4031	Lab	Initial Test-01 test for each brand of cement. Subsequently, 01 test for 200 MT or part thereof for each brand. Cement should be of approved brand and each lot should be accompanied by manufacturer's test certificates
2.	<b>Reinforcement Steel</b> (Approved Brand)	Physical & Chemical Properties	IS :1786	Lab	Initial Test-01 test for each brand and each dia of reinforcement steel , Subsequently - One test for every 25/35/45 MT or part thereof (As specified in Special condition of Contract Para 6.7) ReinforcementSteel should be of approved brand and each lot should be accompanied by manufacturer's test certificates
3.	<b>Water</b>	PH Value, Chlorides, Sulphates, Alkalinity Test, Acidity Test, Suspended Matter, Organic Matter and Inorganic Matter	IS:3025	Lab	Initial Test- Source approval at commencement of work and Subsequently- every six months or change of source.
4.	<b>Coarse Aggregate - Building Works</b>	Gradation	IS 2386 – I	Field / Lab	Minimum one test for every 50 cum or part thereof.
		Deleterious Material	IS 2386 – II	Field / Lab	
		Specific Gravity	IS 2386 – III	Field / Lab	
		Crushing Value	IS 2386 – IV	Field / Lab	
		Impact Value	IS 2386 – IV	Field / Lab	
		10% Fine Value	IS 2386 – IV	Field / Lab	
5.	<b>Fine Aggregate - Building Works</b>	Organic Impurities	Appendix 'A' of Chapter 3, CPWD Specifications	Field	Minimum one test for every 50 cum or part thereof.

SL	Description of Material	Test	Ref. of IS Code/Specs for Testing	Field / Laboratory Test	Frequency of Testing
		Silt Content	Appendix 'C' of Chapter 3, CPWD Specifications	Field	
		Bulking of Sand	Appendix 'D' of Chapter 3, CPWD Specifications	Field	
		Gradation	Appendix 'B' of Chapter 3, CPWD Specifications	Field / Lab	
6.	<b>Coarse Aggregate - Road, Pavement Works</b>	Gradation	IS 2386 – I	Field / Lab	One test for everyday's work
		Flakiness and Elongation Index	IS 2386 – I	Field / Lab	Once for each source of supply and subsequently on monthly basis
		Deleterious Material	IS 2386 – II	Lab	Once for each source of supply and subsequently on monthly basis
		Water Absorption	IS 2386 – III	Lab	Once for each source of supply and subsequently on monthly basis
		Los Angeles Abrasion Value/Aggregate Impact Value	IS 2386 – IV	Lab	Once for each source of supply and subsequently on monthly basis
		Soundness	IS 2386 – V	Lab	Before approving the aggregates and every month subsequently.
		Alkali aggregate reactivity	IS 2386-VII, IS:456	Lab	Before approving the aggregates and every month subsequently.
7.	<b>Fine Aggregate - Road, Pavement Works</b>	Gradation	IS 2386 – I	Field / Lab	One test for everyday's work.
		Deleterious material	IS 2386 – II	Lab	Once for each source of supply and subsequently on monthly basis.
		Water Absorption	IS 2386 – III	Lab	Once for each source of supply and subsequently on monthly basis.
		Silt Content	Appendix 'C' of Chapter 3, CPWD Specifications	Field	Once for each source of supply and subsequently on monthly basis.

**Volume II : Schedule II- Appendix -IV (Technical specifications of works)**

SL	Description of Material	Test	Ref. of IS Code/Specs for Testing	Field / Laboratory Test	Frequency of Testing
8.	<b>Slump Test - Building Works</b>		Appendix 'D' of Chapter 4, CPWD Specifications	Field	Minimum one test for every 20 cum of concrete or part thereof
9.	<b>Slump Test - Pavement Works</b>		IS 1199	Field	One test per each dumper load at both Batching Plant Site and Paving Site initially when work starts. Subsequently, sampling may be done from alternate dumper.
<b>10.</b>	<b>Cube Test</b>				
(i)	Reinforced Cement Concrete - Building works	7 days and 28 days Compressive Strength	IS 516	Lab	One sample of six cubes for every 50 cum or part thereof
(ii)	Pavement Quality Concrete (PQC) - Pavement Work	Compressive Strength, Flexure Strength	IS 516	Lab	2 cube set samples and 2 beam set samples per 150 cum or part thereof for each day production.
<b>11.</b>	<b>Earthwork</b>				
	Control Test on Borrow Pits	Gradation	IS 2720 -IV	Lab	One or two tests per 8000 cum
		Plasticity	IS: 2720-V	Lab	
		Proctor Test	IS 2720- VIII	Lab	
		Maximum Dry Density / OMC	IS 2720-VIII	Lab	
		Deleterious Content		Lab	As and when required by Engineer
		Moisture Content	IS 2720-II	Lab	250 cum
	Embankment under (OMC Conditions)	Field Density	IS 2720-XXVIII		250 cum
		Moisture Content	IS 2720-II		250 cum
<b>12.</b>	<b>Granular Sub-Base</b>	Gradation	IS 2386-I	Field / Lab	Minimum 1 test per source and additional test after every 1000 cum
		Water Absorption	IS 2386-III	Lab	Minimum 1 test per source and additional test as required by Engineer

**Volume II : Schedule II- Appendix -IV (Technical specifications of works)**

SL	Description of Material	Test	Ref. of IS Code/Specs for Testing	Field / Laboratory Test	Frequency of Testing
		Wet Aggregate Impact Value test (if WA > 2%)	IS 5640	Lab	As required by Engineer
		Aggregate Impact Value	IS 2386-IV	Lab	Minimum 1 test per source and additional test after every 2000 cum
		Atterberg's Limit	IS 2720-V	Lab	Minimum 1 test per source and additional test after every 1000 cum
		Maximum Dry Density / OMC	IS 2720-VIII	Lab	Minimum 1 test per source and additional test as required by Engineer
		Moisture Content prior to compaction	IS 2720-II	Field	Minimum 1 test every 400 cum
		Field Density	IS 2720-XXVIII	Field	one test per 2000 Sqm or part thereof
		Deleterious Material	IS 2720-XXVII	Lab	Minimum 1 test per source and additional test as required by Engineer
		CBR	IS 2720-XVI	Lab	Minimum 1 test per source and additional test as required by Engineer
<b>13.</b>	<b>Water Bound Macadam</b>	Gradation	IS 2386-I	Field / Lab	Minimum 1 test per source and additional test after every 500 cum
		Aggregate Value or Aggregate Impact Value	IS 2386-IV or IS5640	Lab	Minimum 1 test per source and additional test after every 500 cum
		Combined Flakiness	IS 2386-I	Lab	Minimum 1 test per source and additional test after every 500 cum
		Los Angles	IS 2386-IV	Lab	Minimum 1 test per source and additional test after every 500 cum or part thereof
<b>14.</b>	<b>Wet Mix Macadam</b>	Gradation	IS 2386-I	Field / Lab	Minimum 1 test per source and additional test after every 500 cum
		Water Absorption	IS 2386-III	Lab	Minimum 1 test per source and additional test as required by Engineer

**Volume II : Schedule II- Appendix -IV (Technical specifications of works)**

SL	Description of Material	Test	Ref. of IS Code/Specs for Testing	Field / Laboratory Test	Frequency of Testing
		Soundness (if WA > 2%)	IS 2386-V	Lab	As required by Engineer
		Atterberg's Limit of Portion of Aggregate Passing 425 micron Sieve	IS 2720-V	Lab	Minimum 1 test per source and additional test after every 500 cum or part thereof
		Aggregate Impact Value	IS 2386-IV or IS 5640	Lab	Minimum 1 test per source and additional test after every 500 cum
		Maximum Dry Density / OMC	IS 2720-VIII	Lab	Minimum 1 test per source and additional test as required by Engineer
		Combined Flakiness and Elongation Indices	IS 2386-I	Lab	Minimum 1 test per source and additional test after every 500 cum
		Moisture Content	IS 2720-II	Field	Minimum 3 tests per day
		Field Density	IS 2720-XXVIII	Field	One set of three tests per 2000 sqm or part thereof
15.	<b>Bitumen</b>	As prescribed in IS 73	As prescribe din IS 73	Lab	As required by the Engineer-in-charge
16.	<b>Dense Bituminous Macadam / Bituminous Concrete</b>	Quality of Binder	IS 73	Lab	As required
		Los Angeles Abrasion Value / Aggregate Impact Value	IS 2386-IV	Lab	100 cum
		Stripping Value	IS 6241	Lab	100 cum
		Water Absorption	IS 2386-III	Lab	100 cum
		Flakiness Index	IS 2386-I	Lab	One test for 100 cum.
		Sieve Analysis for Filler	IS 2386-I	Lab	One test for each consignment subject to minimum one test per 5 cum
		Mix Grading	IS 2386-I	Lab	One set of test on individual constituent and mixed aggregates from dryer of each 100 tonnes of mixed subject to a minimum of two sets per plant per day

**Volume II : Schedule II- Appendix -IV (Technical specifications of works)**

SL	Description of Material	Test	Ref. of IS Code/Specs for Testing	Field / Laboratory Test	Frequency of Testing
		Stability of Mix	ASTM D-1559	Lab	Three Marshal Specimen per 100 tonnes of mix, subject to a minimum of two sets being tested per plant per day
		Binder Content		Field	Minimum 2 tests per day
		Thickness, Density of Compacted Layer	Appendix 'B' of CPWD Specification	Field	One test of 3 samples per 500 sqm
17.	<b>Brickwork / Brick Tiles / Sewer Brick / Burnt Clay Perforated Building Bricks</b>	Dimension	Appendix A, B, C & D of Chapter 6 of CPWD Specifications	Lab	Minimum one test for every 50000 bricks or part thereof
		Compressive Strength		Lab	
		Water Absorption		Lab	
		Efflorescence		Lab	
18.	<b>Stone Work</b>	Water Absorption	IS 1124	Lab	Minimum one test for every 200 sqm / 100 cum or part thereof
		Transverse Strength	IS 1121 – II		
		Resistance to Wear	IS 1706		
		Durability	IS 1126		
19.	<b>Marble</b>	Moisture Absorption	IS 1124	Lab	Minimum one test for every 100 sqm or part thereof
		Hardness Test	Mho's Scale		
		Specific Gravity	IS 1122		
20.	<b>Granite</b>	Moisture	IS 1124	Lab	Minimum one test for every 100 sqm or part thereof
		Specific Gravity	IS 1122		
21.	<b>Structural Steel</b> (other than PEB)	Tensile Strength	IS 1599	Lab	Minimum one test for every 20 tonnes or part thereof per source and also manufacturer's test certificates for each consignment
		Bend Test			
22.	<b>Steel Tubular Pipes</b>	Tensile Test	IS 1608	Lab	Minimum one test for every 8 tonne or part thereof per source and also manufacturer's test certificates for each consignment
		Bend Test	IS 2329		
		Flattening Test	IS 2328		
23.	<b>M-40/50 Grade Cement Concrete Paver Blocks</b>				

**Volume II : Schedule II- Appendix -IV (Technical specifications of works)**

SL	Description of Material	Test	Ref. of IS Code/Specs for Testing	Field / Laboratory Test	Frequency of Testing
(i)	M-40/50 Grade Pre-Cast Concrete Paving Blocks	Compressive Strength	As per IS Code 15658	Field / Lab	Minimum one test for every 50000 bricks or part thereof
		Water absorption	As per IS Code 15658	Field / Lab	
		Dimensions	As per IS Code 15658	Field / Lab	
(ii)	Sand for Bedding Layer	Percentage of Deleterious material	IS 2386	Lab	Minimum one test for every 50 cum or part thereof
		Particle Size Distribution	As per Technical specification	Field / Lab	
		Silt Content	As per Appendix 'C' of Chapter 3 of CPWD Specifications	Field	
		Moisture Content	IS 2720	Field	
(iii)	Sand for Joint Filling	Particle Size Distribution	As per Technical Specification	Field / Lab	Minimum one test for every 50 cum or part thereof.

Note : For items not covered above may be dealt with as per the Technical Specifications in the contract / mandatory tests will be carried out as per CPWD's Specification

LIST OF APPROVED MAKES

The CWC reserves the right to select any of the brands indicated in the list of approved makes. The Tenderer shall quote his rates on the basis of the price of quality and grade of product of the brand/make stipulated in the item of works as described in BOQ & Specification as well as in the list of approved makes. The contractor cannot claim extra if CWC changes the make but within the list of approved makes. However other equivalent manufacture may be considered with prior approval of Engineer due to issue of local availability.

Final approval of Make will be as decided by Engineer authorized by Corporation.

CIVIL WORKS

SL.NO.	ITEM	MAKE
1	GREY CEMENT OPC-43 Grade	Produced from major plants of following brands: ACC, Ultra Tech, Ambuja, Shree Cement, Lafarge Duraguard cement, Birla, Chettinad Cement, Ramco cement, India Cement, JSW Cement
2	WHITE CEMENT	JK, BIRLA
3	REINFORCEMENT	SAIL, TISCO, RINL (VIZAG), TATA, JSW Neo
4	STRUCTURAL STEEL	TATA, SAIL, Jindal steel , RINL.
5	Structural Steel- Truss pipes (RHS/CHS/SHS sections)	TATA, APPOLO, SAIL, JINDAL
6	Galvalume Sheets	TATA BlueScope, JSW Colouron/ JSW Steel
7	Self-drilling/ tapping Zinc plated screws size 5.5x55mm for Galvalume sheets	HILTI or equivalent
8	PUF Panel	Sheets make- TATA BlueScope / JSW -Zn al alloy steel sheet
9	CONCRETE ADDITIVE	FOSROC, CICO-TL, SIKA
10	FLUSH DOORS	GREEN, DURO, CENTURY, SWASTIK, KIT PLY, ALPRO
11	FIRE CHECK DOORS	GLOBAL FIRE PROTECTION COMPANY, RADIANT SAFE FIRE DOORS, GODREJ; NAVAIR; SHAKTI Horman, Gandhi Automation
12	PLYWOOD / BLOCK BOARD / SOFT BOARD	ANCHOR, DURO, MERINO, GREEN, CENTURY, KITPLY, ALPRO
13	PRELAMINATED PARTICLE BOARD	NOVAPAN, ANCHOR, MERINO; BHUTAN BOARD, KITLAM. GREEN LAM
14	LAMINATES	CENTURY, ROYAL CHALLENGE, MERINO, GREENLAM, DURO, AMUL
15	ADHESIVE FOR WOOD WORK	DUNLOP, FEVICOL, VAMICOL, PIDILITE
16	POLYURETHANE SEALANT	MBT, CHOKSEY, CHEMATAL RAI, FOSROC, PIDLITE
17	ALUMINIUM SECTIONS EXTRUDED	JINDAL, HINDALCO, ALUPURE, FINESTA
18	STAINLESS STEEL	SALEM, JINDAL' CAVELIER



SL.NO.	ITEM	MAKE
19	EXPANSION, FASTENERS	FISCHER, HILTI, ANCHORS
20	FLOAT GLASS	MODI GUARD, SAINT GOBAIN, ASAHI
21	CERAMIC TILES	NITCO, KAJARIA, SOMANI, ORIENT, Johnson (only premium/first quality)
22	VITRIFIED PORCELINE TILES	NAVEEN DIAMOND TILES, KAJARIA, NITCO, BELL, MARBONITE, BOSS PROFILES, RESTILE, JOHNSON, SOMANI (only premium/first quality)
23	TERRAZZO TILES	NITCO, MODERN, HINDUSTAN
24	CEMENT CONCRETE TILES DESIGNER TILES	UNISTONE, ULTRA, EUROCON, TERRA FIRMA
25	SYNTHETIC ENAMEL PAINTS	BERGER (LUXOL GOLD), ASIAN (APCOLITE), ICI DULUX (GLOSS), NEROLAC (FULL GLOSS HARD DRYING)
26	OIL BOUND DISTEMPER	ASIAN (TRACTOR), BERGER (BISON), NEROLAC (SUPER ACRYLIC)
27	CEMENT PAINT	SNOWCEM PLUS, BERGER (DUROCEM EXTRA), NEROLAC (NEROCHEM WITH TITANIUM)
28	PLASTIC EMULSION PAINT	ICI, ASIAN, NEROLAC
29	OTHER PAINTS/PRIMERS	ICI DULUX, ASIAN, BERGER, NEROLAC
30	TEXTURED COATING	UNITILE, SPECTRUM, HERITAGE
31	DOOR FITTINGS	GODREJ, EVERITE, SIGMA, OPEL, DOORSET, PALLADIUM
32	LOCKS	EVERITE, GODREJ, HARRISON, YALE
33	NON METALLIC HARDENER COMPOUND	FOSROC, CICO, SIKKA
34	ROLLING SHUTTER (Galvalume/ POWER OPERATED)/ DOCK DOOR	GANDHI AUTOMATION, SHAKTI HORMANN
35	POLYSULPHIDE SEALANT	PIDLITE, FOSROC. CHOKSEY, CHEMATAL RAI
36	ALUMINIUM Bldg. Expansion Joint	VEXCOLT, WATSON BOWMAN, ACME, C/S EXPANSION JOINT, Z-TECH INDIA, J. SONS, METCO.
37	Aluminium Composite panels	ALUCOBOND, RENOBOND, ALSTRONG, DURA BUILD
38	Tile Joint Filler	"ROFF RAINBOW TILE MATE" OF ROFF CONSTRUCTION CHEMICALS PVT. LTD. WINSIL 20/SILICON SEALANT OF GE BAYER SILICON, MATRIX GROUP.
39	Silicone Sealants	GE BAYER SILICONE/DOW CORNING/WACKER/ 3M
40	Polyurethane Paint	MRF
41	Wax Polish	RECKITT & COLMAN
42	Melamine	ICI DULUX, TIMBERSTONE MELAMINE COATING

43	Silicon Water Repellent Solution	GE BAYER SILICON(I) P LTD., METROARK P LTD. OR "SILICON WATERPELLER" BY STP LTD "NISIWA-SH" OF MC-BAUCHEME (I) P LTD., "TECHREPEL" OF CHOKSY CHEMICALS P LTD.
44	Gypsum Ceiling	INDIA GYPSUM, GYP ROC, ARMSTRONG, USG BORAL
45	Mineral Fibre Tiles	ARMSTRONG, AMF, INSULA, GYPROC
46	Laminated Wooden Flooring	KRONO, PERGO, HARO, BERRY, ARMSTRONG, MIKASA, WELSPUN
47	Venetian Blinds	MAC DÉCOR, VISTA, MARVEL
48	PVC Flooring	POLYFLOR, LG, WONDERFLOOR
49	MDF Board	NUWUD, URO, CENTURY
50	A. Vitreous china sanitary ware	CERA, HINDWARE, ROCA, KOHLER, jaquar
51	Seat cover (heavy duty)	SAME AS PER SANITARY WARE MAKE
52	Stainless steel sink	PRESTIGE, KINGSTON, NEELKANTH, JAYANA
53	Auto urinal flush system	AOS AUTO ROBO FLUSHING SYSTEM, TOSHI, UTEC SYSTEM
54	Sensor operated flush valve, W.B. pillar tap / mixer, soap dispenser	AOS AUTO ROBO FLUSHING SYSTEM, TOSHI, UTEC SYSTEM, IDROLL
55	Hand drier	KOPAL, ATMAS, UTEC SYSTEM, TOSHI, EURONICS
56	CP Brass Fittings and toilet accessories	JAQUAR, HINDWARE, KOHLER, CERA, ROCA
57	Angel valve with fitter	JAQUAR, HINDWARE, KOHLER, CERA, ROCA
58	GI Pipes (IS : 1239 and IS : 3589)	TATA STEEL, JINDAL , PRAKASH-SURYA
59	GI pipes fittings	UNIK, ZOLOTO,KS, R BRAND,
60	PVC pipe	SUPREME, ASTRAL, FINOLEX, PRINCE
61	Gm / forged brass values	LEADER, ZOLOTO, RB IBP
62	Sluice Valves / Non return valves	KIRLOSKAR, INDIAN VALUE COMPANY, KALPANA
63	Butterfly valve	AUDCO, KSB, ZOLOTO, DANFOSS
64	Wafer type check valve	ADVANCE, KIRLOSKAR
65	Pressure reducing valve	LEADER, ZOLOTO, RBM, FLOMATIC
66	Air release value	ZOLOTO, OR,RBM
67	Storm water drainage sump pumps	KIRLOSKAR, CROMPTON
68	Sewage handling pumps	KIRLOSKAR, CROMPTON
69	Drinking water cooler	USHA (SHRIRAM AQUA COOLER), BLUE STAR, VOLTAS, SIDHWAL
70	Borewell pump	KIRLOSKAR, CROMPTON, V-GUARD
71	water tank PVC	SINTEX, ASTRAL
72	Welding rods	ADVANI, VICTOR OR EQUIVALENT ISI MAKE
73	Concealed Cistern	VIEGA, GEBRIT

74	CP Waste, spreaders, urinal	JAQUAR, CERA, HINDWARE, ROCA
75	Soil, Waste & rain water pipes & fittings UPVC	JAIN, SUPREME, FINOLEX
76	CPVC pipes & fittings/UPVC pipes & fittings	AASHIRVAD FLOWGUARD, ASTRAL FLOWGUARD

### ELECTRICAL WORKS

SR. NO.	ITEMS	MA KE
1	PVC CONDUIT	BEC/ AKG / PRECISION / LAPP / PLAZA/ FINOLEX
2	FLEXIBLE CONDUIT	HENSEL / LEGRAND / TRINITY TOUCH / LAPP
3	BACKELITE SHEET	HYLAM / FORMICA / GREEN / LAM
4	1.1 KV PVC INSULATED FRLS COPPER WIRE (ISI MARKED)	FINOLEX / HAVELLS / POLYCAB
5	1.1 KV PVC / XLPE INSULATED L. T. CABLE (ISI MARKED)	FINOLEX / POLYCAB/ HAVELLS / KEC/KEI
6	11 KV PVC / XLPE INSULATED HT CABLE (ISI MARKED)	GLOSTER / HAVELL'S / POLYCAB / KEI / FINOLEX
7	TELEPHONE CABLE	SKY TONE / NATIONAL / FINOLEX / HAVELL'S
8	TV COAXIAL CABLE	SKY TONE / NATIONAL / SHYAM / HAVELL'S
9	CONTROL & INSTRUMENTATION CABLE	SKY TONE / NATIONAL / LAPP / ANCHOR
10	COMPUTER CABLE	LUCENT / AVAYA / LEGRAND / AMP / ANCHOR / SYSTIAMX
11	CABLE JOINTING KITS	RAYCHEM / M. SEAL / JAISON / 3M
12	CABLE GLAND	GRIP WELL / EMI / COMET / LEGRAND / HENSEL / TRINITY TOUCH
13	THIMBLES	DOWELLS
14	CABLE TRAY	MODERN / VENUS / SLOTOO / PILCO/PROFAB/AKG/CHOCK STORAGE/CTM (Engg.)
15	MODULAR TYPE SWITCHES AND SOCKET OF ALL RATINGS	MK / CLIPSAL / NORTH WEST / LEGRAND / TOYOMA / SSK / CRABTREE / THANES (HAVELLS)/ SIEMENS/ABB/ ANCHOR
16	L.T. ACB	L & T GE POWER / SIEMENS / ABB / CROMPTON
17	MCCB	L & T / SIEMENS / LEGRAND / ABB / SCHNEIDER/ STANDARD / HAGER
18	SWITCH FUSES UNIT / FUSE SWITCH UNIT	G.E. POWER / SIEMENS / L & T / CONTROL & SWITCH GEAR/ STANDARD/SPC ELECTROTECH PVT. LTD.
19	HRC FUSES	GEC / L & T / SIEMENS / ADHUNIK/STANDARD
20	BUS TRUNCKING / RISING MAIN	SCHEINDER ELECTRIC / GE POWER / GODREJ / CONTROL & SWITCH GEAR CO. LTD / CPRI APPROVED VENDORS /L&T /SPC ELECTROTECH PVT. LTD
21	MCB DISTRIBUTION BOARD	L & T / HAGER / LEGRAND (MDS) / SIEMENS / GE / ABB/ HAVELLS / STANDARD
22	POLYCARBONATE MCB DB	HENSEL / LEGRAND / STANDARD

23	MCB, ISOLATOR, RCCB ELCB (OF ALL RATINGS)	L & T / HAGER / LEGRAND / SIEMENS / GE / ABB / HAVELLS / STANDARD / SCHNEIDER
24	METAL CLAD SHEET STEEL ENCLOSURE SOCKET / PLUG BOX	CROMPTON / L & T / HAGER / STANDARD
25	CAPACITOR	GENERAL ELECTRIC / L & T / SIEMENS / EPCOS / CROMPTON / ABB / HAVELLS
26	CONTROL GEAR (CONTACTOR'S & O/L RELAY)	L & T / GE POWER / SIEMENS / CROMPTON / SCHNEIDER / ABB
27	PROTECTION RELAYS	G.E. / ALSTHOM / EASUN / REYROLTS - RELAY / MYSORE ELECTRIC INDUSTRIES / L & T
28	METERS (INSTRUMENTS)	L & T / (RISHAB) AUTOMATIC ELECTRIC / IMP / ENERCON / TRINITY
29	ENERGY METER	HAVELLS / L & T / SECURE / HPL SOCOMAC / ADHUNIK
30	INDICATION LAMPS & C.T.	VAISHNO / L & T / RASS, CONTROLS
31	DOL STARTER	L & T / SIEMENS / GE POWER
32	11 KV SWITCH GEAR / VCB	CROMPTON / SIEMENS / ABB / L&T / HAGER / SCHNEIDER
33	TAG BLOCK	KRONE / ISI / ERICSON
34	M.S. STEEPED TUBULAR POLE	ASPL OR APPROVED EQUIVALENT / ADVANCE STEEL TUBE
35	CEILING FANS	GE / BAJAJ / CROMPTON / USHA / HAVELLS
36	EXHAUST / AXIAL FLOW / VENTILATION FAN	G.E. / CROMPTON GREAVES / BAJAJ / KHATTAN / USHA
37	LIGHT FIXTURE / FITTINGS AND LAMPS	PHILIPS / CROMPTON / BAJAJ / HAVELLS
38	MANUAL CALL POINT	AGNI / ALERT / NOVAFR / SYSTEM SENSOR / KAC / GAC
39	RESPONSE INDICATOR	AGNI / ALERT / NOVAFR / SYSTEM SENSOR
40	TRANSFORMER	CROMPTON / ABB / NGEF / KIRLOSKAR / POWER WARE / ALSTOM / UNIVERSAL
41	ENGINE (DG SET)	KIRLOSKAR / CUMMINS / CATERPILLAR
42	LT PANELS	SIEMENS / CONTROL & SWITCH GEARS LTD. / SPC ELECTROTECH PVT. LTD / Adlec / ADI / L&T
43	ELEVATOR / Lift (imported)	MITSUBUSHI / SCHINDLER / OTIS / JOHNSONS / KONE
44	SMOKE DETECTORS (BOTH IONIZATION AND OPTICAL)	APOLLO / BASCH (BOSCH) / NOTIFIER / COOPER / EDWARDS / SIEMENS / TYCO
45	RISE HEAT DETECTOR	APOLLO / BASCH (BOSCH) / NOTIFIER / COOPER / EDWARDS / SIEMENS / TYCO
46	FIRE ALARM PANELS	APOLLO / BASCH (BOSCH) / NOTIFIER / COOPER / EDWARDS / SIEMENS / TYCO
47	DUCT CASTING UNIT	APOLLO / SYSTEM SENSUR / SAFEWAY
48	BATTERY	EXIDE / YUASA / AMAR RAJA / AMARON
49	SPEAKER BOX	GAC / DAKSH
50	AMPLIFIER LMT & SPEAKER	PHILIPS / AHNIYA
51	DIESEL ENGINE	CUMMINS / KIRLOSKAR / CATERPILLAR
52	PUMP	KIRLOSKAR / KSB / MATHER'S PLATT

53	MOTOR	ABB / SIEMENS / CROMPTON GREAVES / KIRLOSKAR
54	BAILER	THERMAX / ECOFLAM
55	HOT WATER STORAGE TANK	AS APPROVED BY ENGINEER-IN-CHARGE
56	ALTERNATOR (DG SET)	KIRLOSKAR / CROMPTON / STAMFORD / AVK
60	Selector Switches	KAYCEE, L & T

### **FIRE FIGHTING WORK**

S.NO	DETAIL OF EQUIPMENT/MATERIAL	APPROVED MAKES / MANUFACTURERS
1.	FIRE HYDRANT VALVES	MINIMAX, SUPEREX, NEWAGE
2.	FIRE HOSE PIPES	JAYSHREE, NEWAGE, SUPEREX
3.	FIRST AID FIRE HOSE REELS	MINIMAX, NEWAGE, SUPEREX
4.	SPRINKLERS	TYCO, SPRARY SAFE
5.	PRESSURE SWITCH	INDFOSS/SWITZER
6.	VIBRATION ISOLATOR	RESISTOFLEX, DUNLOP, KUNWAL
7.	CURRENT TRANSFORMER	AE, KAPPA
8.	INDICATING LAMPS	SIEMENS
9.	SELECTOR SWITCH	KAYCEE, SALZER
10.	MS/GI PIPES	TATA, JINDAL, SURYA, APPOLO
11.	CI BUTTERFLY VALVES	AUDCO, ZOLOTO, C&R
12.	CI DOUBLE FLANGED NRVs	KIRLOSKAR, DRIP, CASTLE, INTER VALVE, ZOLOTO
13.	GATE VALVE	LEADER, ZOLOTO, SANT
14.	BALL VALVE	AUDCO, ZOLOTO TBS
15.	CLEAR WATER PUMPS	KIRLOSKAR, BEACON, KSB
16.	SUMP PUMPS	JS, KSB, HOMA, KIRLOSKAR
17.	FIRE EXTINGUISHERS	MINIMAX, SAFEX, SUPEREX
18.	FIRE FIGHTING FIRST AID HOSE REEL TUBING	MITRA DUNLOP, JYOTI

