



**VADODARA MUNICIPAL CORPORATION**

**TENDER FOR  
CONSTRUCTION WORK OF COMPOUND WALL AT SAMA  
PUNAMNAGAR TANK.**

**VOLUME – II SPECIFICATION**

**THE EXECUTIVE ENGINEER,  
WATER WORKS PROJECT,  
VADODARA MUNICIPAL CORPORATION,  
VADODARA**

**June – 2026**

## **1. GENERAL SPECIFICATIONS**

### **2. Civil Works**

The work shall be carried out in accordance with the latest specification as on the date of receipt of tenders. The specific technical requirements given herein are supplementary to the said specification. In case of any variations between the IndSTT/MCGM/GWSSB/R&B specification and the specifications given herein; the latter shall prevail. In cases, where the IndSTT/MCGM/GWSSB/R&B specification and the specifications given below are silent about any aspect in respect any item of work, the work shall be carried out as per the relevant IS Code of Practice with up-to-date amendments and as per sound engineering practice as decided by Engineer-in- Charge.

## **3. EARTHWORK IN EXCAVATION AND BACKFILLING**

### **1. SCOPE**

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

### **2. APPLICABLE CODES**

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

- a. IS: 783 - Code of practice for laying of concrete pipes.
- b. IS: 1200 - (Part 1 & Part 27)-Method of Measurement of Building Works
- c. IS: 3764 - Safety code for excavation work.
- d. IS: 3385 - Code of practice for measurement of Civil Engineering works.
- e. IS: 2720 - Part 2 Determination of Moisture Content,

Part 7 Determination of Moisture Content-Dry density relation using Light Compaction,

Part 8 Determination of Moisture Content -Dry density relations using Heavy Compaction,

Part 28 Determination of Dry Density of Soils, in-place, by the Sand Replacement Method,

Part 29 Determination of Dry Density of Soils, in-place, by the Core Cutter Method.

### **3. DRAWINGS**

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

### **4. GENERAL**

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

4.2 Contractor shall carry out the survey of the site before excavation and set properly all lines and establish levels for various works such as earthwork in excavation for grading, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to establish reference/grid lines at 8 m intervals or nearer as determined by Engineer based on ground profile. These shall be checked by Engineer and thereafter properly recorded.

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

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

## **5. CLEARING**

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

## **6. PRECIOUS OBJECTS, RELICS, OBJECTS OF ANTIQUITY, ETC**

All gold, silver, oil, minerals, archaeological and other findings of importance, trees cut or other materials of any description and 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 Owner and Contractor shall duly preserve the same to the satisfaction of Owner and from time to time deliver the same to such person or persons as Owner may from time to time authorize or appoint to receive the same.

## **7. CLASSIFICATION**

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

Any earthwork will be classified under any of the following categories:

### **a) Ordinary & Hard Soils**

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

### **b) Soft and Decomposed Rock**

This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite and all other

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

### **c) Hard Rock**

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

## **8. EXCAVATION**

- 8.1 All excavation work shall be carried out by mechanical equipment's unless, in the opinion of Engineer, the work involved and time schedule permits manual work.
- 8.2 Excavation for permanent work shall be taken out to such widths, lengths, depths and profiles as are shown on the drawings or such other lines and grades as may be specified by Engineer. Rough excavation shall be carried out to a depth 150 mm above the final level. The balance shall be excavated with special care. Soft pockets shall be removed even below the final level and extra excavation filled up as directed by Engineer should be carried out just prior to laying the mud-mat.
- 8.3 Contractor may, for facility of work or similar other reasons excavate, and also backfill later, if so approved by Engineer, at his own cost, outside the lines shown on the drawings or directed by Engineer. Should any excavation be taken below the specified elevations, Contractor shall fill it up, with concrete of the same class as in the foundation resting thereon, up to the required elevation. Contractor shall claim no extra on this account.
- 8.4 All excavation shall be done to the minimum dimensions, as required for safety and working facility prior approval of Engineer shall be obtained by Contractor in each individual cases, for the methods he proposes to adopt for the excavation, including dimensions, side slopes, dewatering, disposal, etc. This approval, however, shall not in any way relieve contractor of his responsibility for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. Side slopes shall be as steep as will stand safely for the actual soil conditions encountered. Every precaution shall be taken to prevent slips. If slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope. Removal of the slipped earth will not be paid for if the slips are due to the negligence of contractor.
- 8.5 Excavation shall be carried out with such tools, tackles and equipment as described above. Blasting or other methods may be resorted to in the case of hard rock; however not without the specific permission of Engineer.
- 8.6 Engineer may also direct that in some extreme case, the rock may be excavated by heating and sudden quenching for splitting the rock. Fire - wood shall be used for burning and payment shall be made for such work as called for in the schedule of quantities.

## **9. STRIPPING LOOSE ROCK**

All loose boulders, semi-detached rocks (along with earthy stuff which might move therewith) not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of Engineer, to fill or otherwise endanger the workmen, equipment, or the work, etc., shall be stripped off and removed away from the area of the excavation. The method used shall be such as not to shatter or render unstable or unsafe the portion, which was originally sound and safe.

Any material not requiring removal as contemplated in the work, but which, in the opinion of Engineer, is likely to become loose or unstable later, shall also be promptly and satisfactorily removed as directed by Engineer. The cost of such stripping will be paid for at the unit rates accepted for the class of materials in question.

## **10. TRIMMING TRENCH EXCAVATIONS**

Where no bedding material is specified to be laid beneath the pipe the bottom of Trench Excavations shall be carefully boned in and trimmed true to grade with the aid of a straight edge at least six meters long so as to ensure a continuous support for the pipes. The trench bottom shall then be pricked over with a fork and any stones or flints either likely to cause the pipe to bed unevenly or to damage the pipe and its coating or greater than 20mm in size shall be picked out of the pipe bed and any holes so formed shall be filled in with soft material and trimmed to the correct level.

Where no bedding material is specified, all shattered and loose material shall be removed from the bottom of the Trench Excavation so that the bedding material rest on a solid and clean foundation.

## **11. TRIAL PITS OR TRENCHES**

The Engineer-in-Charge may require trial pits or trenches be excavated well ahead of the trench excavation to such depths as he shall order to determine the alignment for the trench. Any further trial pits or trenches required by the Contractor to determine the position of underground services, sub-soils, drains or for any other reason shall be excavated and reinstated at the Contractor's expense.

The Contractor shall arrange for the refilling and reinstatement of trial pits or trenches to be carried out immediately after the required information is obtained. The reinstatement to the surfaces of trial pits or trenches shall be carried out to the approval of the Engineer-in- Charge.

## **12. EXISTING SERVICE**

Where Trench Excavation is carried out close to or across the line of sewers, water lines, gas pipelines, cables and other services, the Contractor shall, wherever necessary, provide temporary supports or slings and where such sewer, pipe, cable or other services temporarily disturbed it shall be replaced for which nothing shall be paid.

Where in the opinion of the Engineer-in-Charge, construction of the pipeline cannot reasonably be carried out unless the sewer, pipe, cable or other service is permanently severed or permanently diverted or permanently supported by concrete he shall order the Contractor to undertake such work.

Notwithstanding any relevant information furnished by the Engineer-in-Charge, the contractor shall be responsible for ascertaining from his own inspection of the site and from the respective supply authorities and other public bodies the positions of all mains, pipes and cable whether underground or overhead, within or near the Site.

## **13. HEDGES, FENCES AND WALLS**

Where the Trench Excavation crosses barriers such as hedges, fences and walls, the Contractor, as temporary measure during construction of the pipeline, shall provide temporary fencing for any parts of such barriers as have had to be removed.

After Trench Excavation has been reinstated, the Contractor shall carry out such work as the Engineer-in-Charge may order for permanent restoration of such barriers.

#### **14. CROSSING WATER COURSES ETC.**

Where the pipeline crosses nallaha, culverts and other watercourses, the Contractor shall be deemed to have allowed for all the additional measures necessary for the proper construction of the pipeline at these crossing including maintaining the full flow of water across the trench.

##### **Sub Soil Water**

The excavation under sub-soil water shall be classified as excavation in saturated soil.

The sub-soil water table is likely to be met with during the execution of work. For measurement of different items required to be executed at site, actual sub- soil water table shall be recorded in 3 pits dug along the specified length of alignment and the average steady water level shall be taken. The sub-soil water table shall be recorded by the department/Engineer-in-charge/ a team of Engineers and the contractor. The measurement of works/items as per Bill of Quantities executed under sub-soil water will be made/worked out with center of gravity i.e. the quantity will be calculated by multiplying the depth measured from top of sub-soil water level up to the center of gravity of cross-sectional area of the item.

The contractor shall arrange sufficient number of diesel and Electric Pump for lowering down the water table below the required excavation level and to keep the excavation dry for sufficient period to enable of works executed. The contractor shall also arrange at his cost Diesel generator Sets of adequate capacity as a standby arrangement in good running condition including making pressure release holes if necessary and plugging the same subsequently to the satisfaction of Engineer-in-Charge. Pumping of sub-soil water shall be ensured to be continued to keep sub-soil water level well below the deepest construction level during execution to avoid floatation of the partially constructed structure due to uplift pressure of subsoil water. This arrangement shall be maintained till full structure has been constructed the uplift pressure due to sub-soil water. Nothing extra shall be paid over and above the rates quoted in the BOQ.

The sub-soil water pumped will be drained off to the proper disposal point. The drain shall be kept cleaned regularly. Contractor shall ensure hygienic conditions as per the guidelines and procedure of the health/sanitation department and nothing extra shall be paid on this account.

While withdrawing the casing pipes of the bores, the space and the cavity so formed, the contractor shall fill the same with sand at his own cost.

#### **15. FILL, BACK FILLING AND SITE GRADING**

##### **15.1 GENERAL**

All fill materials will be subject to Engineer's approval. If Engineer rejects any materials, Contractor shall remove the same forthwith from the site at no extra cost to the Owner. Surplus fill material shall be deposited/disposed off as directed by Engineer after the fill work is completed. No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by Engineer.

##### **15.2 MATERIAL**

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

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

#### **15.4 FILLING IN PITS AND TRENCHES AROUND FOUNDATIONS OF STRUCTURES, WALLS ETC.**

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 not exceeding 45 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. Earth shall be rammed with approved mechanical compaction machines. Usually no manual compaction shall be allowed unless Engineer is satisfied that in some cases manual compaction by tampers cannot be avoided. The final backfill surface shall be trimmed and leveled to proper profile as directed by Engineer or indicated on the drawings.

#### **15.5 PLINTH FILLING**

Plinth filling shall be carried out with approved material as described above in layers not exceeding 45 cm, watered and compacted with mechanical compaction machines. Engineer May however permit manual compaction by hand tampers in case he is satisfied that mechanical compaction is not possible. When filling reaches the finished level, the surface shall be flooded with water, unless otherwise directed, for at least 24 hours, allowed to dry and then the surface again compacted as specified above to avoid settlements at a later stage. The finished level of the filling shall be trimmed to the level/slope specified.

Where specified in the schedule of works, compaction of the plinth fill shall be carried out by means of 12 tones rollers smooth wheeled, sheep-foot or wobbly wheeled rollers. A smaller weight roller may be used only if permitted by Engineer. As rolling proceeds water sprinkling shall be done to assist consolidation. Water shall not be sprinkled in case of sandy fill. The thickness of each unconsolidated fill layer can in this case be up to a maximum of 450 mm. Engineer will determine the thickness of the layers in which fill has to be consolidated depending on the fill materials and equipment used. Rolling shall commence from the outer edge and progress towards the centre and continue until compaction is to the satisfaction of Engineer, but in no case less than 10 passes of the roller will be accepted for each layer. The compacted surface shall be properly shaped, trimmed and consolidated to an even and uniform gradient. All soft spots shall be excavated and filled and consolidated. At some location/areas it may not be possible to use rollers because of space restrictions etc. Contractor shall then be permitted to use pneumatic tampers, rammers, etc. and he shall ensure proper compaction.

#### **15.6 SAND FILLING IN PLINTH AND OTHER PLACES**

At places backfilling shall be carried out with local sand if directed by Engineer. The sand used shall be clean, medium grained and free from impurities. The filling-in-sand shall be kept flooded with water for 24 hours to ensure maximum consolidation. Any temporary work

required to contain sand under flooded condition shall be to Contractor's account. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floors or other structures on sand fill shall not be started until Engineer has inspected and approved the fill.

## **15.7 FILLING IN TRENCHES**

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipe and drains have been tested and passed. The backfilling materials shall be properly consolidated by watering and ramming, taking due care that no damage is caused to the pipes.

Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the centerline of the pipe shall be done by hand compaction with selected approved earth in layers, backfilling above the level of the centre line of the pipe shall be done with selected earth by hand compaction or other approved means in layers.

In case of excavation of trenches in rock, the filling up to a level 30 cm. above the top of the pipe shall be done with fine materials, such as earth, murrum etc. The filling up of the level of the centerline of the pipe shall be done by hand compaction in layers. Whereas the filling above the centerline of the pipe shall be done by hand compaction or approved means in layer not exceeding 45 cm. The filling from a level 30-cm above the top of the pipe to the trench shall be done by hand or other approved mechanical methods with broken rock filling mixed with fine material as available to fill up the voids.

Filling of the trenches shall be carried simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

## **16. GENERAL SITE GRADING**

- 16.1 Site grading shall be carried out as indicated in the drawings and as directed by Engineer. Excavation shall be carried out as specified in the specification. Filling and compaction shall be carried out as specified under Clause 10.0 and elsewhere unless otherwise indicated below.
- 16.2 If no compaction is called for, the fill may be deposited to the full height in one operation and leveled. If the fill has to be compacted, it shall be placed in layers not exceeding 450 mm and leveled uniformly and compacted as indicated in Clause 10.0 before the next layer is deposited.
- 16.3 To ensure that the fill has been compacted as specified, field and laboratory tests shall be carried out by Contractor at his cost.
- 16.4 Field compaction test shall be carried out at different stages of filling and also after the fill to the entire height has been completed. This shall hold good for embankments as well.
- 16.5 Contractor shall protect the earth fill from being washed away by rain or damaged in any other way. Should any slip occur, Contractor should remove the affected material and make good the slip at his cost.
- 16.6 The fill shall be carried out to such dimensions and levels as indicated on the drawings after the stipulated compaction. The fill will be considered as incomplete if the desired compaction has not been obtained.
- 16.7 If specifically permitted by Engineer, compaction can be obtained by allowing loaded trucks conveying fill or other material to ply over the fill area. Even if such a method is permitted, it will be for Contractor to demonstrate that the desired/ specified compaction has been obtained. In order that the fill may be reasonably uniform throughout, the material should be

dumped in place in approximately uniform layers. Traffic over the fill shall then be so routed to compact the area uniformly throughout.

- 16.8 If so specified, the rock as obtained from excavation may be used for filling and leveling to indicate grades without further breaking. In such an event, filling shall be done in layers not exceeding 50 cm approximately. After rock filling to the approximate level, indicated above has been carried out the void in the rocks shall be filled with finer materials such as earth, broken stone, etc. and the area flooded so that the finer materials fill up the voids. Care shall be taken out. Over the layer so filled, as 100 mm thick mixed layer of broken material and earth shall be laid and consolidation carried out by a 12-tonne roller. No less than twelve passes of the roller shall be accepted before subsequent similar operations are taken up.

## **17. FILL DENSITY**

The compaction only where so called for, in the schedule of quantities/items shall comply with the specified (proctor modified proctor) density at moisture content differing not more than 4 percent from the optimum moisture content. Contractor shall demonstrate adequately at his cost, by field and laboratory tests that the specified density has been obtained. The contractor shall have to submit fill density tests reports. For compaction the contractor shall have to pour water by means of Tankers to match water volume with equivalent approximately 15% pour value of earth fill. For that statements / records of water tankers shall have to be submitted to the Engineer-in-charge.

## **18. LEAD**

Lead for deposition/disposal of excavated material, shall be as specified in the respective item of work. For the purpose of measurement of lead, the area to be excavated or filled or area on which excavated material is to be deposited/disposed 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 by the shortest straight line route on the plan and not the actual route taken by Contractor. No extra compensation is admissible on the grounds that the lead including that for borrowed material had to be transported over marshy or 'katcha' land/route. The disposal of surplus material shall be done in the area specified by the Engineer-in-charge (within the VMC limit).

## **19. MEASUREMENT AND PAYMENT**

- 19.1 Backfilling as per specification the sides of foundations of columns, footings, structures, walls, tanks, rafts, trenches etc. With excavated materials will not be paid for separately. It shall be clearly understood that the rate quoted for excavation including backfilling shall include stacking of excavated material as directed, excavation/packing of selected stacked material, conveying it to the place of final backfill, compaction etc. as specified. As a rule, material to be backfilled shall be stacked temporarily within the VMC limit. If Engineer directs/permits a lead of over 100 meters for such material, the conveyance of the material for the extra distance over the basic lead of 100 meters for backfilling will be paid for.

- 19.2 Payment for fill inside trenches, plinth or similar filling with selected excavated material will be made for only compaction as specified/directed. Cost of all other operations shall be deemed to have been covered in the rate quoted for excavation. Payment for this work will be made based on measurement of plinth/trench dimensions filled. The Plinth ground levels shall be surveyed before hand for this purpose. If no compaction is specified/desired such filling will not be separately paid for. In such an event the fill shall be finished/finished to the profile as directed at no extra cost.

- 19.3 Backfilling, plinth filling etc. with borrowed earth will be paid for at rates quoted. The quoted

rate shall include all operations such as clearing, excavation, lead and transport, fill, compaction etc. as specified. Actual quantity of consolidated filling or actual quantity of excavation in the borrow pits (less such topsoil which has been excavated and not used for filling) whichever is less shall be measured and paid for in cubic meters. The lead, lift etc. shall be as indicated in the schedule of quantities.

19.4 Actual quantity of consolidated sand filling shall be measured and paid in cubic meters.

19.5 The excavation and working in wet condition including De-watering shall be paid based on the approved tender rate with out any extra rate.

## **TIMBER SHORING**

### **1. SCOPE**

This specification covers the general requirements of timber shoring for excavation of trenches, pits, open excavations etc. Shoring / Strutting item shall be operated by the contractor where excavation in slope as mentioned in excavation clause is not possible due to space restriction or where the soil strata is loose and needs protection and safety for working.

### **2. DESCRIPTION**

- 2.1 Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'polling boards'. These shall be of minimum 25 cm x 4 cm sections or as directed by Engineer. The board shall generally be placed in position vertically side by side without any gap on each side of the excavation and shall be secured by horizontal walling of strong wood at maximum 1.2 meters spacing, strutted with bellies or as directed by Engineer. The length of the belie struts shall depend on the width of the trench or pit. If the soil is very soft and loose, the boards shall be placed horizontally against each side of the excavation and supported by vertical wallings, which in turn shall be suitably strutted. The lowest boards supporting the sides shall be taken into the ground and no portion of the vertical side of the trench or pit shall remain exposed, so as to render the earth liable to slip out.
- 2.2 Timber shoring shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench. The type of timbering shall be as approved by Engineer. It shall be the responsibility of contractor to take all necessary steps to prevent the sides of excavations, trenches, pits, etc., from collapsing.
- 2.3 Timber shoring may be required to keep the sides of excavations vertical to ensure safety of adjoining structures or to limit the slope of excavations, or due to space restrictions or for other reasons. Such shoring shall be carried out, except in an emergency, only under instructions from Engineer.
- 2.4 The withdrawal of the timber shall be done very carefully to prevent the collapse of the pit or trench. It shall be started at one end and proceeded systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber. No claim shall be entertained for any timber, which cannot be withdrawn and is lost or buried.
- 2.5 In case of open timbering the entire surface of the side of trench or pit is not required to be covered. The vertical boards of minimum 25 cm x 4 cm sections shall be spaced sufficiently apart to leave unsupported strips of maximum 50 cm average width. The detailed arrangement, sizes of the timber and the spacing shall be subject to the approval of Engineer. In all other respects, specification for close timbering shall apply to open timbering.

- 2.6 In case of large pits and open excavations, where shoring is required for securing safety of adjoining structures or for any other reasons and where the planking for sides of excavations/pits cannot be strutted against, suitable inclined struts supported on the excavated bed shall be provided. Load from such struts shall be suitably distributed on the bed to ensure no yielding of the strut. If, however, Engineer directs any timbering to be left in, keeping in mind the type of construction or any other factor, Contractor shall be paid for at the scheduled item rate for such left - in timbering.

### **3. MEASUREMENT**

The actual effective area of shored faces as approved by Engineer shall be measured in sq. m. The area of planking embedded in the bed/sides of excavation will not be considered, nor the area supporting inclined struts in case of large pits/open excavation. All planks, boards, waling, verticals, struts, props and all other materials for shoring and subsequent safe dismantling and removal shall be included in the quoted unit rates.

### **4. DEWATERING AND DIVERTING OF CONTENTS OF KAANS**

#### **1. SCOPE**

This specification covers the general requirements of dewatering in general.

#### **2. DESCRIPTION**

- 2.1 All excavations shall be kept free of water; Grading in the vicinity of excavations shall be controlled to prevent surface water running into excavated areas. Contractor shall remove by pumping or other means approved by Engineer any water inclusive of rain water and subsoil water accumulated in excavations and keep all excavating dewatered until the foundation work is completed and backfilled. Sumps made for dewatering must be kept clear of the excavations/trenches required for further work. Method of pumps shall be approved by Engineer but in any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping. Pumping arrangements shall be adequate to ensure no delays in construction.
- 2.2 When there is a continuous inflow of water and quantum of water to be handled is considered in the opinion of Engineer, as large, well point system - Single stage or multistage, shall be adopted, Contractor shall submit to Engineer his scheme of well point system including the stages, the spacing, number and diameter of well points, headers etc., and the number, capacity and location of pumps for approval. Unless separately provided for in the Schedule of prices, the cost of dewatering shall be included in the item rate for excavation.

### **3. MEASUREMENT**

Unless separately provided for in the Schedule of quantities, dewatering is deemed to have been included in the unit rates quoted for excavation. If separately provided for, the unit of measurement shall be as indicated in the schedule of quantities.

### **5. STORM WATER DRAINAGE**

#### **1. SCOPE**

Grading in the vicinity of excavation shall be such as to exclude rain/surface water draining into excavated areas. Excavation shall be kept clean of rain and such water as the contractor may be using for his work by suitably pumping out the same at no extra cost to the Owner. The Engineer shall approve the scheme for pumping and discharge of such water.

### **6. CONCRETE AND ALLIED WORKS**

## **1. SCOPE**

- 1.1 This specification covers the general requirements for concrete using on-site production facilities including requirements in regard to the quality, handling, storage of ingredients, proportioning, batching, mixing, transporting, placing, curing, protecting, repairing, finishing and testing of concrete, Formwork; requirements in regard to the quality storage, bending and fixing of reinforcement grouting as well as mode of measurement and payment for completed works.
- 1.2 These specifications are complementary and are to be read together for correct interpretation of the provisions of this specification.
- 1.3 It shall be very clearly understood that the specifications given herein are brief and do not cover minute details. However, all works shall have to be carried out in accordance with the relevant standards and codes of practices or in their absence in accordance with the best accepted current engineering practices or as directed by ENGINEER from time to time. The decision of ENGINEER as regards the specification to be adopted and their interpretation and the mode of execution of work shall be final and binding on CONTRACTOR and no claim whatsoever will be entertained on this account.
- 1.4 Irrespective of the tender conditions, the Contractor shall use only Ready Mixed Concrete (RMC) for all the major concrete work.

## **2. APPLICABLE CODE AND SPECIFICATIONS**

- 2.1 The following specifications, standards and codes including all official amendments/revisions and other specifications and codes referred to therein, should be considered a part of this specification. In all cases the latest issue/edition/revision shall apply. In case of discrepancy between this specification and those referred to herein below or other specifications forming a part of this bid document, this specification shall govern.

### **2.2 MATERIALS**

- 1) IS: 269 - Specification for 33 grade ordinary Portland cement
- 2) IS: 455 - Specification for Portland slag cement
- 3) IS: 1489 (Part 1 & 2) - Specification for Portland- Pozzolana cement
- 4) IS: 8112 - Specification for 43-grade ordinary Portland cement.
- 5) IS: 12330 - Specification for Sulphate resisting Portland cement
- 6) IS: 383 - Specification for coarse and fine aggregates from natural sources for concrete
- 7) IS: 432 - Specification for mild steel and medium tensile steel bars and hard-drawn steel wires for concrete reinforcement.
- 8) IS: 1786 - Specification for high strength deformed steel bars and wires for concrete reinforcement.
- 9) IS: 1566 - Specification for hard-drawn steel wire fabric for concrete reinforcement
- 10) IS: 9103 - Specification for admixtures for concrete

- 11) IS: 2645 - Specification for integral cement water proofing compounds
- 12) IS: 4990 - Specification for plywood for concrete shuttering work.
- 13) IS: 12269 - Specifications for 53 grade Ordinary Portland Cement.

### **2.3 MATERIAL TESTING**

- 14) IS: 4031(Parts 1 to 15) -Methods of physical tests for hydraulic cement
- 15) IS: 4032 - Method of chemical analysis of hydraulic cement
- 16) IS: 650 - Specification for standard sand for testing of cement.
- 17) IS: 2430 - Methods for sampling of aggregates for concrete.
- 18) IS: 2386 - Methods of test for aggregates for concrete (Parts 1 to 8)
- 19) IS: 3035 - Methods of sampling and test (physical and chemical) water used in industry
- 20) IS: 6925 - Methods of test for determination of water-soluble chlorides in concrete admixtures.

### **2.4 MATERIALS STORAGE**

- 21) 1) IS: 4082-Recommendations on stacking and storing of construction materials at site.

### **2.5 CONCRETE MIX DESIGN**

- 22) IS: 10262-Recommended guidelines for concrete mix design
- 23) SP: 23 -Handbook on Concrete Mixes

### **2.6 CONCRETE TESTING**

- 24) IS: 1199 - Method of sampling and analysis of concrete
- 25) IS: 516 - Method of test for strength of concrete
- 26) IS: 9013 - Method of making, curing and determining compressive strength of accelerated cured concrete test specimens.
- 27) IS: 8142 - Method of test for determining setting time of concrete by penetration resistance.
- 28) IS: 9284 - Method of test for abrasion resistance of concrete
- 29) IS: 2770 - Methods of testing bond in reinforced concrete.

### **2.7 EQUIPMENT**

- 30) IS: 1791 -Specification for batch type concrete mixers.
- 31) IS: 2438 -Specification for roller pan mixer.
- 32) IS: 4925 -Specification for concrete batching and mixing plant.

- 33) IS: 5892 -Specification for concrete transit mixer and agitator
- 34) IS: 7242 -Specification for concrete spreaders
- 35) IS: 2505 -General Requirements for concrete vibrators : Immersion type..
- 36) IS: 2505 -General Requirements for screed board concrete vibrators
- 37) IS: 2514-Specification for concrete vibrating tables.
- 38) IS: 3366 -Specification for form vibrators for concrete.
- 39) IS: 4656- Specification for form vibrators for concrete.
- 40) IS: 11993- Code of practice for use of screed board concrete vibrators.
- 41) IS: 7251 - Specification for concrete finishers.
- 42) IS: 2722 - Specification for portable swing weigh batchers for concrete (single and double bucket type).
- 43) 14) IS: 2750 - Specification for steel scaffoldings

## **2.8CODES OF PRACTICE**

- 44) IS: 456 -Code of practice for plain and reinforced concrete
- 45) IS: 457 -Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
- 46) IS: 3370-Code of practice for concrete structure for storage of liquids (Parts 1 to 4)
- 47) IS: 3935-Code of practice for composite construction.
- 48) IS: 2204-Code of practice for construction of reinforced concrete shell roof.
- 49) IS: 2210 -Criteria for the design of reinforced concrete shell structures and folded plates.
- 50) IS: 2502-Code of practice for bending and fixing of bars for concrete reinforcement.
- 51) IS: 5525-Recommendation for detailing of reinforcement in reinforced concrete works.
- 52) IS: 2751-Code of practice for welding of mild steel plain and deformed bars used for reinforced concrete construction.
- 53) IS: 9417 -Specification for welding cold worked bars for reinforced concrete construction.
- 54) IS: 3558-Code of practice for use of immersion vibrators for consolidating concrete.
- 55) IS: 3414 -Code of practice for use of design and installation of joints in buildings.
- 56) IS: 4326 -Code of practice for earthquake resistant construction of building.
- 57) IS: 4014 -Code of practice for steel tubular scaffolding (Part 1& 2)

58) IS: 2571 -Code of practice for laying in-situ cement concrete flooring.

59) IS: 7861 -Code of practice for extreme weather concreting. Part - 1 recommended practice for hot weather

60) Part - 2 recommended practice for cold weather concreting

## **2.9 CONSTRUCTION SAFETY**

61) IS: 3696 -Safety code for scaffolds and ladders (Parts 1 & 2)

62) IS: 7696 -Safety code for handling and storage of building materials

63) IS: 8989 -Safety code for erection of concrete framed structures.

## **2.10 MEASUREMENT**

64) 1) IS: 1200 -Method of measurement of building and engineering works.

## **3. GENERAL**

3.1 ENGINEER shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and Engineer's approval obtained, prior to starting of concrete work. This shall, however, not relieve CONTRACTOR of any of his responsibilities. All materials, which do not conform to this specification, shall be rejected.

3.2 Materials should be selected so that they can satisfy the design requirements of strength, serviceability, safety, durability and finish with due regards to the functional requirements and the environmental conditions to which the structure will be subjected conditions to which the structure will be subjected. Materials complying with codes/standards shall generally be used. Other materials may be used after approval of the ENGINEER and after establishing their performance suitability based on previous data, experience or test.

## **4. MATERIALS**

### **4.1 CEMENT**

Unless otherwise specified in specification or called for by ENGINEER/OWNER, cement shall be Ordinary Portland Cement (OPC) conforming to IS:269 (latest edition). The approved makes of Cement shall be ACC, Ultratech, JK Laxmi, Ambuja, Sanghi, Binani, Birla, Hathi, Kamal, Birla Cement wonder, Nuvoco vistas.

Where OPC is used, it shall be ensured that consistency of quality is maintained, there will be no adverse interactions between the materials and the finish specified is not marred.

Only one type of cement shall be used in any one mix. The source of supply type or brand for cement within the same structure or portion thereof shall not be changed without approval from ENGINEER.

Cement, which is not used within 90 days from its date of manufacture, shall be tested at a laboratory approved by ENGINEER and until the results of such tests are found satisfactory, it shall not be used in any work.

## **4.2 AGGREGATES (GENERAL)**

Aggregates shall consist of naturally occurring stones (crushed or uncrushed), gravel and sand. They shall be chemically inert, strong, hard, clean, durable against weathering, of limited porosity, free from dust/silt/organic impurities/deleterious materials and conform to IS: 383. Aggregates such as slag, crushed over burnt bricks, bloated clay ash, sintered fly ash and tiles shall not be used.

Aggregates for special purposes shall be as specified in specifications.

Aggregates shall be washed and screened before use where necessary or if directed by the ENGINEER.

Aggregates containing reactive materials shall be used only after tests conclusively prove that there will be no adverse affect on strength, durability and finish including long-term effects, on the concrete.

The fineness modules of sand shall neither be less than 2.2 nor more than 3.2

The maximum size of coarse aggregate shall be as stated on the drawings but in no as greater than 1/4 of the minimum thickness of the member.

Plums 160 mm and above of a reasonable size may be used where directed. Plums shall not constitute more than 20% by volume of the concrete.

## **4.3 WATER**

Water used for both mixing and curing shall conform to IS : 456. Potable water generally satisfactory.

Water containing any excess of acid, alkali, sugar or salt shall not be used.

## **4.4 REINFORCEMENT**

The Reinforcement bars shall be TMT grade Fe500 conforming to BIS as shown or specified on the drawing. The approved makes of the reinforcement shall be SAIL / Vizag / Tata / Welspun / Electrotherm / National / Hytuff /Gujarat NRE, Kamdhenu/ Friends/ Pagoda/Jindal/Essar/ German TMX/ Mono Steel/Rudra TMX/Nilkanth/Birla/ Gallant TMT

All reinforcement shall be clean, free from pitting, oil, grease, paint, loose mill scales, rust, dirty, dust, or any other substance that will destroy or reduce bond.

If permitted by ENGINEER, welding of reinforcement shall be done in accordance with IS : 2751 or IS: 9417 as applicable.

## **4.5 ADMIXTURES**

Accelerating, retarding, water reducing and air entraining admixtures shall conform to IS: 9103 and integral water proofing admixtures to IS:2645.

Admixtures may be used in concrete as per manufacturer's instructions only with the approval of ENGINEER based upon evidence that with the passage of time neither the compressive strength nor its durability is reduced. Trial mixes shall verify an admixture's suitability and effectiveness with the other materials used in the works. If two or more

admixtures are to be used simultaneously in the same concrete mix, their interaction shall be checked and trial mixes done to ensure their compatibility. There should also be on increase in risk of corrosion of the reinforcement or other embedment.

Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted such as in mass concrete works, it shall be dissolved in water and added to the mixing water by an amount not exceeding 1.5 percent of the weight of the cement in each batch of concrete. The designed concrete mix shall be corrected accordingly.

#### **4.6 WASTAGE**

Wastage allowance for cement and steel shall be as specified under Instruction to Bidders.

### **5. SAMPLES AND TESTS**

All materials used for the works shall be tested before use.

Manufacturer's test certificate shall be furnished for each batch of cement/steel and when directed by ENGINEER. Samples shall also be got tested by the CONTRACTOR in a govt approved laboratory approved by ENGINEER at no extra cost to OWNER. However, where material is supplied by OWNER, all testing charges shall be borne by OWNER, but transportation of material samples to the laboratory shall have to be done by CONTRACTOR at no extra cost.

Sampling and testing shall be as per IS: 2385 under the supervision of ENGINEER. The cost of all tests, sampling etc. shall be borne by CONTRACTOR.

Water to be used shall be tested to comply with requirements of IS: 456.

CONTRACTOR shall furnish manufacture's test certificates and technical literature for the admixture proposed to be used. If directed the admixture shall be got tested at an approved laboratory at no extra cost.

### **6. STORING OF MATERIALS**

All materials shall be stored in a manner so as to prevent its deterioration and contamination, which would preclude its use in the works. Requirements of IS:4082 shall be complied with.

CONTRACTOR will have to make his own arrangements for the storage of adequate quantity of cement even if stored properly by OWNER. If such cement is not stored properly and has deteriorated, the material shall be rejected. Cost of such rejected cement, where OWNER supplies cement, shall be recovered at issue rate or open market rates which ever is higher. Cement bags shall be stored in dry weatherproof shed with a raised floor, well away from the outer walls and insulated from the floor to avoid moisture from ground. Not more than 15 bags shall be stacked in any tier. ENGINEER shall approve storage arrangement. Storage under tarpaulin shall not be permitted. Each consignment of cement shall be stored separately and consumed in its order of receipt.

Each size of coarse and fine aggregates shall be stacked separately and shall be protected from leaves and contamination with foreign material. The stacks shall be on hard, clean, free draining bases, draining away from the concrete mixing area.

CONTRACTOR shall make his own arrangements for storing water at site in tanks to prevent contamination.

The reinforcement shall be stacked on top of timber sleepers to avoid contact with ground/water. Each type and size shall be stacked separately.

## 7. CONCRETE

### 7.1 GENERAL

Concrete grade shall be as designated on drawings. In concrete grade M15, M20 etc. the number represents the specified characteristic compressive strength of 150 mm cube at 28 days, expressed in N/sq.mm as per IS:456. Concrete in the work shall be "DESIGN MIX CONCRETE" or "NOMINAL MIX CONCRETE". All concrete works of grade M5, M7.5 and M10 shall be NOMINAL MIX CONCRETE whereas all other grades, M15 and above, shall be DESIGN MIX CONCRETE. The Contractor shall use only approved Ready Mixed Concrete (RMC) for all the major concrete. Approved make s being: Ultratech, Nuvoco Vistas Corp. Ltd (formerly Lafarge), JK lakshmi. Perfect, Raj or own plant subject to prior approval of TPI/PMC/VMC.

### DESIGN MIX CONCRETE

#### Mix Design & Testing

For Design Mix Concrete, the mix shall be designed according to IS: 10262 and SP: 23 to provide the grade of concrete having the required workability and characteristic strength not less than appropriate values given in IS:456. The design mix shall in addition be such that it is cohesive and does not segregate and should result in dense and durable concrete and also capable of giving the finish as specified. For liquid retaining structures, the mix shall also result in watertight concrete. The CONTRACTOR shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

Unless otherwise specifically mentioned in specifications, the minimum cement content for Design Mix Concrete shall be as per Appendix - A of IS :56 or as given below whichever is higher.

Grade of Concrete	Minimum Cement Content in Kg/Cum. of
M15	260
M20	315
M25	365
M30	410
M40	430
M50	465

The minimum cement content stipulated above should be adopted irrespective of whether the CONTRACTOR achieves the desired strength with less quantity of cement. The Contractor's quoted rates for concrete shall provide for the above eventuality and nothing extra shall become payable to the CONTRACTOR in this account. Even in the case where the quantity of cement required is higher than that specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the CONTRACTOR.

It shall be Contractor's sole responsibility to carry out the mix design at his own cost. He

shall furnish to ENGINEER at least 30 days before concreting operations, a statement of proportions proposed to be used for the various concrete mixes and the strength results obtained. The strength requirements of the concrete mixes ascertained on 150 mm cubes as per IS: 516 shall comply with the requirements of IS: 456.

#### Minimum Compressive Strength

Grade of Concrete	N/sq.mm at 7 days	N/sq.mm at 28
M15	10.0	15.
M20	13.5	20.
M25	17.0	25.
M30	20.0	30.
M35	23.5	35.
M40	27.0	40.

A range of slumps, which shall generally be used for various types of construction unless otherwise instructed by the ENGINEER, is given below:

#### Slump in Millimeters

Structure	Maximum	Minimum
Reinforced foundation walls and footing	75	25
Plain footings, caissons and substructure walls	75	25
T.G. and massive compressor foundations	50	25
Slabs, Beams and reinforced walls	100	25
Pumps, & Miscellaneous	75	25
Building columns	100	25
Pavements	50	25
Heavy mass construction	50	25

#### Batching & mixing of Concrete

Proportions of aggregates and cement, as decided by the concrete mix design, shall be by weight. These proportions shall be maintained during subsequent concrete batching by means of weigh batchers capable of controlling the weights within one percent of the desired value.

Amount of water added shall be such as to produce dense concrete of required consistency, specified strength and satisfactory workability and shall be so adjusted to account for moisture content in the aggregates. Water - cement ratio specified for use by ENGINEER shall be maintained. Each time the work stops, the mixer shall be cleaned out, and while recommencing; the

first batch shall have 10% additional cement to allow for sticking in the drum.

Arrangement should be made by CONTRACTOR to have the cubes tested in an approved laboratory or in field at his own expense, with prior consent of ENGINEER. Sampling and testing of strength and workability of concrete shall be as per IS : 1199, IS:516 and IS : 456.

## **7.2 NOMINAL MIX CONCRETE**

### **Mix Design & Testing**

Mix design and preliminary tests are not necessary for Nominal Mix Concrete. However works tests shall be carried out as per IS: 456. Proportions for Nominal Mix Concrete and w/c ratio may be adopted as per Table 3 of IS: 456. However it will be Contractor's sole responsibility to adopt appropriate nominal mix proportions to yield the specified strength.

### **Batching & mixing of Concrete**

Based on the adopted nominal mixes, aggregates shall be measured by volume. However cement shall be by weight only.

## **8. FORMWORK**

8.1 FORMWORK shall be all inclusive and shall consist of but not limited to shores, bracing, sides of footings, walls, beams and columns, bottom of slabs etc. Including ties, anchors, hangers, inserts, false work, wedges etc.

8.2 The design and engineering of the framework as well as its construction shall be the responsibility of CONTRACTOR. However, if so desired by ENGINEER the drawings and calculations for the design of the Formwork shall be submitted to ENGINEER for approval.

8.3 FORMWORK shall be designed to fulfill the following requirements:

- a. Sufficiently rigid and tight to prevent loss of grout or mortar from the concrete at all stages and appropriate to the methods of placing and compacting.
- b. Made of suitable materials
- c. Capable of providing concrete of the correct shape and surface finishes within the specified tolerance limits.
- d. Capable of withstanding without deflection the worst combination of self-weight, reinforcement and concrete weight, all loads and dynamic effects arising from construction and compacting activities, wind and weather forces.
- e. Capable of easily striking without shock, disturbance or damage to the concrete.
- f. Soffit forms capable of imparting a camber if required.
- g. Soffit forms and supports capable of being left in position if required.
- h. Capable of being cleaned and /or coated if necessary immediately prior to casting the concrete, design temporary opening where necessary for these purposes and to facilitate the preparation of construction joints.

8.4 The framework may be of timber, plywood, steel, plastic or concrete depending upon the type

of finish specified. Sliding forms and slip form may be used with the approval of ENGINEER. Timber for FORMWORK shall be well seasoned, free from sap, shakes, and loose knots, wormholes, warps and other surface defects. Joints between FORMWORK and structures shall be sufficiently tight to prevent loss of slurry from concrete, using seals if necessary.

- 8.5 The faces of FORMWORK coming in contact with concrete shall be cleaned and two coats of approved mould oil applied before fixing reinforcement. All rubbish, particularly chipping, shavings, sawdust, wire pieces dust etc shall be removed from the interior of the forms before the concrete is placed. Where directed, cleaning of forms shall be done by blasting with a jet of compressed air at no extra cost.
- 8.6 Forms intended for reuse shall be treated with care. Forms that have deteriorated shall not be used. Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes suitably plugged, joints repaired and warped lumber replaced to the satisfaction of ENGINEER. CONTRACTOR shall equip himself with enough shuttering to allow for wastage so as to complete the job in time.
- 8.7 Permanent FORMWORK shall be checked for its durability and compatibility with adjoining concrete before it is used in the structure. It shall be properly anchored to the concrete.
- 8.8 Wire ties passing through beams, columns and walls shall not be allowed. In their place bolts passing through sleeves shall be used. FORMWORK spacers left in situ shall not impair the desired appearance or durability of the structure by causing spalling, rust staining or allowing the passage of moisture.
- 8.9 For liquid retaining structures sleeves shall not be provided for through bolts nor shall through bolts be removed if provided. The bolts, in the latter case, shall be cut at 25- mm depth from the surface and the hole made good by cement mortar of the same proportion as the concrete just after striking the FORMWORK.
- 8.10 Where specified or shown on drawings all corners and angles exposed in the finished structure shall have chamfers or fillets of 20 mm x 20 mm size.
- 8.11 Forms for substructure may be omitted when, in the opinion of ENGINEER, the open excavation is firm enough (in hard non-porous soils) to act as a form such excavations shall be slightly larger, as directed by ENGINEER, than that required as per drawing to compensate for irregularities in excavation.
- 8.12 CONTRACTOR shall provide adequate props carried down to a firm bearing without overloading any of the structures.
- 8.13 The shuttering for beams and slabs shall be so erected that the side shuttering of beams can be removed without disturbing the bottom shuttering. If the shuttering for a column is erected for the full height of the column, one side shall be built up in sections as placing of concrete proceeds or windows left for placing concrete from the side to limit the drop of placing concrete from the side to limit the drop of concrete to 1.0 m or as directed by ENGINEER. CONTRACTOR shall temporarily and securely fix items to be cast in (embedment/inserts) in manner that will not hinder the striking of forms or permit loss of grout.
- 8.14 FORMWORK showing excessive distortion during any stage of construction shall be repositioned and strengthened. Placed concrete affected by faulty FORMWORK, shall be entirely removed and FORMWORK corrected prior to placement of new concrete at contractor's cost.
- 8.15 The striking time for FORMWORK shall be determined based on the following requirements:

- a. Development of adequate concrete strength
- b. Permissible deflection at time of striking formwork
- c. Curing procedure employed - its efficiency and effectiveness
- d. Subsequent surface treatment to be done
- e. Prevention of thermal cracking at re-entrant angles
- f. Ambient temperature, and
- g. Aggressive of the environment (unless immediate adequate steps are taken to prevent damage to the concrete)

8.16 Under normal circumstance (generally where temperature are above 20 Deg. C) forms may be struck after expiry of the time period given in IS: 456 unless directed otherwise by ENGINEER. For Portland Pozzolana cement stripping time shall be suitably modified as directed by the ENGINEER. It is the contractor's responsibility to ensure that forms are not struck until the concrete has developed sufficient strength to support itself, does not undergo excessive deformation and resist surface damage and any stressed arising during the construction period.

## **9. REINFORCEMENT WORKMANSHIP**

- 9.1 Reinforcing bars supplied, bent or in coils, shall be straightened cold without damage at no extra cost. No bending shall be done when ambient temperature is below 5 Deg. C. Local warming may be permitted if steel is kept below 100 Deg. C.
- 9.2 All bars shall be accurately bent gradually and according to the sizes and shapes shown on the drawings/schedules or as directed by ENGINEER.
- 9.3 Re-bending or straightening incorrectly bent bars shall not be done without approval of ENGINEER
- 9.4 Reinforcement shall be accurately fixed and maintained firmly in the correct position by the use of blocks, spacers, chairs, binding wire etc. to prevent displacement during placing and compaction of concrete. The tied in-place reinforcement shall be approved by ENGINEER prior to concrete placement. Spacers shall be of such materials and design as will be durable, not lead to corrosion of the reinforcement and not cause spalling of the concrete cover.
- 9.5 Binding wire shall be 16-gauge soft annealed wire. Ends of the binding wire shall be bent away from the concrete surface and in no case encroach into the concrete cover.
- 9.6 Substitution of reinforcement, laps/splices not shown on drawing shall be subject to Engineer's approval.

## **10. TOLERANCES**

- 10.1 Tolerance for formed and concrete dimensions shall be as per IS: 456 unless specified otherwise.
- 10.2 Tolerance specified for horizontal or vertical building lines or footing shall not be constructed to permit encroachment beyond the legal boundaries.

## **11. PREPARATION PRIOR TO CONCRETE PLACEMENT**

- 11.1 Before concrete is actually placed in position, the inside of the FORMWORK shall be cleaned

and mould oil applied, inserts and reinforcement shall be correctly positioned and securely held, necessary openings, pockets etc. provided.

11.2 All arrangements - FORMWORK, equipment and proposed procedure, shall be approved by ENGINEER. CONTRACTOR shall maintain separate Pour Card for each pour as per the format enclosed.

## **12. TRANSPORTING, PLACING AND COMPACTING CONCRETE**

12.1 Concrete shall be transported from the mixing plant to the FORMWORK with minimum time lapse by methods that shall maintain the required workability and will prevent segregation, loss of any ingredients or ingress of foreign matter or water.

12.2 In all cases concrete shall be deposited as nearly as practicable directly in its final position. To avoid segregation concrete shall not be re-handled or caused to flow. For locations where direct placement is not possible and in narrow forms CONTRACTOR shall provide suitable drops and "Elephant Trunks". Concrete shall not be dropped from a height of more than 1.0 m as stipulated in clause 8.13.

12.3 Concrete shall not be placed in flowing water. Under water, concrete shall be placed in position by tremies or pipeline from the mixer and shall never be allowed to fall freely through the water.

12.4 While placing concrete the CONTRACTOR shall proceed as specified below and also ensure the following:

- a. Continuously between construction joints and predetermined abutments.
- b. Without disturbance to forms or reinforcement.
- c. Without disturbance to pipes, ducts, fixings and the like to be cast in ensure that such items are securely fixed. Ensure that concrete cannot enter open ends of pipes and conduits etc.
- d. Without dropping in a manner that could cause segregation or shock.
- e. In deep pours only when the concrete and FORMWORK designed for this purpose and by using suitable chutes or pipes.
- f. Do not place if the workability is such that full compaction cannot be achieved.
- g. Without disturbing the unsupported sides of excavations prevent contamination of concrete with earth. Provide sheeting if necessary. In supported excavations, withdraw the linings progressively as concrete is placed.
- h. If placed directly onto hardcore or any other porous materials, dampen the surface to reduce loss of water from the concrete.
- i. Ensure that there is no damage or displacement to sheet membranes.
- j. Record the time and location of placing structural concrete.

12.5 Concrete shall normally be compacted in its final position within thirty minutes of leaving the mixer. Concrete shall be compacted during placing with approved vibrating equipment without causing segregation until it forms a solid mass free from voids thoroughly worked

around reinforcement and embedded fixtures and into all corners of the FORMWORK. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn slowly till air bubbles cease to come to the surface, leaving no voids. When placing concrete in layers advancing horizontally, care shall be taken to ensure adequate vibration, blending and melding of the concrete between successive layers. Vibrators shall not be allowed to come in contact with reinforcement, FORMWORK and finished surfaces after start of initial set. Over-vibration shall be avoided.

12.6 Concrete may be conveyed and placed by mechanically operated equipment after getting the complete procedure approved by ENGINEER. The slump shall be held to the minimum necessary for conveying concrete by this method. When concrete is to be pumped the concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

12.7 Except when placing with slip forms, each placement of concrete in multiple lift, work shall be allowed to set for at least 24 hours after the final set of concrete shall stop when concrete reaches the top of the opening in walls or bottom surface of slab, in slab and beam construction, and it shall be resumed before concrete takes initial set but not until it has had time to settle as determined by ENGINEER. Concrete shall be protected against damage until final acceptance.

### **13. MASS CONCRETE WORKS**

Sequence of pouring for mass concrete works shall be as approved by ENGINEER. CONTRACTOR shall exercise great care to prevent shrinkage cracks and shall monitor the temperature of the placed concrete if directed.

### **14. CURING**

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

- a. Premature drying out, particularly by solar radiation and wind.
- b. Leaching out by rain and flowing water
- c. Rapid cooling during the first few days after placing
- d. High internal thermal gradients
- e. Low temperature or frost
- f. Vibration and impact, which may disrupt the concrete and interfere with its bond to the reinforcement.

14.2 All concrete, unless directed otherwise by ENGINEER, shall be cured by use of continuous sprays or ponded water or continuously saturated coverings of sacking, canvas, session or other absorbent material for the period of complete hydration with a minimum of 7 days. The quality of curing water shall be the same as that used for mixing.

14.3 Where a curing membrane is directed to be used by the ENGINEER, the same shall be of a non-wax base and shall not impair the concrete finish in any manner. The curing compound to be used shall be got approved from the ENGINEER before use and shall be applied with spraying equipment capable of a smooth, even textured coat.

14.4 Curing may also be done by covering the surface with an impermeable material such as polyethylene, which shall be well sealed and fastened.

## **15. CONSTRUCTION JOINTS AND KEYS**

15.1 Construction joints will be as shown on the drawing or as approved by ENGINEER. Concrete shall be placed without interruption until completion of work between construction joints. If stopping of concreting becomes unavoidable anywhere, a properly formed construction joint shall be made with the approval of ENGINEER.

15.2 Dowels for concrete work, not likely to be taken up in the near future, shall be coated with cement slurry and encased in lean concrete as indicated on the drawings or as directed by ENGINEER.

15.3 Before resuming concreting on a surface which has hardened all laitance and loose stone shall be thoroughly removed by wire brushing/hacking and surface washed with high pressure water jet and treated with thin layer of cement slurry for vertical points and a 15 mm thick layer of cement sand mortar for horizontal layers, the ratio of cement and sand being the same as in the concrete mix.

15.4 When concreting is to be resumed on a surface, which has not fully hardened, all laitance shall be removed by wire brushing, the surface wetted, free water removed and a coat of cement slurry applied. On this a layer of concrete not exceeding 150- mm thickness shall be placed and well rammed against the old work. Thereafter work shall proceed in the normal way.

## **16. FOUNDATION BEDDING**

All earth surfaces upon which or against which concrete is to be placed, shall be well compacted and free from standing water, mud or debris. Soft or spongy area shall be cleaned out and back filled with either soil- cement mixture, lean concrete or clean sand compacted as directed by ENGINEER. The surfaces of absorptive soils shall be moistened.

Concrete shall not be deposited on large sloping rock surfaces. The rock shall be cut to form rough steps or benches by picking, barring or wedging. The rock surface shall be kept wet for 2 to 4 hours before concreting.

## **17. FINISHES**

### **17.1 GENERAL**

The formwork for concrete works shall be such as to give the finish as specified. The CONTRACTOR shall make good as directed any unavoidable defects consistent with the type of concrete and finish specified, defects due to bad workmanship (e.g. damaged or misaligned forms, defective or poorly compacted concrete) will not be accepted. CONTRACTOR shall construct the FORMWORK using the correct materials and to meet the requirements of the design and to produce finished concrete to required dimensions, plumbs, planes and finishes.

### **17.2 Surface Finish Type F1**

This type of finish shall be for a non-exposed concrete surface against which back fill or concrete is to be placed. The main requirement is that of dense, well-compacted concrete. No treatment is required except repair of defective areas, filling all form tie holes and cleaning up of loose or adhering debris. For surface below grade, which will receive waterproofing treatment, the concrete shall be free of surface irregularities, which would interfere with proper and effective application of waterproofing material, specified for use.

### 17.3 Surface Finish Type F2

This type of finish shall be for all concrete work, which will be exposed to view upon completion of the job. The appearance shall be that of a smooth dense, well - compacted concrete showing the slight marks of well fitted shuttering joints. The CONTRACTOR shall make good any blemishes.

### 17.4 Surface Finish Type F3

This type of finish shall be for concrete work which will be exposed to view but to give an appearance of smooth, dense, well - compacted concrete with no shutter marks, stain free and with no discoloration, blemishes, arises, air-holes etc. Only lined or coated plywood with very tight joints shall be used to achieve this finish. The panel size shall be uniform and as large as practicable. CONTRACTOR shall make any minor blemishes that might occur good.

### 17.5 INTEGRAL CEMENT FINISH ON CONCRETE FLOOR

In all cases where integral cement finish on a concrete floor has been specified, the top layer of concrete shall be screened off to proper level and tamped with tamper having conical projections so that the aggregate shall be forced below the surface. The surface shall be finished with a wooden float and a trowel with pressure. The finish shall be continued till the concrete reaches its initial set. No cement or cement mortar finish shall be provided on the surface. Where specified, a floor hardener as approved by the ENGINEER shall be supplied and used as recommended by the manufacturer.

## 18. REPAIR AND REPLACEMENT OF UNSATISFACTORY CONCRETE

18.1 Immediately after the shuttering is removed, all the defective areas such as honey- combed surfaces, rough patches, holes left by form bolts etc. shall be brought to the notice of ENGINEER who may permit patching of the defective areas or reject the concrete work.

18.2 All through holes for shuttering shall be filled for full depth and neatly plugged flush with surface.

18.3 Rejected concrete shall be removed and replaced by CONTRACTOR at no additional cost to OWNER.

18.4 For patching of defective areas all loose materials shall be removed and the surface shall be prepared as directed by the ENGINEER.

18.5 Bonding between hardened and fresh concrete shall be done either by placing cement mortar or by applying epoxy. The decision of the ENGINEER as to the method of repairs to be adopted shall be final and binding on the contractor and no extra claim shall be entertained on this account. The surface shall be saturated with water for 24 hours before patching is done with 1:5 cement sand mortar. The use of epoxy for bonding fresh concrete shall be carried out as directed by ENGINEER.

## 19. VACUUM DEWATERING OF SLABS

19.1 Where specified floor slabs either on grade or suspended, shall be finished by vacuum DEWATERING including all operations such as poker vibration, surface vibration, vacuum processing, floating and toweling as per equipment manufacturers recommendation. The equipment to be used shall be subject to Engineer's approval.

## 20. HOT WEATHER REQUIREMENTS

Concreting during hot weather shall be carried out as per IS:7861 (Part I). Adequate provisions shall be made to lower concrete temperatures, which shall not exceed 40 Deg. C at the time of placement of fresh, concrete. Where directed by ENGINEER, CONTRACTOR shall spray non-wax based curing compound on unformed concrete surfaces at no extra costs.

## **21. COLD WEATHER REQUIREMENTS**

21.1 Concreting during cold weather shall be carried out as per IS:7861(Part II)

21.2 The ambient temperature during placement and up to final set shall not fall below 5 Deg. C. Approved anti freeze/accelerating additives shall be used where directed.

21.3 For major and large scale concreting works the temperature of concrete at times of mixing and placing, the thermal conductivity of the FORMWORK and its insulation and stripping period shall be closely monitored.

## **22. LIQUID RETAINING STRUCTURES**

22.1 The CONTRACTOR shall take special care for concrete for liquid retaining structures, underground structures and those others specifically called for to guarantee the finish and water tightness.

22.2 The minimum level of surface finish for liquid retaining structures shall be Type F2. All such structures shall be hydro-tested.

22.3 The CONTRACTOR shall include in his price of hydro testing of structure, all arrangements for testing such as temporary bulk heads, pressure gauges, pumps, pipe lines etc.

22.4 Any temporary arrangements that may have to be made to ensure stability of the structures shall also be considered to have been taken into account while quoting the rates.

22.5 Any leakage that may occur during the hydro-test or subsequently during the defects liability period or the period for which the structure is guaranteed shall be effectively stopped either by cement/epoxy pressure grouting, grouting or such other methods as may be approved by the ENGINEER. All such rectification shall be done by the CONTRACTOR to the entire satisfaction of the OWNER / ENGINEER at no extra cost to the OWNER.

## **23. TESTING CONCRETE STRUCTURES FOR LEAKAGE**

23.1 Hydrostatic test for water tightness shall be done at full storage level or soffit of cover slab as may be directed by ENGINEER, as described below:

- a. In case of structures whose external faces are exposed, such as elevated tanks, the requirements of the test shall be deemed to be satisfied if the external faces show no sign of leakage or sweating and remain completely dry during the period of observation of seven days after allowing a seven day period for absorption after filling with water.
- b. In the case of structures whose external faces are submerged and are not accessible for inspection such as underground tanks, the structures shall be filled with water and after the expiry of seven days after the filling; the level of the surface of the water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24 hrs over a period of seven days. Backfilling shall be withheld till the tanks are tested. The total drop in surface level over a period of seven days shall be taken as an indication of the water-tightness of the structure. The ENGINEER shall decide on the actual permissible nature of

this drop in the surface level, taking into account whether the structures are open or closed and the corresponding effect it has on evaporation losses. Unless specified otherwise, a structure whose top is covered shall be deemed to be water tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

- c. Each compartment/segment of the structure shall be tested individually and then all together.
- d. For structures such as pipes, tunnels etc. the hydrostatic test shall be carried out by filling with water, after curing as specified, and subjecting to the specified test pressure for specified period. If during this period the loss of water does not exceed the equivalent of the specified rate, the structure shall be considered to have successfully passed the test.

## 24. OPTIONAL TESTS

24.1 If the ENGINEER feels that the materials i.e. cement, sand, coarse aggregates, reinforcement and water are not in accordance with the specifications or if specified concrete strengths are not obtained, he may order tests to be carried out on these materials in laboratory, to be approved by the ENGINEER, as per relevant IS Codes. Owner shall pay only for the testing of material supplied by the OWNER; otherwise CONTRACTOR shall have to pay for the tests. Transporting of all materials to the laboratory shall however be done by the CONTRACTOR at no extra cost to OWNER.

24.2 In the event of any work being suspected of faulty material or workmanship requiring its removal or if the ENGINEER reserves the right to order the CONTRACTOR to take out cores and conduct tests on them or do ultrasonic testing or load testing of structure, etc. All these tests shall be carried out by CONTRACTOR at no extra cost to the OWNER. Alternately ENGINEER also reserves the right to ask the CONTRACTOR to dismantle and re-do such unacceptable work at the cost of CONTRACTOR.

24.3 If the structure is certified by the ENGINEER as having failed, the cost of the test and subsequent dismantling reconstruction shall be borne by CONTRACTOR.

24.4 The quoted unit rates/prices of concrete shall be deemed to provide for all tests mentioned above.

## 25. GROUTING

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

Use	Grout thickness	Mix Proportions	W/C
a) Fluid Mix	Under 25 mm	One part Portland Cement to one part Sand	0.44
b) General	25 mm and over but	One part Portland Cement to 2	0.53

Mix	less than 50 mm	parts of Sand	
c) Stiff Mix	50 mm and over	One part Portland Cement to 3 parts of Sand	0.53

#### NON - SHRINK GROUT

Non-shrink grout where called for in the schedule of Quantities or specified on the drawings shall be provided in strict accordance with the manufacturer's instructions/specifications on the drawings.

### 26. INSPECTION

All materials, workmanship and finished construction shall be subject to continuous inspection and approval of ENGINEER. Materials rejected by ENGINEER shall be expressly removed from site and shall be replaced by CONTRACTOR immediately at no extra cost to OWNER.

### 27. CLEAN UP

Upon the completion of concrete work, all forms equipment, construction tools, protective covering and any debris, scraps of wood, etc. resulting from and work shall be removed and the premises left clean.

### 28. ACCEPTANCE CRITERIA

28.1 Any concrete work shall satisfy the requirements given below individually and collectively for it to be acceptable.

- a. Properties of constituent materials
- b. Characteristic compressive strength
- c. Specified mix proportions
- d. Minimum cement content
- e. Maximum free-water/cement ratio
- f. Workability
- g. Temperature of fresh concrete
- h. Density of fully compacted concrete
- i. Cover to embedded steel
- j. Curing
- k. Tolerances in dimensions
- l. Tolerances in levels
- m. Durability

- n. Surface finishes
- o. Special requirements such as:
- p. Water tightness
- q. Resistance to aggressive chemicals
- r. Resistance to freezing and thawing
- s. Very high strength
- t. Improved fire resistance vi) Wear resistance
- u. Resistance to early thermal cracking

28.2 The Engineer's decision as to the acceptability or otherwise of any concrete work shall be final and binding on the CONTRACTOR.

28.3 For work not accepted, the ENGINEER may review and decide whether remedial measures are feasible so as to render the work acceptable. The ENGINEER shall in that case direct the contractor to undertake and execute the remedial measures. The CONTRACTOR shall expeditiously and effectively implement these. Nothing extra shall become payable to the CONTRACTOR by the OWNER for executing the remedial measures.

## **29. MODE OF MEASUREMENT AND PAYMENT**

29.1 The unit rate for concrete work under various categories shall be all-inclusive and no claims for extra payment on account of such item sleaving holes, embedding inserts, etc. shall be entertained unless separately provided for in the schedule of Quantities. No extra claim shall also be entertained due to change in the number, position and /or dimensions of holes, slots or openings, sleeves, inserts or on account of any increased lift, lead of scaffolding etc. All these factors should be taken into consideration while quoting the unit rates. Unless provided for in the schedule of quantities the rates shall also include fixing inserts in all concrete work, whenever required.

29.2 Payment for concrete will be made on the basis of unit rates quoted for the respective items in the Schedule of Quantities. No deduction in the concrete quantity will be made for reinforcements, inserts etc, and opening less than 0.100 of a sq. m. in areas where concrete is measured in sq.m. and 0.010 cum. where concrete is measured in cubic meters. Where no such deduction for concrete is made, payment for shuttering work provided for such holes, pockets etc, will not be made. Similarly the unit rates for concrete work shall be inclusive or exclusive of shattering as provided for in the schedule of Quantities.

29.3 Payment for beams will be made for the quantity based on the depth being reckoned from the underside of the slabs and length measured as the clear distance between supports. Payment for columns shall be made for the quantity based on height reckoned up to the underside of slabs/beams.

29.4 The unit rate for pre-cast concrete members shall include FORMWORK moldings, finishing, hoisting and setting in position including setting mortar provision of lifting arrangement etc. Complete. Reinforcement and inserts shall be measured and paid for separately under respective item rates.

- 29.5 Only the actual quantity of steel embedded in concrete including laps as shown on drawings as approved by ENGINEER shall be measured and paid for, irrespective of the level or height at which the work is done. The unit rate for reinforcement shall include all wastage, binding wires, chairs, spacers bars etc for which no separate payment shall be made.**
- 29.6 Where the FORMWORK is paid for separately, it shall be very clearly understood that payment for FORMWORK is inclusive of FORMWORK, shuttering, shoring, propping scaffolding, etc. complete. Only the net area of concrete formed (shuttered) shall be measured for payment.
- 29.7 List of Approved Vendors for supply of Steel reinforcement, Structural steel & Cement based on Vendor selection/ Sample- Test reports of various projects GWSSB, GWIL, GSPL & GSPC in and around Gujarat State executed by TPI

#### **LIST OF APPROVED VENDORS FOR CIVIL WORKS**

<b>ITEMS</b>	<b>Approved Brands/Quality</b>
CEMENT : S.R.C. , O.P.C.	Ultra Tech, Ambuja , ACC, Sanghi,Kamal, J K laxmi, wonder, Binani, Birla, Hathi, NUVOCO Vistas (Duraguard)
SAND	Clear river sand as per latest prevailing IS
AGGREGATE / KAPCHI	Standard size black trapped hard stone kapachi as per latest prevailing IS
BRICKS	MBM / KBM / SXB/any other marked and satisfying provisions of latest prevailing IS code locally available standard size, table moulded, kiln burnt bricks having crushing strength not less than 35 Kg./sq.cm.
HYSD /Reinforcement Steel/CRS FE 500 / TMT Fe 500	Tata, SAIL, VIZAG,Electrotherm, Hytuff, Gujarat NRE, welspan, National, friends, Jindal, Essar, German TMX, Mono steel, Rudra TMX, Nilkanth, Birla, Gallant TMT, Pagoda, Kamdhenu
Structural Steel	SAIL, VIZAG steel, Tata, Ambica, Jindal, Essar
RMC	Ultratech, J.K. Lakshmi,NUVOCO-Vistas, MCC, Perfect, Raj or own plant subject to prior approval of TPI/PMC/VMC
CAST IRON PIPES AND FITTINGS.	Orien al Castings, Electro steel Castings/BIC/Nicco

P.V.C. PIPES AND FITTING (UPVC/CPVC)	Finolex, Supreme, Jain, Kisan, Ashirwad, Astral, Dutron, Prince, Polysil
CHROMIUM PLATED WATER SUPPLY FITTINGS	ESSCO, Crown, Metro, Prince Jaquire, SUNT, Leader, Ebco
GALVANIZED PIPE	'B' class Zenith, Ambica, Tata, Surya, Asian
GALVANIZED FITTINGS	'R' Brand, 'RV' Brand
C.I. MACHINE HOLE COVER	Manish, Sil, NECO
PLUMBING FIXTURES	Jaguar / Plumber / Essco
PVC WATER TANK (100% VIRGIN PVC)	Sintex / Aqua(Double coated )
ALUMINIUM SHEETS AND ACCESSORIES	Jindal, Hindalco, Banco
ALUMINIUM EXTRUDED DOOR/ WINDOW SECTION	Indal, Jindal, Ajin India, Aldowin, Alumilite
ALUMINIUM HARDWARE	Rajdo t, Belu, Diamond, Glider
M.S. ANGLE SECTION	Any I.S.I.
WATER PROOFING MATERIALS	Zycosil, Dr. Fixit, Pidilite
HINGES	Suzu, Yama, E.P.P.W.
SCREW AND BOLTS	Nettle Folds- GKW
BOLTS & FASTENERS	Host, Fisher
DI PIPES AND FITTINGS	Electrotherm (I) Ltd., Ahmedabad, Sri Kalahasthi Pipes Ltd., Chennai, Jindal Saw Ltd., Ahmedabad, Kejriwal, Electro steel, Kesins, Chandranchal
AIR VALVE, SLUICE VALVE, SCOUR VALVE	Kirlosker, IVC, IVR, R&D multiple, Froess, HAWA ENGINEERS LTD

- The remaining materials after completion of work shall not be taken by VMC.

Signature of the Contractor with seal

Signature of the Executive Engineer

**(Drainage Project)**

## **7. LAYING OF PIPES AND FITTINGS / SPECIALS**

### **1. SCOPE**

The specification covers the requirements for laying of pipes and fittings/specials below ground. The two parts are complementary and are to be read together for a correct interpretation of the provisions of this specification.

### **2. APPLICABLE CODES**

The laying of pipes and fittings/specials shall comply with all currently applicable statutes, regulations, standards and codes. In particular, the following standards, unless otherwise specified herein, shall be referred to. In all cases, the latest revision of the standards/codes shall be referred to. If requirements of this specification conflict with the requirements of the standards/codes, these specifications shall govern.

#### **CODES OF PRACTICE**

IS: 783-Code of practice for laying of concrete pipes

IS: 3114 -Code of practice for laying of cast iron pipes

IS: 3764 -Excavation work - Code of Safety

IS: 4127 -Code of practice for laying of glazed stoneware pipes

IS: 5822 -Code of practice for laying of electrically welded steel pipes for water supply

IS: 6530 -Code of practice for laying of asbestos cement pressure pipes

### **3. CARTING AND HANDLING**

Pipes and fittings/specials shall be transported from the factory to the work sites at places along the alignment of pipeline as directed by Owner/ Engineer. Contractor shall be responsible for the safety of pipes and fittings/specials in transit, loading/unloading. Every care shall be exercised in handling pipes and fittings/specials to avoid damage. While unloading, the pipes and fittings/specials shall not be thrown down from the truck on to hard surfaces. They should be unloaded on timber skids with steady ropes or by any other approved means. Padding shall be provided on other approved means. Padding shall be provided between coated pipes, fittings/ specials and timber skids to avoid damage to the coating. Suitable gaps between pipes should be left at intervals in order to permit access from one side to the other. In case of spigot socket pipes, care should be taken regarding orientation of pipes while unloading. As far as possible pipes shall be unloaded on one side of the trench only. The pipes shall be checked for any visible damage (such as broken edges, cracking or spalling of pipe) while unloading and shall be sorted out for reclamation. Any pipe, which shows sufficient damage to preclude it from being used, shall be discarded. Dragging of pipes and fittings/specials along concrete and similar pavement with hard surfaces shall be prohibited. Pipes can be brought to site only after the mandatory tests i.e. are completed and pipe lots accepted. i.e. Cube tests, T.E.B., Hydrostatic, water absorption test.

### **4. STORAGE**

Each stack of pipes shall contain only pipes of same class and size, with consignment or batch number marked on it with particulars of suppliers wherever possible. Storage shall be done on firm level and clean ground and wedges shall be provided at the bottom layer to keep the stack stable.

The stack shall be in pyramid shape or the pipes laid length-wise and crosswise in alternate layers. The pyramid stack shall be made for smaller diameter pipes for conserving space in storing them. The height of the stack shall not exceed 1.5m.

Fittings/specials shall be stacked under cover and separated from pipes.

Rubber rings shall be stored in a clean, cool store away from windows, boiler, electrical equipment and petrol, oils or other chemicals. Particularly in the field where the rubber rings are being used it is desirable that they are not left out on the ground in the sun or overnight under heavy frost or snow conditions.

## **5. LAYING**

### **EXCAVATION**

Before excavating the trench the alignment of pipeline shall be approved by Owner/Engineer. The excavation of trenches and pits for machine holes / chambers shall be carried out in accordance with the Technical Specification: section-5 and shall be done such that it does not get far ahead of the laying operation as approved by Owner/Engineer.

To protect persons from injury and to avoid damage to property, adequate barricades, construction signs, red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for the traffic to use the roadways. The relevant Indian Standards and the rules and regulations of local authorities in regards to safety provisions shall be observed.

Suitable fencing shall be provided along the sides of trenches and pits. The posts of fencing shall be of timber securely fixed in the ground not more than 3 m apart and they shall not be less than 75 mm in diameter or less than 1.2m above surface of the ground. There shall be two rails, one near the top of the post and the other about 450mm above the ground and each shall be from 50 mm to 70mm in diameter and sufficiently long to run from post to post to which they shall be bound with strong rope. The method of projecting rails beyond the post and tying them together where they meet will not be allowed on any account. All along the edges of the excavation trenches a bank of earth about 1.2m high shall be formed where required by owner/ engineer for further protection.

The road metal and also the rubble packing shall first be stripped off for the whole width of the trench/pit and separately deposited in such place or places as may be determined by Owner/Engineer.

During excavation, large stones and rubble shall be separated and removed from the excavated soil and stacked separately. The material from excavation shall be deposited on either side of the trench leaving adequate clear distance from the edges of the trench and pit, or as may be necessary to prevent the sides of the trench pit to slip or fall, or at such a distance and in such a manner as to avoid covering fire hydrants, sluice valves, machine holes covers etc. and so as to avoid abutting the wall or structure or causing inconvenience to the public and other service organizations or otherwise as Owner/engineer may direct.

Contractor shall take into account additional excavation if any as Owner/ Engineer may require in order to locate the position of water pipes, drains, sewers etc. or any other works which may be met with, in or about the excavation of trenches/pits while quoting the rates for excavation. Such service lines if met with during excavation shall be properly maintained by Contractor, by means of shoring, strutting, planking over, padding or otherwise as Owner/Engineer may direct, and shall be protected by the Contractor from damage during the progress of the work.

All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipeline of water, gas, sewage etc.

If the work for which the excavation has been made is not completed by the expected date of the setting of monsoon as stipulated or the setting in of rain whichever is earlier, or before the day fixed by Owner/ Engineer for filling in any excavation on account of any festival or special occasion. Contractor shall backfill such excavation and consolidates the filling.

Utmost care shall be taken to see that the width of the trench at the top of pipe is not more than that specified. In case additional width is required it shall be provided only in the top portion from the ground level up to 300-mm above the top of pipe. If any extra width is provided in the area below this portion, Contractor shall have to provide remedial measures in the form of lime concrete or rubble masonry otherwise at the discretion and to the satisfaction of Owner/Engineer. If rock is met with, it shall be removed to 15 cm below the bottom of pipes and fittings/specials and the space resulting shall be refilled with granular materials and properly consolidated. Bottom of trenches/pits shall be saturated with water well rammed wherever Owner/ Engineer may consider it necessary to do so.

Wherever a socket or collar of pipe or fitting/special occurs, a grip is to be cut in the bottom of the trench or concrete bed to a depth of at least 75 mm below the bed of the pipe so that the pipe may have a fair bearing on its shaft and does not rest upon its socket. Such grip shall be of sufficient size in every respect to admit the hand all around the socket in order to make the joint and the grip shall be maintained clear until the joint has been approved by Owner/Engineer.

When welding is to be carried out with the pipes and specials in the trench, additional excavation of not more than 60 cm in depth and 90 cm in length shall be made at joints in order to facilitate welding.

The excess excavated material shall be carried away from site of works to a place up to a distance as directed by Owner/Engineer. This shall be done immediately so as not to cause any inconvenience to the public or traffic. If the instructions from Engineer are not implemented within seven days from the date of instructions to cart the materials and to clear the site, the same shall be carried out by Owner/Engineer and any claim or dispute shall not be entertained in this respect.

## DEWATERING

During the excavation, if subsoil water is met with Contractor shall have to provide necessary equipment and laborers for dewatering the trenches/pits by bailing out water or water mixed with clay; if pumping out subsoil water is found to be necessary, Contractor shall provide sufficient number of pumps for the same. In both the above cases the excavation shall be done to the required level and the pipes shall be laid to proper alignment and gradient. Contractor shall also make necessary arrangement for the disposal of drained water to nearby storm water drain or in a pit if allowed by Owner/Engineer. In no case the water shall be allowed to spread over the adjoining area. Before discharging this water into public sewer/drain, Contractor shall take necessary permission from the local authorities.

## SPECIAL FOUNDATION IN POOR SOIL

Where the bottom of the trench and sub-grade is found to consist of material which is unstable to such a degree that in the opinion of Owner/Engineer, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, a suitable foundation for the pipes, consisting of piling, timbers or other materials, in accordance with relevant drawings and as instructed by Owner/Engineer shall be constructed.

## WOODEN SHORING

Contractor shall suitably design polling bards, walling and struts to meet different soil conditions that might be encountered in excavating trenches/ pits. The horizontal and vertical spacing of struts shall be such that not only the sides of trenches shall be prevented from collapse but also easy lowering of pipe in trenches shall be ensured without creating undue obstructions for the excavation of the work. Any inconvenience and/or delay that might be caused in lowering pipes in trenches as a result of adopting improper spacing of struts by Contractor shall be his sole responsibility. No part of shoring shall be at any time be removed by Contractor without obtaining permission from Owner/Engineer. While taking out shoring planks the hollows of any form must simultaneously be filled in with soft earth well rammed with rammers and with water.

Owner/Engineer may order portions of shoring to be left in the trenches/pits at such places, where it is found absolutely necessary to do so to avoid any damage, which may be caused to buildings, cables, gas mains, water mains, sewers etc. in close proximity of the excavation, by pulling out the shoring from the excavations. Contractor shall not claim, on any reason whatsoever, for the shoring, which may have been left in by him at his, won discretion.

## STEEL PLATE SHORING

Where the subsoil conditions are expected to be of a soft and unstable character in trench/pit excavation, the normal method of timbering may prove insufficient to avoid subsidence of the adjoining road surfaces and other services. In such circumstances Contractor will be required to use steel trench sheeting or sheet piling adequately supported by timber struts, walling etc., as per the instructions, manner and method directed by Owner/ Engineer. Contractor shall supply, pitch, drive and subsequently remove trench sheeting or piling in accordance with other items of the specification.

## BONING STAVES AND SIGHTRAILS

In laying the pipes and fittings/specials the centre for each machine holes /chamber or pipeline shall be marked by a peg. Contractor shall dig holes for and set up two posts (about 100 x 100 x 1800 mm) at each machine holes /chamber or junction of pipelines at nearly equal distance from the peg and at sufficient distances there from to be well clear of all intended excavation, so arranged that a sight rail when fixed at a certain level against the post shall cross the centre line of the machine holes /chamber or pipelines. The sight rail shall not in any case be more than 30m apart. intermediate rails shall be put up if directed by Owner/Engineer.

Boning staves of 75mm x 50 mm size shall be prepared by Contractor in various lengths, each length being of a certain whole number of meters and with a fixed tee head and fixed intermediate cross pieces, each about 300 mm long. The top-edge of the cross piece must be fixed below the top- edge of the cross piece must be fixed below the top-edge of the tee-head at a distance equal to the outside diameter of the pipe or the thickness of the concrete bed to be laid as the case may be. The top of cross pieces shall indicate different levels such as excavation for pipeline, top of concrete bed, top of pipe etc. as the case may be.

The sight rail of size 250-mm x 40 mm shall be screwed with the top edge resting against the level marks. The centre line of the pipe shall be marked on the rail and this mark shall denote also the meeting point of the centre lines of any converging pipes. A line drawn from the top edge of one rail to the top edge of the next rail shall be vertically parallel with the bed of the pipe, and the depth of the bed of pipe at any intermediate point may be determined by letting down the selected boning staff until the tee head comes in the line of sight from rail to rail.

The post and rails shall be perfectly square and planned smooth on all sides and edges. The rails shall be painted white on both sides and the tee-heads and crosspiece of the boning staves shall be painted

black.

For the pipes converging to a machine holes /chamber at various levels, there shall be a rail fixed for every different level. When a rail comes within 0.60 M of the surface of the ground, a higher sight-rail shall be fixed for use with the rail over the next point.

The posts and rails shall in no case be removed until the trench is excavated, the pipes are laid and Owner/Engineer gives permission to proceed with the backfilling.

## BEDDING

The type of bedding for pipes shall be as per Approved Drawing.

## LAYING OF PIPES AND FITTINGS/SPECIALS

All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipeline of water, gas, sewage etc. After excavation of trenches, pipes shall not be lowered unless the dimensions of trenches and bedding work for pipes at the bottom of the trenches are approved and measured by Owner/Engineer. Pipes and fittings/specials shall be carefully lowered in the trenches. Special arrangements such as cranes, tripods with chain pulley block for lowering the pipes and fitting/specials shall be made by Contractor. In no case pipes and fittings/specials shall be dropped. Slings of canvas or equally non- abrasive material of suitable width or special attachment to fit the ends of pipes and fittings/specials shall be used to lift and lower the coated pipes and fittings/specials. The pipes and fittings/specials shall be inspected for defects and is rung with slight hammer preferably while suspended to detect cracks. If doubt persists, further confirmation shall be done by pouring a little kerosene /dye on the inside of the pipe at the suspected spot. No sign of kerosene/dye should appear on the outside surface. Pipes and fittings/specials damaged during lowering or aligning shall be rejected by Owner/Engineer.

All the pipes are to be laid perfectly true both in alignment and to gradient specified. In case of spigot and socket pipe the socket end of the pipe shall face upstream, except when the pipeline runs uphill in which case the socket ends should face the upgrade. The laying of pipes shall always proceed upgrade of a slope. After placing a pipe in the trench, the spigot end shall be centered in the socket and the pipe forced home and aligned to required gradient. The pipes shall be secured in place with approved backfill material tamped under it except at the socket. Pipes and fittings/specials, which do not allow a sufficient and uniform space for joints, shall be removed and replaced with pipes and fittings/specials of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the jointing space. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by Owner/Engineer. During the period that the plug is on, the Contractor shall take proper precautions against floating of the pipe owing to entry of water into the trench. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long radius curves are permitted the deflection allowed at joints shall not exceed 2½%. In case of pipes, with joints to be made with loose collars, the collars shall be slipped on before the next pipe is laid. The pipes shall be laid such that the marking on pipes appears at the top of the pipes.

The cutting of pipe for inserting valves, fittings or specials shall be done in a neat and workman like manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. For this purpose, pipe-cutting machine shall be used.

## THRUST BLOCKS

Thrust blocks shall be provided, to counteract hydraulic thrust, at places wherever directed by

Owner/Engineer and as per relevant drawing. Drawing for the same shall be taken approval of by the agency from Engineer in charge.

## **JOINTING**

Jointing for pipes and fittings/specials shall be done in accordance with the relevant specifications depending upon the type of pipes being used.

## **TESTING AND COMMISSIONING**

Testing and commissioning of pipes shall be done in accordance with the relevant specifications.

## **BACKFILLING**

Trenches shall be backfilled with approved selected excavated material only after the successful testing of the pipeline. The tamping around the pipe shall be done by hand or other hand-operated mechanical means. The water content of the soil shall be as near the optimum moisture content as possible. Filling of the trench shall be carried out simultaneously on both sides of the pipe in such a manner that unequal pressure does not occur. Backfilling shall be done in layers not exceeding 30 cm. Each layer shall be consolidated by watering, ramming, care being taken to avoid damage to the pipeline. In case of mild steel pipes/specials, the spiders provided during assembly and welding shall be retained until the trench is refilled and consolidated. Where timbers are placed under the pipeline to aid alignment, these timbers shall be removed before backfilling.

## **REINSTATEMENT OF ROAD/FOOTPATH**

Reinstatement of road/footpath shall be done as per the requirements of local authorities and the relevant specifications after completion of work without any extra cost.

## **CLEARING OF SITE**

All surplus materials, and all tools and temporary structures shall be removed from the site as directed by Owner/Engineer and the construction site left clean to the satisfaction of Owner/Engineer.

## **6. MEASUREMENT**

The measurement for excavation in trenches shall be done in following manner and will be paid accordingly.

Length: As per the actual length of pipes and fittings/specials laid at work site.

Width & cross-section: As specified.

Depth: Average depth of trench from ground level to invert of pipe.

Excavation of asphalt road and reinstatement of road shall be measured on per square meter basis and the length and width at top of trench shall be considered same as those mentioned for excavation of trench.

In case the excavation is done in wet condition either by bailing out water or by resorting to pumping, the respective items shall be paid according to the items in schedules of quantities and rates. The measurement for these items shall be made as per the units for relevant item(s) in schedule of quantities and rates. However, Engineer will decide on site the mode of dewatering and his decision shall be final and binding on Contractor.

Shoring (open/close) shall be measured on the square meter basis of the actual area of trenches horde.

The measurement for removal of excess excavated material up to a specified distance shall be as per the relevant item(s) in the Schedule of Quantities and Rates and shall be measured on cubic meter basis. In case of soil 30% deduction shall be done to take account for voids where it will be 40% in case of rubble.

Measurement for pipes and fittings/specials shall be in accordance with the relevant Clause (5) of specification for particular type of pipes.

## NOTES

Fencing provided along the sides of trenches and pits shall not be paid for separately and Contractor shall take into account the costs of such works and quote accordingly.

In case of the metal packing or dressed stones not being deposited as specified or being mixed up with excavated materials, and not available for the reinstatement of road/pavement, the cost of the new metal packing or dressed stones required shall be charged to Contractor by Owner/Engineer.

Contractor shall not be paid any additional compensation for excess excavation over what is specified as well as for any remedial measures that are specified.

The excess excavated material shall be carried away from site of works as specified, failing which in view of public safety and traffic convenience Owner/Engineer may carry out the work by any other agency at Contractor's risk and cost.

Portion of shoring left in the excavate trenches or pits shall be measured and paid separately if instructed by Owner/Engineer to do so.

## **8. REINFORCED CEMENT CONCRETE PIPES (SOCKET-SPIGOT TYPE ONLY)**

### **1.0 SCOPE**

This specification covers the requirements for manufacturing, testing, supplying, jointing and testing at work sites of Reinforced Cement Concrete (RCC) pipes, of both pressure and non pressure varieties used for pumping mains, sewers and storm water drains. Laying of pipes and fittings/specials is covered in Technical Specifications: section-5 the two parts are complementary and are to be read together for a correct interpretation of the provisions of this specification.

### **APPLICABLE CODES**

The manufacturing, testing, supplying, jointing and testing at work sites of RCC pipes shall comply with all currently applicable statutes, regulations, standards and codes. In particular, the following standards, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the codes shall be referred to. If requirements of this specification conflict with the requirements of the codes and standards, this specification shall govern.

### **MATERIALS**

IS: 458- Specification for pre-cast concrete pipes (with and without Reinforcement.)

IS: 3597 - Method of tests for concrete pipes.

IS: 5382 - Specification for rubber sealing rings for gas mains, water mains and sewers.

IS: 516 - Method of test for strength of concrete.

## CODE OF PRACTICE

IS: 456 - Code of practice for plain and reinforced concrete

IS: 783 - Code of practice for laying of concrete pipes

## 3.0 DESIGN

Design of RCC pipes including reinforcement details and the ends of pipes shall be in accordance with the relevant clauses of IS: 458.

## MANUFACTURING

### GENERAL

The method of manufacture shall be such that the form and the dimensions of the finished pipes are accurate within the limits specified in relevant clause of IS: 458. The surfaces and edges of the pipes shall be well defined and true, and their ends shall be square with the longitudinal axis. The ends of the pipes shall be further reinforced by an extra ring of reinforcement to avoid breakage during transportation.

The RCC pipes and collars/rubber rings shall be systematically checked for any manufacturing defects by experienced supervisors so as to maintain a high standard of quality.

Owner/Engineer shall at all reasonable times have free access to the place where the pipes and collars/rubber rings are manufactured for the purpose of examining and testing the pipes and collars/rubber rings and of witnessing the test and manufacturing.

All tests specified either in this specification or in the relevant Indian Standards shall be performed by the supplier/contractor at his own cost and in presence of Owner/Engineer if desired. For this, sufficient notice before testing of the pipes and fittings shall be given to Owner/Engineer.

If the test is found unsatisfactory, Owner/Engineer may reject any or all pipes of that lot. The decision of Owner/Engineer in this matter shall be final and binding on Contractor and not subject to any arbitration or appeal.

## MATERIALS

### Cement

Cement used for the manufacture of RCC pipes and collars should be (Sulphate Resisting Cement) (SRC) only and shall conform to relevant IS codes.

### Aggregates

Aggregates used for the manufacture of RCC pipes and collars shall conform to IS:383. The maximum size of aggregate should not exceed one-third the thickness of the pipe or 20 mm, whichever is smaller.

### Mixing and Curing Water

Water shall be clean, colorless and free from objectionable quantities of organic matter, alkali, acid, salts or other impurities that might reduce the strength, durability or other desirable qualities of

concrete and mortar.

### Reinforcement

Reinforcement used for the manufacture of the RCC pipes and collars shall be mild steel Grade I or medium tensile steel bars conforming to IS: 432 (Part-I) or hard-drawn steel wire conforming to IS: 421 (Part-2). Reinforcement cages for pipes and collars shall be as per relevant requirements of ARE: 458.

### Concrete

Concrete used for the manufacture of RCC pipes and collars shall conform to IS: 456. The minimum cement content and minimum compressive strength of concrete shall be as per relevant requirements of IS:458 (Latest Edition). Compressive strength tests shall be conducted on 15 cm cubes in accordance with the relevant requirements of IS: 456 and IS: 516.

### Rubber Ring

Rubber ring chords used in pipe joints shall confirm to 1A of IS: 5382-1967

### CURING

Pipes manufactured in compliance with IS:458 (Latest Edition) shall be either water cured or steam cured for minimum stipulated curing period in accordance with relevant requirements of the latest revised IS:458 (Latest Edition).

### DIMENSIONS

The internal diameter, wall thickness and length of barrel and collar of pipes, reinforcement (longitudinal and spiral), type of ends and minimum clear cover to reinforcement and strength test requirements shall be as per the relevant clauses/tables of IS: 458 for different classes of pipes.

The tolerances regarding overall length, internal diameter of pipes or sockets and barrel wall thickness shall be as per relevant clause of IS: 458.

### WORKMANSHIP AND FINISH

Pipes shall be straight and free from cracks except that craze cracks may be permitted. The ends of the pipes shall be square with their longitudinal axis so that when placed in a straight line in the trench no opening between ends in contact shall exceed 3 mm in pipes up to 600 mm diameter (inclusive), and 6 mm in pipes larger than 600 mm diameter.

The outside and inside surfaces of the pipes shall be smooth, dense and hard, and shall not be coated with cement wash or other preparation unless otherwise agreed to between Owner/Engineer and the manufacturer or supplier.

The pipes shall be free from defects resulting from imperfect grading of the aggregate, mixing or molding.

The pipes shall be free from local dents or bulges greater than 3 mm in depth and extending over a length in any direction greater than twice the thickness of barrel.

The deviation from straight in any pipe throughout its effective length, tested by means of a rigid straight edge parallel to the longitudinal axis of the pipe shall not exceed, for all diameters 3 mm forever meter run.

## TESTING

All pipes for testing purposes shall be selected at random from the stock of the manufacturer and shall be such as would not otherwise be rejected under the criteria of tolerances as mentioned in IS:458 (Latest Edition).

During manufacture, tests on concrete shall be carried out as per IS:456. The manufacturer shall supply, when required to do so by Owner/Engineer the results of compressive tests of concrete cubes and split tensile tests of concrete cylinders made from the concrete used for the pipes. The manufacturer shall supply cylinders or cubes for test purposes required by the Owner/Engineer and such cylinders or cubes shall withstand the tests prescribed by the manufacturer for the hydrostatic test pressure. For non-pressure pipes, 2 percent of the pipes shall be tested for hydrostatic test pressure.

The specimen of pipes for the following tests shall be selected in accordance with relevant Clause of IS:458 (Latest Edition) and tests in accordance with the methods described in IS:3597.

Hydrostatic test

Three edge bearing test

Absorption test

Note : Three edge bearing strength to produce 0.25 mm crack in case of special design of pipes shall be as per IS 458 - Latest Edition.

One pipe per lot of supply shall have to be broken at factory site as well as work site to verify quantity of steel used. However, necessary payment of pipe broken at work site (if found OK) will be done by department.

## SAMPLING AND INSPECTION

In any consignment, all the pipes of same class and size and manufactured under similar conditions of production shall be grouped together to constitute a lot. The conformity of a lot to the requirements of this specification shall be ascertained on the basis of tests on pipes selected from it.

The number of pipes to be selected from the lot for testing shall be in accordance with Table 15 of IS:458 (Latest Edition).

Pipes shall be selected at random. In order to ensure randomness, all the pipes in the lot may be arranged in a serial order and starting from any pipe, every 'n'th pipe be selected till the requisite number is obtained, n being the integral part of  $N/n$ , where N is the lot size and n is the sample size.

All pipes selected as per clause 4.7.2 shall be inspected for dimensional requirements, finish and deviation from straight. A pipe failing to satisfy one or more of these requirements shall be considered as defective.

The number of pipes to be tested for tests under clause 4.6.3 shall be in accordance with column 4 of Table 15 of IS:458 (Latest Edition). These pipes shall be selected from pipes that have satisfied the requirements mentioned in Clause 4.7.4.

A lot shall be considered as conforming to the requirements of IS:458 (Latest Edition) if the following conditions are satisfied.

The number of defective pipes shall not be more than the permissible number given in column 3 of Table 15 of IS:458 (Latest Edition).

All the pipes tested for various tests as per Clause 4.6.3 shall satisfy corresponding requirements of the tests.

In case the number of pipes not satisfying requirements of any one or more tests, one or two further samples of same size shall be selected and tested for the test or tests in which failure has occurred. All these pipes shall satisfy the corresponding requirements of the test.

## **MARKING**

The following information shall be clearly marked on each pipe :

Internal diameter of pipe

Class of pipe

Date and year of manufacture, and

Name of manufacturer or his registered trademark or both.

Name of client and ISI mark

## **5.0 LAYING OF PIPES**

The laying of RCC pipes shall conform to Technical Specifications: Section-D6.

## **JOINTING**

### **GENERAL**

Jointing of RCC pipes shall be done with OPC cement only and as per the requirements of following specifications and as per the relevant IS. The type of joints shall be as per Bill of Quantity. After jointing, extraneous material, if any, shall be removed from the inside of the pipe and the newly made joints shall be thoroughly cured. In case, rubber-sealing rings are used for jointing, these shall conform to IS 5382.

### **SPIGOT AND SOCKET JOINT(RIGID)**

The spigot of each pipe shall be slipped home well into the socket of the pipe previously laid and adjusted in the correct position. The opening of the joint shall be filled with stiff mixture of cement mortar in the proportion as specified, which shall be rammed with caulking tool. This joint is used for low-pressure pipeline.

### **COLLAR JOINT (RIGID)**

After laying the RCC pipes at proper alignment and gradient their abutting faces shall be coated with hot bitumen in liquid condition by means of a brush. The wedge-shaped groove in the end of the pipe shall then be filled with a tarred gasket in one length for each joint. The collar shall then be slipped over the end of the pipe and the next pipe butted well against the tarred gasket by suitable appliances approved by Owner/Engineer so as to thoroughly compress the tarred gasket into the grooves, care being taken that the concentricity of the pipes and levels are not disturbed during this operation. The collar shall then be placed symmetrically over the end

of the two pipes and the space between the inside of the collar and the outside of the pipe filled with a mixture of cement and sand as specified, tempered with just sufficient water to have a consistency of the semi-dry conditions, well packed and thoroughly rammed with caulking tools. The joints shall be finished off with a fillet sloping at 45° to the side of the pipe. The finished joints shall be protected and cured thoroughly as directed by Owner/Engineer. Any plastic solution or cement mortar that may have been squeezed into the inside of the pipe shall be removed so as to leave the inside of the pipe perfectly clean.

#### FLUSH JOINT (INTERNAL)

This joint shall be generally used for culvert pipes of 900-mm diameter and over. The ends of the pipes are specially shaped to form a self-centering joint with an internal jointing space 13-mm wide. The finished joint is flush with both inside and outside with the pipe wall. The jointing space is filled with cement mortar in the proportion as specified in IS Code, mixed sufficiently dry to remain in position when forced with a trowel or rammed.

#### FLUSH JOINT (EXTERNAL)

This joint is suitable for pipes which are too small for jointing from inside. This joint is composed of specially shaped pipe ends. Each end shall be butted against each other and adjusted in correct position. The jointing space shall then be filled with cement mortar as specified in IS Code, sufficiently dry and finished off flush. Great care shall be taken to ensure that the projecting ends are not damaged as no repairs can be readily affected from inside the pipe.

#### SPIGOT AND SOCKET (SEMI-FLEXIBLE)

This joint is composed of specially shaped spigot and socket ends on the RCC pipes. A rubber ring as specified in IS Code, shall be lubricated and then placed on the spigot, which is forced into the socket of the pipe previously laid. This compresses the rubber ring as it rolls into the annular space formed between the two surfaces of the spigot and socket, stiff mixture of cement and mortar as specified in Data Sheet-A, shall then be filled into the remaining annular space with a caulking tool.

#### COLLAR JOINT (SEMI-FLEXIBLE)

This joint is made up of a loose collar, which covers two specially shaped pipe ends. Each end shall be fitted with a rubber ring as specified in Data Sheet-A which when compressed between the spigot and collar, seals the joint. Stiff mixture of cement mortar shall then be filled into the remaining annular space and rammed with a caulking tool.

#### SPIGOT AND SOCKET JOINT (FLEXIBLE)

The RCC pipe with the rubber ring accurately positioned on the spigot shall be pushed well home into the socket of the previously laid pipe by means of uniformly applied pressure with the aid of a jack or similar appliance. The RCC pipes shall be of spigot and socket type and rubber rings as specified in IS Code, shall be used, and the manufacturer's instructions shall be deemed to form a part of these specifications. The rubber rings shall be lubricated before making the joint and the lubricant shall be soft soap water or an approved lubricant supplied by the manufacturer.

#### CLEANING OF PIPES

As soon as a stretch of RCC pipes has been laid complete from machine holes to machine holes or for a stretch as directed by Owner/Engineer, contractor shall run through the pipes both backwards and forwards a double disc or solid or closed cylinder 75 mm less in diameter than the internal diameter of pipes. The open end of the incomplete stretch of pipeline shall be securely closed as

may be directed by Owner/Engineer to prevent entry of mud or silt etc.

If as a result of the removal of any obstructions Owner/Engineer considers that damages may have been caused to the pipelines, he shall be entitled to order the stretch to be tested immediately. Should such test prove unsatisfactory, contractor shall amend the work and carry out such further tests as are required by Owner/Engineer.

It shall also be ascertained by contractor that each stretch from machine holes to machine holes or the stretch as directed by Engineer is absolutely clear and without any obstruction by means of visual examination of the interior of the pipeline suitably enlightened by projected sunlight or otherwise.

#### **TESTING AT WORK SITE**

after laying and jointing of RCC pipes is completed the pipeline shall be tested at work site as per the following specifications and as directed by Owner/Engineer. All equipment for testing at work site shall be supplied and erected by contractor. Water for testing of pipes shall be arranged by him. Damage during testing shall be contractor's responsibility and shall be rectified by him to the full satisfaction of Owner/Engineer. Water used for test shall be removed from pipes and not released to the excavated trenches.

After the joints have thoroughly set and have been checked by Owner/Engineer and before backfilling the trenches, the entire section of the sewer or storm water drain shall be provided with Flow Test. The method used for the purpose of testing shall be approved by Owner/Engineer. Contractor if required by Owner/Engineer shall dewater the excavated pit and keep it dry during the period of testing.

#### **DISINFECTION OF WATERMAINS**

The mains intended for potable water supplies should be disinfected before commissioning them for use.

The mains shall be chlorinated with a liquid chlorine solution (that is liquid chlorine gas and water mixture). The disinfection shall be considered to have been achieved if a chlorine residual of not less than 10 PPM remains in the water after 24 hours standing in the pipe. If this requirement is met with, the mains should be thoroughly flushed with clean water.

If the treatment specified in clause 9.2 is not possible, enough chlorinated lime, calcium or sodium hypochlorite should be introduced to produce the required concentration of chlorine in the solution. The solution should then be allowed to stand for not less than 24 hours, after which it should be tested for residual chlorine, which should not be less than 10 PPM. If found satisfactory, the mains should be thoroughly flushed with clean water.

#### **MEASUREMENT**

All RCC pipes shall be measured according to the work actually done and no allowance will be made for any waste in cutting to the exact length required. The measurement for pipes shall be in running meter nearest to a cm. of length along the centre line of pipe as actually laid at work sites.

The rate for providing, laying and jointing of RCC pipes shall be deemed to include the cost of collars/rubber rings, jointing material, testing and extra excavation required for ordinary bedding of pipes and also for collars and pipe sockets, if any.

**NOTES:**

If any damage is caused to the pipeline during the execution of work or while cleaning / testing the pipe line as specified, Contractor shall be held responsible for the same and shall replace the damaged pipe line and retest the same at his own cost to the full satisfaction of Engineer.

Water for testing of pipe line shall be arranged by Contractor at his own cost.

Pipes shall be brought on site proportionate to the required progress for Thirty days only.

#### DATA SHEET-A

<b>Sr. No.</b>	<b>Item</b>	<b>Provision of: IS: 458</b>
1.	Three edge bearing strength to produce 0.25 mm. (NP2)	150 mm dia – 10.40 KN/m 200 mm dia – 11.90 KN/m 250 mm dia – 11.40 KN/m 300 mm dia – 12.00 KN/m 350 mm dia – 12.60 KN/m
	Three edge bearing strength to produce 0.25 mm (NP3)	400 mm dia – 19.16 KN/m 450 mm dia – 21.56 KN/m 500 mm dia – 23.95 KN/m 600 mm dia – 28.74 KN/m
	Three edge bearing strength to produce 0.25 mm crack (NP4)	700 mm dia – 52.20 KN/m 800 mm dia – 59.30 KN/m 900 mm dia – 66.30 KN/m 1000 mm dia – 74.90. KN/m 1400 mm dia – 106.10 KN/m
2.	Type of Joints	Spigot-Socket
3.	Proportion of cement use mortar for use in jointing of pipes	(1.1)

## **9. ANCILLARY WORKS-MACHINE HOLES , CATCH-PITS AND VENT SHAFTS**

### **1.0 SCOPE**

This specification covers the requirements for providing and constructing ancillary works such as machine holes , scraper machine holes , vent shafts etc. These specifications are to be read together for a correct interpretation of the provisions of this specification.

### **APPLICABLE CODES**

The following standards/codes, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the standards/codes shall be referred to. If requirements of this specification conflict with the requirements of the codes and standards, this specification shall govern.

### **MATERIALS**

IS: 210 - Specification for grey iron castings

IS: 269 - Specification for ordinary and low heat Portland cement.

IS: 383 - Specification for coarse and fine aggregate.

IS: 432 - Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.

IS: 518 - Methods of tests for strength of concrete.

IS: 651 - Specification for salt-glazed stoneware pipes and fittings.

IS: 1077 - Specification for common burnt clay building bricks

IS: 1726 - Specification for cast iron machine holes covers and frames

IS: 1766 - Specification for high strength deformed steel bars and wires for concrete reinforcement.

IS: 2116 - Specification for sand for masonry mortars.

IS: 3495 - Methods of tests of burnt clay building bricks, mains, water mains and sewers.

IS: 5455 - Specification for cast iron steps for machine holes .

### **CODE OF PRACTICE**

IS: 456 - Code of practice for plain and reinforced concrete

IS: 2211 - Code of practice for brickwork

IS: 2250 - Code of practice for preparation and use of masonry mortars

IS: 4111 - Code of practice for ancillary structures in STORM WATER DRAINAGE system machine holes

IS: 4127 -Code of practice for laying of glazed stoneware pipes.

## MACHINE HOLES / CATCH-PITS

### LOCATION

Machine holes shall be constructed at places as shown on relevant drawings (the detailed drawings will be furnished during execution of the work) and as directed by Owner/Engineer. The type, size and specific requirements for construction of machine holes shall be as per Approved drawing.

### EXCAVATION

Excavation, shoring, dewatering etc. for the pits of machine holes shall be done in accordance Technical Specification: section-5 for excavation, shoring and dewatering and Technical Specification: section-5 for laying of pipes and fittings/specials. The rate quoted for machine holes shall be inclusive of excavation and backfilling, bailing or pumping out water and shoring.

### BED CONCRETE

The bed concrete for machine holes shall be done in accordance with specification Technical Specification:

section-5 and drawings.

### BRICKS

Bricks used for construction of machine holes shall conform to the relevant Indian Standards. They shall be sound, hard, homogeneous in texture, well burnt in kiln without being vitrified, table molded, deep red, cherry or copper colored, of regular shape and size and shall have sharp and square and parallel faces. The bricks shall be free from pores, chips, flaws or lumps of any kind. Bricks containing ungrounded particles and/or which absorb water more than 1/6th of their weight when soaked in water for twenty-four hours shall be rejected. Over burnt or under burnt bricks shall be liable to rejection. The bricks shall give a clear ringing sound when struck and shall have a minimum crushing strength of 35-kg/sq. cm. Unless otherwise noted in drawings. The class and quality requirements of bricks shall be as laid down in IS: 1077.

The size of the brick shall be 23.0 x 11.5x7.5 cm unless otherwise specified; but tolerance up to (3 mm in each direction shall be permitted. Only full size brick shall be used for masonry work. Brickbats shall be used only with the permission of Owner/Engineer to make up required wall length or for bonding. Sample bricks shall be submitted to Owner/Engineer for approval and bricks supplied shall conform to approved samples. If demanded by Owner/Engineer, brick sample shall be got tested as per IS: 3495 by Contractor at no extra cost to Owner/Engineer. Bricks rejected by Owner/Engineer shall be removed from the site of works within 24 hours.

### CEMENT MORTAR

Mortar for brick masonry shall be prepared as per IS: 2250. Machine holes shall be constructed in brick masonry with cement mortar. Gauge boxes for sand shall be of such dimensions that one bag containing 50 kg of cement forms one unit. The sand shall be free from clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be as approved by Owner / Engineer. If so directed by Owner/Engineers and shall be thoroughly washed till it is free of any contamination.

For preparing cement mortar, the ingredients shall first be mixed thoroughly in dry conditions. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall be used within 25 minutes of mixing. Mortar left unused in the specified period shall be

rejected.

Contractor shall arrange for test on mortar samples if so directed by Owner/Engineer. Re tempering of mortar shall not be permitted.

## BRICK MASONRY

All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry work of machine holes shall be in the proportion specified in 3.6.2. Brick work 230 mm thick and over shall be laid in English Bond unless otherwise specified. 115 mm thick brickwork shall be laid with stretchers. For laying bricks, a layer of mortar shall be spread over the full width of suitable length of the lower course. Each brick shall be pressed into the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall be laid with frogs uppermost.

All brickwork shall be plumb and square unless otherwise shown on drawing and true to dimensions shown. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be leveled. The thickness of brick courses shall be kept uniform. For walls of thickness greater than 230 mm both faces shall be kept in vertical planes unless otherwise specified. All interconnected brickwork shall be carried out at nearly one level (so that there is uniform distribution of pressure on the supporting structure) and no portion of the works shall be left more than one course lower than the adjacent work. Where this is not possible, the works shall be raked back according to bond (and no saw toothed) at an angle not exceeding 45 degrees. But in no case the level difference between adjoining walls shall exceed 1.25 m. Workmanship shall conform to IS: 2212.

Brick shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6 mm and not more than 10 mm. The face joints shall be raked to a minimum depth of 12 mm by raking tools daily during the progress of work when the mortar is still green, so as to provide a proper key for the plastering to be done. When plastering is not required to be done, the joints shall be uniform in thickness and be struck flush and finished at the time of laying. The face of brickwork shall be cleaned daily and all mortar droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top. If mortar in the lower courses has begun to set, the joints shall be raked out to a depth of 12mm before another course is laid. No extra payment will be made for raking joints.

## CEMENT PLASTER

All joints in masonry shall be raked to a depth of 12 mm with a hooked tool made for the purpose when the mortar is still green and in any case within 48 hours of its laying. These surface to be rendered shall be washed with fresh clean water free from all dirt, loose material, grease etc. and thoroughly wetted for 6 hours before plastering work is commenced. Concrete surfaces to be rendered will however be kept dry. The wall should not be too wet but only damp at the time of plastering. The damping shall be uniform to get uniform bond between the plaster and the wall.

The proportion of the cement mortar shall be as specified on relevant drawings. Cement shall be mixed thoroughly in dry condition and then just enough water added to obtain workable consistency. The quality of water, sand and cement shall be as per relevant I.S. The mortar thus mixed shall be used immediately and in no case shall the mortar be allowed to remain for more than 25 minutes after mixing with water.

Curing of plaster shall be started as soon as the applied plaster has hardened enough so as not to be damaged. The decision, as to when the plaster has hardened, will be given by Owner/Engineer. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days.

Plastering shall be done on both faces of brick masonry in cement mortar.

#### CEMENT CONCRETE CHANNEL

The channel for the machine holes shall be constructed in cement concrete 1:2:4. Both sides of the channel shall be taken up to the level of the crown of the outgoing sewer. They shall be benched up in concrete and rendered in cement mortar (1:1) of 20-mm thickness and formed to a slope of 1 in 12 towards the channel.

#### PIPE ENTERING OR LEAVING MACHINE HOLES

Whenever a pipe enters or leaves a machine holes, bricks on edge must be cut to a proper form and laid around the upper end of the pipe so as to form an arch. All around the pipes, there shall be a joint of cement mortar (1:2) 13-mm thick between it and the bricks.

#### CAST IRON STEPS

Cast iron steps shall be as per IS :5455. The steps shall be of grey cast iron or grade 15 as per IS 210. The steps shall be clean, well-cast and they shall be free from air and sand holes, cold shuts and wrappings. The portion of the step, which projects, from the wall of the machine holes shall have a raised chequered design to provide an adequate non-slip grip. C.I. steps shall weigh not less than 4.5 kg each and shall be of 150 mm x 375 mm over all dimensions. These steps shall be coated with a black bituminous composition. The coating shall be smooth and tenacious. It shall not flow when exposed to a temperature of 63 degrees C and shall not be brittle as to chip off at temperature of 0-degree C.

Where the depth of invert of machine holes exceeds 800 mm, cast iron steps of approved pattern shall be fixed in the brickwork at the interval of 300 mm vertically and staggered at 360 mm horizontally center to center. In case of pipe diameter greater than 600 mm, box type C.I. steps weighing 19 kg each shall be provided at 300 mm vertically in the channel of machine hole as per drawing.

Poly Propylene molded/coated steps should be as per instructions of Engineer-in-charge and Abstract sheet

#### FRAME AND COVERS

Frame and covers for machine holes shall be of required type and dimensions as per the relevant drawings. Following information shall be clearly marked on each cover.

Date and Year of manufacture ; ISI mark

Identification mark of the purchaser ; Name of client

#### SEWER/SWD

Arrow showing direction of flow.

#### Cast Iron Frame and Cover

The cast iron frame and cover shall be of grey cast iron as per IS: 1726. The general requirements for casting and coating of CI frame and cover shall be as specified for CI steps in Clause 3.10.1. The covers shall have a raised chequered design to provide an adequate non-slip grip. The rise of the chequered shall be not less than 4 mm. The locking device for cover shall be provided as directed by Owner/Engineer. The CI covers for load test shall be selected at one for every lot of fifty

or part thereof for each type and size manufactured and as directed by Owner/Engineer. The frame shall be fixed in cement concrete of M15 grade all round and finished with neat cement. The machine holes frame shall have 560-mm diameter clear opening and shall weigh not less than 208 kg. Including cover. In case of rectangular CI frame and cover of 900 mm x 600 mm clear opening, the total weight shall not be less than 275 kg. In case of scraper machine holes the frame shall have clear opening of 1200 mm x 900 mm and shall weigh not less than 900 kg including cover. The machine holes cover and frame shall be painted with three coats of anti-corrosive paint after fixing in position. The size, type, weight of frame and cover as well as locking arrangement for cover shall be as per Approved drawing.

#### Fiber Reinforced Concrete Frame and Cover

Fiber reinforced concrete frame and cover shall be capable of withstanding load of 35 tones. The frame shall be fixed in cement concrete of M15 grade all around and finished with neat cement. The fiber-reinforced frame shall have clear opening of 560-mm diameter and weighing 102kg. The cover shall have a minimum thickness of 100 mm and weighing 78-kg. The fibers shall constitute 1% by weight of the concrete in the form of 50 mm to 100-mm long high tensile steel wires. For the cover, MS sheet lapping of 18 gauges shall be provided to avoid damage to the edges. Similarly for frame, MS angle/flat shall be provided along the edge. Both MS sheet and angle shall be painted with black bituminous paint. The cover should have suitable lifting arrangement. The fiber reinforced frame and cover shall be manufactured as per the drawing approved by Owner/Engineer. The size, type, weight and locking arrangement for frame and cover shall be as per approved drawing.

#### Reinforced Cement Concrete Frame and Cover

Reinforced cement concrete frame and cover for machine holes shall be of required dimensions and shape as shown in drawing. The frame and cover shall be cast in cement concrete of M20 grade. Minimum cover to the reinforcement shall be 40 mm. The edges of frame and covers shall be provided with mild steel angles to avoid damages to the corners. These angles shall be painted with black bituminous paint. The covers should have suitable lifting arrangement.

#### DROP MACHINE HOLES

When a sewer connects a main sewer, and where the difference in level between water line (peak flow levels) of main line and the invert level of branch line is more than 800 mm or a drop of more than 800 mm is required to be given in the same sewer line and it is uneconomical or impractical to arrange the connection within 600 mm, a drop connection shall be provided for which a machine holes shall be constructed as per relevant drawing, incorporating a vertical drop pipe from the higher sewer to the lower one. This pipe shall be provided outside the shaft and encased in concrete. A continuation of the branch sewer should be built through the shaft wall to form a rotting and inspection eye, which should be provided with a half blank flange. The diameter of the backdrop should be at least as large as that of the incoming pipe. The drop pipe should terminate at its lower end with a plain or duck-foot bend turned so as to discharge its flow at 45 degrees or less to the direction of the flow in the mains sewer. The pipe unless of cast iron should be surrounded with 150 mm thick concrete.

In the case of sewers over 450 mm in diameter the drop in level may be accomplished by one of the following methods as shown on relevant drawings:

A cascade

A ramp

By drops in previous machine holes .

## RCC MACHINE HOLES

In general, plain and reinforced concrete work for machine holes shall be carried out in accordance with the Technical Specification: section-5 unless otherwise specified in this specification. The top slab of machine holes shall be cast with shutters lined with plywood and shall be smooth finished as per Clause 22.4.3 of above specification. For avoiding surface cracks due to variation in atmospheric temperature and exposure to direct sunlight, RCC slab of machine holes after casting shall be kept wet. M40 grade of concrete used for construction of RCC machine holes shall have minimum cement content of 430 kg/cum. of concrete. Bar bending schedule for reinforcement shall be prepared by Contractor and got approved from Owner/Engineer before proceeding with the work. Minimum cover to the reinforcement shall be 20 mm.

## SPECIFIC TECHNICAL REQUIREMENTS FOR LAYING OF RCC PIPES

### SCOPE

This section specifies the specific technical requirements for laying, jointing, testing and commissioning of R.C.C. pipes for conveyance of sewage. This section and other specifications of Chapter: 8 are mutually dependent and essential for correct interpretation of the contract. In case of conflict in any of these specifications, the requirements of this section shall govern.

### EXCAVATION

Before excavating the trench, the alignment of the R.C.C. pipes shall be got approved from Owner/Engineer. The excavation for trenches shall be carried out in accordance with the Technical Specification: section-5 . All excavation work in trenches for laying of the R.C.C. pipes shall be mechanized except in local developed areas to expedite the work.

All precautions shall be taken during excavation and construction to guard against possible damage to any existing structure/pipelines etc. Also utmost care shall be taken to prevent side collapse during excavation. No payment for removal of any collapsed earth shall be made.

Contractor shall provide suitable barricade, fencing on both sides of excavation for its full length. Also necessary construction signs, red lanterns and guards as required shall be provided and maintained during the progress of work.

Stable side slopes to excavation shall be provided wherever space for such slopes is available and side slopes are permitted by Engineer. The excavation with side slopes shall be measured and paid for. Engineer's approval for side slopes during excavation shall not relieve Contractor from his responsibility for any damage or subsidence. In congested areas, where side slopes are not feasible and/or not permitted by Engineer, Contractor shall provide suitable shoring and strutting for excavation. The design of bedding and quantities are based on width of trench defined in approved drawing and side slope of 1 horizontal to 10 vertical on either side. A suitable side slope shall be provided to meet with specific site condition as directed by Engineer-in-Charge.

The material from excavation shall be deposited at such places as directed by Engineer leaving adequate clear distance from the edge of the trench as may be necessary to prevent the sides of the trench from slipping or collapsing or at such a distance and in such a manner as to avoid covering fire hydrants, machine holes covers, etc. and so as to avoid abutting against any wall or structure or causing inconvenience to the public and other service organizations or otherwise as Owner/Engineer may direct. The basic lead for disposal of excavator material shall be 50m, as against 100m mentioned in Technical Specifications: section-5 , Earthwork in Grading, Excavation and Backfilling.

Service lines if met with during excavation shall be properly maintained by Contractor by means of shoring, strutting, planking over, padding or otherwise as Owner/Engineer may direct and shall be protected by Contractor from damage during the progress of the work and if damaged, such damage shall be made good either by Contractor or by other agency, as Owner/Engineer may decide and wholly, in either case at the risk and cost to contractor. For supporting 150mm diameter and above pipes and high-tension cables, contractor shall be paid separately only if special measures have been taken to support the above services by Contractor and deemed fit by Engineer.

Utmost care shall be taken to see that width of trench at the top of pipe is not more than that specified in Approved drawing. In case additional width is required it shall be provided only in the top portion from the ground level up to 3mm above the top of pipe. If any extra width is excavated in the area below this portion Contractor shall have to provide remedial measures as directed by Engineer. Contractor shall not be paid for extra excavation as well as for any remedial measures. The design of bedding and quantities are based on width of trench defined in Approved drawing and side slope of 1 horizontal to 10 vertical on either side. A suitable side slope shall be provided to meet with specific site condition as directed by Engineer-in-Charge.

In case of excavation of existing roads, the road metal and also the rubble packing shall first be stripped off for the whole width of the trench/pit and separately deposited in such place or places as may be determined by Engineer. In case of the metal packing or Khandakies not being so deposited or being mixed up with excavated material and not being available for making good the road surface, the cost of the new metal packing of Khandakies as required shall be charged to the Contractor. Excavation in asphalt/concrete road or pavement of any thickness shall be considered as separate item for payment as provided in Schedule of Quantities and Rates. Such work shall neither be part of excavation in hard rock as mentioned in Technical Specification: section-5.

The excess excavated material shall be carried away immediately from site of works to places up to a distance specified in Schedule of Quantities and Rates and as directed by Owner/Engineer so as not to cause any inconvenience to the public or traffic convenience, Owner/Engineer shall carry out and the work by any other agency at Contractor's risk and cost. If the instructions from Engineer are not followed within seven days from the date of instructions to cart the materials and to clear the site, the same shall be carried out by Owner/Engineer at the risk and cost of Contractor and no claim or dispute shall be entertained in this respect.

### **Method of Working**

The contractor should furnish his work program, i.e. construction methodology & sequence of works for completion of the works within the scheduled time, within 15 days after the Notice to proceed and prior to start of the construction activities at site.

Before excavating the trench, the alignment of sewer line shall be approved by the Engineer-in-Charge.

Laying of the pipeline shall be done as per Standard Specifications.

The trial pits/ trenches shall be taken by the Contractor at his own cost, without being directed to do so, along the proposed sewer line alignment, in advance of the excavations for the purpose of satisfying himself as to the location of underground obstructions or conditions, the contractor shall proceed with caution, in any excavation and shall use every means to determine the exact location of underground structures, pipelines, conduits etc., prior to excavation in the immediate vicinity thereof. The Contractor shall be solely responsible for the cost of protections or repair or replacement of any structure, pipeline/storm water drain, conduit etc. above or below ground, which may be broken or otherwise damaged his operations.

The lighting, guarding of the trenches, warning signs, reflectors and the provision of watchman, barricading of the trenches shall be done by the Contractor at his cost.

Special arrangements such as cranes, tripods with chain pulley block for lowering the pipes and fittings shall be made by Contractor at his own cost. In no case pipes and fittings shall be dropped.

The posts and rails & barricading shall in no case be removed till the backfilling of the trench is completed.

The bedding for sewer lines shall be provided as specified in the drawings and as per direction of the Engineer-in-Charge.

In case of PCC bedding, the pipes can be laid after 24 hours of laying of PCC bedding and after the clearance of the Engineer-in-Charge. The trench can be filled up to the top of the pipe level with moist soil to ensure curing of concrete and then after testing of sewer line, trench should be filled. In the duration before filling the trench, soil should be kept moist to ensure adequate curing.

The pipes and specials shall be stacked along the alignment in advance with utmost care during transit so that they are not damaged. Any damage due to these reasons shall be Contractor's liability.

All the sewer lines are to be laid perfectly true both in alignment and to gradient specified. In case of spigot and socket pipe, the socket end of the pipe shall face upstream.

The sewer lines shall be secured in place with approved backfill material tamped under it except at the socket.

The sewer lines shall be laid such that the marking on pipes appears at the top of the pipes.

Properly fitted temporary wooden stoppers shall be provided to close the ends of all incomplete sewer line.

The stoppers are only to be removed when pipes are being laid and jointed. Opening at end of day's work shall be capped and sealed.

Sewer pipe laying and jointing shall be started and completed only section wise as per the instruction of the Engineer-in-Charge. The sections shall be chosen from machine holes to machine holes.

The work of sewer line laying and machine holes construction shall be done simultaneously so that hydraulic testing can be done efficiently. The construction of the works shall progress from downstream end (i.e.) the discharge point and proceed towards upstream.

In case contractor finds any discrepancy in the Ground Levels and/ or Invert Levels during the setting out of work he shall immediately bring it to the notice of the Engineer-in-Charge for necessary rectification before commencing the pipe laying works.

Contractor shall not be paid any additional compensation for excess excavation cover what is specified as well as for any remedial measures that are specified.

The excess excavated material shall be carried away from the site of works as specified, failing which in view of public safety and traffic convenience, Engineer-in-Charge may carry out the work by any other agency at Contractor's risk and cost.

All the testing of sewer lines and other appurtenances, at both factory and site shall be carried out

in presence of Engineer-in-Charge or his representative. Besides, third party inspection for sewer lines shall be done as specified earlier.

The Contractor shall submit to the Engineer-in-Charge within two months of actual completion of the individual works but not later than the completion date of Contract, "as built Drawings" as specified below. These Drawings shall be accurate and correct in all respects and shall be shown to and approved by the Engineer-in-Charge.

The contractor, along with a soft copy in CD, shall supply completed and as built works certified drawings on six prints and one polyester film of appropriate size sheets. Plan with scale 1: 1000 (A1 Size) & Auto CAD Copy showing the roads along with other details such as property width, storm water drains, footpaths, location of electrical/ telephone poles. Location of machine holes with coordinates along with all the dimensions wherever possible shall be prepared. The type of road, footpath details etc. shall be further elaborated in terms, of their dimensions and material used. Finally exact alignment of sewer, road side chamber and machine holes details such as type and size of pipe, GL& IL at each machine holes, dia. of machine holes, etc. shall be marked on the plan. Nomenclature of network shall be same as given in the network design drawing furnished to the Contractor during execution. The connection details at the existing outfall sewer shall be shown in plan and section.

The water pipelines, valves, their sizes, material, depth etc. and other services which are encountered during the excavation and trial trench shall also be shown on the completion drawings.

## BACKFILLING

Trench shall be back filled with approved selected excavated material only after successful inspection / testing / verification of levels of the pipeline by VMC or their authorized representative. The tamping around the pipe shall be done by hand and other hand operated mechanical means. The water content of the soil shall be as near the optimum moisture content as possible. Filling of the trench shall be carried out simultaneously on both sides of the pipe in such a manner that unequal pressure does not occur. Backfilling shall be done in layers not exceeding 30cm. Each layer shall be consolidated by watering, ramming, care being taken to avoid damage to the pipeline. The compaction shall be done to achieve the 95% of Proctor density. The trench shall be back filled after end of work and road shall be restored according to the drawing and specifications.

## R.C.C. PIPES

R.C.C. pipes and collars shall strictly conform to IS: 458. The internal diameter, type, class and three edge bearing strength of pipes shall be as per IS: 458 - Latest Edition.

The pipes shall be laid perfectly true both in alignment and gradient on specified bedding as shown on relevant drawing. The type of joint and the cement mortar proportion for jointing of pipes shall be as per IS Code.

Contractor should protect the completed work of pipeline from any damage and prevent the back-filled earth entering into the pipe at his own cost. After laying and jointing of pipeline Contractor should clear the entire pipeline inclusive of machine holes /chambers of all debris before testing. It will be the sole responsibility of the contractor to prevent the earth, silt, any type of material/water etc. entering into the excavated trench, laid pipelines or machine holes during the course of execution of work also. Due to any reason, any material if entered, will have to be removed by the contractor, at his own risk and cost.

## TESTING FOR WATERTIGHTNESS

R.C.C. pipes after jointing inclusive of machine holes shall be tested for water tightness in

suitable stretches before backfilling excavated earth, as per clause nos. 8.1 and 8.2 of Technical Specification: section-5 Reinforced Cement Concrete Pipes.

## **AGGREGATES**

Aggregates used for concrete shall consist of naturally occurring stones (crushed or uncrushed) and sand.

## **10. BREAKING OF ASPHALT ROAD SURFACE**

### **Breaking of Asphalt road surface :**

For laying of pipes the contractor shall break the asphalt road surface of any thickness wherever shown by the corporation after diverting the traffic and keeping the sign board of "Road closed - Work in Progress". The contractor shall carry out the work after providing proper lighting during the night hours, providing fencing wherever required and publishing a public notice for the closure of road. The rubbish excavated shall be stacked nearby and shall be used during refilling.

The rate shall be in sq. meters.

## **11. CI / DI PIPES Specials/ Valves/ Valve Chamber Supplying Ductile Iron Valves Sluice Valve**

For the work of supplying of (PN-1.6) D.I. double flanged metal seated sluice valve, as per relative IS Specification (IS 1484-2000) & mark, double flanged, non magnetic, stainless steel housing, 3 tpi spindle with gun metal nut, hand wheel-operated and opening clockwise direction, tested & confirming to flanges drilled to IS 1538/ 1976 with cap, hydraulic tested of Kirloskar, I.V.C., Kilburn, Durga make as approved by department, shall be supplied at site. Test certificate as per IS requirements shall have to be provided with the valve. The rate shall be inclusive of all type of taxes, loading, unloading, freight, octroi, insurance, etc. in the proposed supply. The sluice valve body shall be tested for a pressure of 20 kg/cm<sup>2</sup>. And seat for 10 kg/cm<sup>2</sup>. Item includes supply of tail pieces for the connections. The rate shall be per number.

### **Air Valve**

The Air Valve shall be 200mm dia. Double ball flanged type of relative IS Specification (IS 780 & IS 2906) and approved make, H-40 type, with all types of fittings, required bolts, rubber gasket (packing) etc. shall be supplied with the valve.

The rate shall be per number.

### **Fixing of DI Valve**

The materials purchased from the market such as sluice valves, air valves, tail piece, bolt, nut, rubber packing, lime, etc. after properly checking and verifying, transporting to the site of work, jointing the tail piece and valve using rubber packing, nut, bolt, lime, etc. after properly cleaning the tail piece and the flanges of the valve. Thereafter the trench shall be further excavated as required and the valve shall be lowered using the chain pulley block and keeping wooden planks and bricks at the side and bottom for proper leveling. The contractor shall be responsible for protecting the valve, tail piece, etc. materials brought to the site. The contractor will be responsible for protecting the sluice valve spindle till the pipe line is handed over to the corporation. The excavation required for the valve shall be paid in the item of excavation. The rate shall be per number.

### **Constructing Valve Chamber**

The contractor shall carry out the excavation work as per the relevant item. To lay 150 mm. thick 1:2:4 PCC using black metal cement concrete, compacting, finishing and curing as shown in the design and drawing. To construct 23 cm thick wall in CM 1:6, 12 mm thick (1:3) smooth cement plaster from inside and 1:3 cement pointing on outside surface with cement pointing. The top of the chamber shall be covered with 150 mm. thick in M35 RCC pre-cast slab in two parts with Key hole provision. 30 cm below the pipe line invert the cement concrete block shall be extended. The coping shall be 150mm thick in M-200. The valve base shall be in M-200 C.C. C.I. steps shall be of 4.5 kg/each weight and at 350mm vertical c/c distance. The IPS shall be casted in 40 mm. thick in the proportion of (1:2:4). The above work shall be inclusive of cost for centering, reinforcement, sand, bricks; binding wire and all other required material and labor etc. The rate shall be per number up to 1.0m depth chamber of above size. If depth exceeds 1m extra rate applicable shall be per meter depth beyond 1m depth.

For the additional depth work shall be carried out as specified above, the rate of which shall be per running meter.

The contractor shall construct valve chamber required for the heavy duty valve inclusive of required brick masonry, plaster, etc., as shown in the drawing and specification and inclusive of the required material and labor.

#### Constructing Valve Chamber

The contractor shall carry out the excavation work as per the relevant item. To lay 150 mm. thick 1:2:4 PCC using black metal cement concrete, compacting, finishing and curing as shown in the design and drawing. To construct 35 cm thick wall in CM 1:6, 15 mm thick (1:3) smooth cement plaster from inside and 1:3 cement pointing on outside surface with cement pointing. The top of the chamber shall be covered with 150 mm. thick in M-35. RCC pre-cast slab in two parts with Key hole provision. 30 cm below the pipe line invert the cement concrete block shall be extended. The coping shall be 150mm thick in M-200. The valve base shall be in M-200 C.C. The C.I. steps shall be of 4.5 kg/each weight and at 350mm vertical c/c distance. The IPS shall be casted in 40 mm. thick in the proportion of (1:2:4). The above work shall be inclusive of cost for centering, reinforcement, sand, bricks, binding wire and all other required material and labor etc. The rate shall be per number up to 2.0m depth chamber of above size. If depth exceeds 2m extra rate applicable shall be per meter depth beyond 1m depth.

For the additional depth work shall be carried out as specified above, the rate of which shall be per running meter.

The contractor shall construct valve chamber required for the heavy duty valve inclusive of required brick masonry, plaster, etc., as shown in the drawing and specification and inclusive of the required material and labor.

## 12. GENERAL BUILDING ITEMS

Purchasing, Providing & Laying of Ductile Iron Pipes :

Ductile iron Spun Pressure Pipes, suitable for Drainage works, of required diameter Shall be supplied at store as per I.S. 8329-2000 and its latest amendment .

The pipe shall of K-9 class with Socket Spigot ends suitable for push-on-Jointing with inside cement mortar lining (OPC) and outside Zinc plus Mechanically/ Spray (Cold) applied Bitumen Coating conforming to IS 8329-2000 along with test certificate. Materials to be supplied with consideration of third party inspection of the agency approved by VMC.

The pipe shall be of K-9 class and including supply & fixing of SBR Tyton Ring (having ISI mark)

required in joint. Rate shall be per running Meter of pipe length & Contractor shall include in his rate, all taxes, loading, unloading, insurance, carting etc. complete

The socket and spigot shall be properly cleaned using wire brush before the DI pipes and specials are laid in line in the trench. The spigot shall be properly fixed in the socket in line and level, using chain pulley block or such approved method. If required the pipes shall be cut using appropriate equipment before they are laid.

Fixing/ Jointing of specials is included in the labour charge. The Tyton rings as per IS 5382-1985 (Neoline and Nitrile rubber, SBR ) shall be used for making the joints for the pipes and specials. The required material for the Tyton joint shall be procured and supplied by the contractor and its rate shall be included. Laying of D.I. pipes include necessary connections with the existing APS / Machine holes as per the instruction of the Engineer-in-charge. Contractor shall give Hydraulic pressure test at 6.0 kg/sq.cm. for 15 minutes and leakage test at 3 kg/sq.cm for 2 hours as per relative IS Specification, the water, material & equipment required for testing shall be arranged by the contractor at his own cost.

### **The Rate shall be per running meter.**

#### **Supply of DI Specials**

Manufacture, supply & Delivery of Ductile Iron Flange socket spigot bends, tees, reducers or any other specials as per BS-EN-545/1995 Class-A series K-12 suitable for use with D.I. pipes manufactured as per IS:8329/1994 delivery of specials is to be made to VMC store or site of works. D.I. fitting shall be as per IS specification and ISI-mark, along with test certificate, including all taxes, loading, unloading, carting, stacking, insurance, inspection charges, octroi etc. complete.

The rates shall be per kilogram weight of specials.

#### **Lead Jointing :**

The DI pipes shall be cut as per instruction of the Engineer in-charge and the material / debris and waste obtained shall be deposited in the respective stores of the corporation. The contractor shall bring Tee, collar, bends, etc., specials to the site of work, place the same in position, cut the existing DI pipe, and fix the pipe in required line and level. The required jute, lead, tools, etc., shall be supplied by the contractor. For the excavation for the existing lines, the contractor shall provide rope fencing, required lighting during night hours, after dressing and providing wooden planks, de-watering, lead joint shall be made in presence of the corporation's Engineer in-charge.

To make the lead joint and the to facilitate the caulking the area around the joint shall be excavated to 1.5 ft. as directed by the corporation' engineer to make available the working space. Cleaning the pipes and special sockets, supplying approved quality of jute and inserting it with required equipment and filling the joint with lead as per the details given below or as per PWD HBA-2, Table - CC (VII). The joint shall be kept open from all the sides and got checked from the site overseer.

Sr No.	Details of Lead required Depth of Lead Joint Remark				
(kg)			(cm)		
1	100 mm.	DI pipe	2.50	5.0	As per PWD
2	150	"	3.62	6.0	HBA-2,
3	225	"	6.12	7.85	Table - CC (VII)

4	300	“	7.70	8.00
5	370	“	10.45	8.25
6	450	“	14.30	8.30
7	525	“	16.25	8.50
8	600	“	19.00	9.15
9	700	“	21.00	10.0
10	750	“	25.00	11.0

Maintaining the gaps as mentioned above, pouring lead into the joints using lead, wool, etc., at site and after heating the lead making the joint in presence of the corporation's engineer. The joint made in absence of the engineer shall not be considered and the contractor shall remove the joints and the lead at his own expense and redo the joint in presence of the engineer. The contractor shall provide the required caulking tools and do the caulking. Contractor shall see that in no case the lead come out of the joint and in no circumstances he would be allowed to cut the same.

**The item shall be paid per number.**

#### **Supplying DI Valves / Sluice Valve**

For the work of supplying of (PN-1.6) D.I. double flanged metal seated sluice valve, as per relative IS Specification (IS 1484-2000) & mark, double flanged, non magnetic, stainless steel housing, 3 tpi spindle with gun metal nut, hand wheel-operated and opening clockwise direction, tested & confirming to flanges drilled to IS 1538/ 1976 with cap, hydraulic tested of Kirloskar, I.V.C., Kilburn, Durga make as approved by department, shall be supplied at site. Test certificate as per IS requirements shall have to be provided with the valve. The rate shall be inclusive of all type of taxes, loading, unloading, freight, octroi, insurance, etc. in the proposed supply. The sluice valve body shall be tested for a pressure of 20 kg/cm<sup>2</sup>. And seat for 10 kg/cm<sup>2</sup>. Item includes supply of tail pieces for the connections. The rate shall be per number.

#### **Air Valve**

The Air Valve shall be 200mm dia. Double ball flanged type of relative IS Specification (IS 780 & IS 2906) and approved make, H-40 type, with all types of fittings, required bolts, rubber gasket (packing) etc. shall be supplied with the valve.

The rate shall be per number.

#### **Fixing of DI Valve**

The materials purchased from the market such as sluice valves, air valves, tail piece, bolt, nut, rubber packing, lime, etc. after properly checking and verifying, transporting to the site of work, jointing the tail piece and valve using rubber packing, nut, bolt, lime, etc. after properly cleaning the tail piece and the flanges of the valve. Thereafter the trench shall be further excavated as required and the valve shall be lowered using the chain pulley block and keeping wooden planks and bricks at the side and bottom for proper leveling. The contractor shall be responsible for protecting the valve., tail piece, etc. materials brought to the site. The contractor will be responsible for protecting the sluice valve spindle till the pipe line is handed over to the corporation. The excavation required for the valve shall be paid in the item of excavation. The rate shall be per number.

### Constructing Valve Chamber

The contractor shall carry out the excavation work as per the relevant item. To lay 150 mm. thick 1:4:8 C using black metal cement concrete, compacting, finishing and curing as shown in the design and drawing. To construct 23 cm thick wall in CM 1:6, 12 mm thick (1:3) smooth cement plaster from inside and 1:3 cement pointing on outside surface with cement pointing. The top of the chamber shall be covered with 150 mm. thick in 1:2:4 RCC pre-cast slab in two parts with Key hole provision. 30 cm below the pipe line invert the cement concrete block shall be extended. The coping shall be 150mm thick in 1:2:4. The valve base shall be in 1:2:4 C.C. C.I. steps shall be of 4.5 kg/each weight and at 350mm vertical c/c distance. The IPS shall be casted in 40 mm. thick in the proportion of (1:2:4). The above work shall be inclusive of cost for centering, reinforcement, sand, bricks; binding wire and all other required material and labor etc. The rate shall be per number up to 1.0m depth chamber of above size. If depth exceeds 1m extra rate applicable shall be per meter depth beyond 1m depth.

For the additional depth work shall be carried out as specified above, the rate of which shall be per running meter.

The contractor shall construct valve chamber required for the heavy duty valve inclusive of required brick masonry, plaster, etc., as shown in the drawing and specification and inclusive of the required material and labor.

### Constructing Valve Chamber

The contractor shall carry out the excavation work as per the relevant item. To lay 150 mm. thick 1:2:4 PCC using black metal cement concrete, compacting, finishing and curing as shown in the design and drawing. To construct 35 cm thick wall in CM 1:6, 15 mm thick (1:3) smooth cement plaster from inside and 1:3 cement pointing on outside surface with cement pointing. The top of the chamber shall be covered with 150 mm. thick in M-200. RCC pre-cast slab in two parts with Key hole provision. 30 cm below the pipe line invert the cement concrete block shall be extended. The coping shall be 150mm thick in M-200. The valve base shall be in M-200 C.C. The C.I. steps shall be of 4.5 kg/each weight and at 350mm vertical c/c distance. The IPS shall be casted in 40 mm. thick in the proportion of (1:2:4). The above work shall be inclusive of cost for centering, reinforcement, sand, bricks, binding wire and all other required material and labor etc. The rate shall be per number up to 2.0m depth chamber of above size. If depth exceeds 2m extra rate applicable shall be per meter depth beyond 1m depth.

For the additional depth work shall be carried out as specified above, the rate of which shall be per running meter.

The contractor shall construct valve chamber required for the heavy duty valve inclusive of required brick masonry, plaster, etc., as shown in the drawing and specification and inclusive of the required material and labor.

## 13. GENERAL BUILDING ITEMS

### Specifications of civil engineering materials

#### Water

The Contractor shall make all the arrangements for adequate supply of water for efficient execution of the work and for the needs of the labor employed thereon. Water used in masonry work, making concrete, mortar for bricks and for other plain or reinforced general constructions shall be reasonably clean and free from impurities, Alkali, Salts and other deleterious substances likely to cause efflorescence or which are likely to be harmful to the work. As a rule water is clear and

potable will be considered satisfactory for all those purpose.

### **Sand**

The sand shall consist of natural sand composed of fine granular materials resulting from natural disintegration produced by crushing hard stone or gravel. The sand shall be hard, durable, chemically inert, clean and free from adhering coating, particles of shells, mica and organic, clay balls or pellets. The sand shall not contain any harmful impurities, such as iron, pyrites, alkalis, salts, laminated or other materials in such a form or in such quantities as to affect adversely the hardening, strength, the durability or the appearance of the mortar or concrete. The amount of deleterious substance, namely clay, fine silt and fine dust, shall not exceed 4 percent, sand containing more than the prescribed limits of clay or mud etc. shall be properly washed prior to being used. The sand shall not contain organic impurities in quantities, show a color darker than the standard, when subjected to Carolinian test as specified in IS2116 & IS 1542. The contractor shall use sand for concrete work from approved quarries only.

### **Coarse Aggregate**

The source from which the aggregate is to be procured shall be subject to approval to the Engineer-in-charge /Consulting Engineer, it shall be conforming to IS : 383. The coarse aggregate shall be of stone or clean gravel and the size of gauge specified having clear, hard strong and durable fragments. It shall be free from dirt, clay, leaves or any organic matter, the broken stone and shall be free from admixture of soft or decayed stone and shall have not injurious chemicals actions when mixed with concrete. The contractor shall wash the aggregate use of his expense wherever required by the authorized representative of Engineer-in-charge/ Consulting Engineer.

### **Cement**

Portland Cement conforming to Indian Standards specification IS: 269 1958 shall be used. It shall be stored to the satisfaction of the Engineer-in-charge in weather proof sheds, building or ware house or dry platform and protected from rain and moisture. Cement shall be stored in bulk at place but should be staked out separately and distinctly. Cement which has set a partially set, shall not be used in the work. Any cement that is damaged through careless handling transport and storage shall be contractor's responsibility and contractor shall remove all rejected cement from site within 24 hours. Cement stored for a period not more than three months shall only be allowed to be used, if permitted by the Engineer-in-charge, and if any tests required to be carried out the contractor shall do so at his cost.

### **General Note::**

Wherever discrepancies regarding specifications of materials mentioned aforesaid are found, and where no specification numbers are mentioned (pertaining to materials to be used in the works) in all such cases relevant Indian Standard Specifications with all their latest amendments shall be applicable

The Engineer-in-charge at his own discretion may reject any material offered or delivered for use in the work if not found fulfilling specifications. The quality of the materials is to be supported by manufacturer's certificate.

The contractor shall have to carry out third party inspection of all the material including pipes, valves, etc. at contractor's cost from the Govt. approved Lab. Or Agency fixed by the Engineer-in-charge, and submit the certificates. Above this, the Engineer-in-charge shall have liberty to have this material tested at contractor's cost and the result of such test should be final and binding to the contractor.

## **14. RCC Pipes with HDPE lining**

a) The manufacturing/ supplying, laying and jointing of all Reinforced Cement concrete (RCC) pipes shall be done in accordance with standard CPWD specifications. The RCC pipes with 2500micron thick HDPE lining shall be ISI marked spigot and socket type/with

M.S. Collar and jointing of RCC pipes shall be done using rubber gaskets confirming to IS 5382. All the pipes shall be manufactured as specified in IS 458: 1988 (Amended up to date) and laid in trench as per IS 783. All the tests as specified in the Standard Specifications shall be performed by the Contractor at manufacturer's place in presence of Engineer's representative and/or by third party inspector. The contractor / firm shall submit the name of manufacturers of RCC pipes from whom he is going to procure the pipes for verification of his ISI mark and previous experience in the field of manufacturing of pipes. The bedding below the pipeline and back filling shall be provided as per pipe bedding standard drawings. After the work for laying and jointing of RCC sewer pipes is completed, the sewer line and Machine holes shall be tested at work site.

## **15. DRAWINGS**

The work shall agree in all particulars with the contract drawings and amendments to drawings, which shall be read in conjunction with the specification. The Engineer may issue further drawings, if necessary, as the work proceeds.

The enclosed drawings are for the reference of Contractor and information only, as they are preliminary in nature. Owner/Engineer reserves the right to change the plans, locations, delete or add some parts of the work, etc. if warranted at the time of preparation of detailed drawings or as work proceeds. Contractor will have no claims on Owner/Engineer on this account. Contractor shall carefully scrutinize the drawings and he shall be responsible to point out discrepancy or anomalies if any to the Engineer before execution of the work affected thereby.

Contractor, his employees and agents shall not disclose to anyone any information contained on drawings, or otherwise furnished to him/her by Owner/Engineer including all drawings, reports, etc. prepared by Consultant/Contractor either individually or jointly for the execution of the works without prior approval of Engineer. No photographs of the works or plant within the site premises shall be taken without prior written approval of Owner/Engineer.

## **CHAPTER: 9: ITEM WISE SPECIFICATIONS: (Also refer Chapter: 8: General Specifications)**

### **ITEM NO. 1 & 2:**

#### **Excavation for foundation up to 1.5 m and 1.5 m to 3.0 m depth including sorting out and stacking of useful materials and disposing of the excavated stuff up to 50 mtrs. lead. Dense or hard soil.**

##### **General**

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

##### **Clearing the site**

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

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

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

##### **Excavation**

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

##### **Disposal of the excavated stuff**

The excavated stuff of the selected type shall be used in filling the trenches and plinth or levelling the Ground in layers including ramming and watering etc.

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

##### **Mode of measurements & payment**

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

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

Excavation for foundation in soil 1.5 m to 3.0 m depth including sorting out and stacking of useful materials and disposing of the excavated stuff for all leads and lift for any kind of soil etc. complete.

##### **Workmanship**

The relevant specifications of item No.1 shall be followed except that the excavation work shall be carried out with 1.5 M. to 3.0 M. lift in any kind of soil.

##### **Mode of Measurement & Payment**

The relevant specifications of item No.1 shall be followed.

The excavation work from 1.5 to 3.0 m. shall be measured under this item.

The rate shall be for a unit of one cubic metre.

As Directed by EIC

Excavation for foundation in 3.0 m to 4.5 m depth including sorting out, dewatering and stacking of useful materials and disposing of the excavated stuff for all leads and lift for any kind of soil etc. complete. (If applicable)

Workmanship

The relevant specifications shall be followed except that the excavation work shall be carried out from 3.0.m. to 4.5.m. lift in any kind of soil.

Mode of Measurement & Payment

The excavation work from 3.0.m. to 4.5.m. lit shall be measured under this item.

The rate shall be for a unit of one cubic metre.

**Item No. 3:**

**Providing and Laying Cement Concrete 1:3:6 (1-Cement, 3-Coarse Sand, 6-hand Broken stone aggregates 40 mm nominal size) and curing complete excluding cost of formwork.**

- a) Column footing up to plinth.
- b) Ground beam
- c) For columns in super structure
- d) For lintels
- e) For R.C.C. Hood
- f) R.C.C. beam/coping
- g) Slab
- h) Foundation for pump
- i) Thrust Block or Encasing of Pipes etc.

The sand shall be clean, river sand free from all impurities as per the general specification of materials. The coarse aggregate shall be of machine crushed from approved sevalia quarry of black trap as approved by the Executive Engineer. The aggregate shall be as per specification of general materials.

The concrete shall be mixed in concrete mixer to have uniform and homogeneous mix. In R.C.C work hand mixing shall not be allowed except in breakdown of the mixer. However, under unavoidable circumstances up to the construction joint hand mixing shall be permitted by adding extra 10% of cement at the cost of the contractor without claiming any extra cost. The hand mixing shall be done only to bring the work to the safe stage as directed by the Engineer-in-charge.

The concrete shall be laid in position immediately before the initial setting time of cement begins. Necessary safe scaffolding to lift the concrete to various floors shall be prepared by the contractor.

The concrete after placing in position shall be well tempered by mechanical vibrators if necessary and wooden screeds, so that the whole mass becomes compact and homogeneous of concrete. While placing the concrete care should be taken that the position of reinforcement is not disturbed. Adequate cover should be provided by placing precast concrete cover blocks and not by metal pieces or brick bats. After the finishing of the concrete surface is done the same shall be protected by wet gunny bags till the surface is sufficient hard to receive final curing. The concrete work after proper setting shall be cured properly by water by providing dykes or bunds 8 cms to 10 cms high and filling them by water. The curing shall be continuously done for 14 days. In case of columns, beams, footings, curing by dykes or bund is not possible the RCC members shall be properly cured by wet gunny bags by continuous watering as directed by the Engineer-in-charge.

At the time of concreting, proper care shall be taken that honey combing is minimum.

After the form work is removed any such honey combing is found it shall be finished with cement mortar (1:2) so that all crevices are properly filled up and no reinforcement is exposed. If however, the honey combing is of very severe nature and is found throughout the surface concreting exposing the reinforcement the concrete work shall be rejected and redone without any extra cost.

In case of volume of concrete more than 5M<sup>3</sup> at a time contractor shall cast 15 cms x 15 cms x 15 cms test cubes and slump test shall be taken during the concreting as per I.S.S. These cubes shall be tested in witness of Owner/ PMC/ TPI's Engineers at any Government approved laboratory or Engineering college at the cost of the contractor. The strength of concrete shall be minimum as specified in ISI 456-1964 as specified by the design section. After the centering is removed, all exposed RCC members shall be lightly chiseled to have proper key with mortar for plastering work and shall be finished with cement mortar 1:3 cement plaster of required thickness to bring work in line and level including neeru finish and 3 coats of white wash. The slab when projected shall have to be provided drip molding and no extra payment shall be made on account of this.

The rate of concrete includes cost of all materials, labour and shall be paid as per size of the member cast and not finished. The rate is exclusive of the reinforcement. The rate is inclusive of the cost of finishing with cement plaster 1:3 the exposed faces such as to of lofts, cantilever and chhaja including neeru finishing 3 coats of white or colour wash etc. comp.

In case of casting some of the member which were to be provided as precast, as cast in situ, such work shall be measured and paid against this item without any extra cost.

The measurement of various members of RCC shall be taken as per respective item and specification as per ISS No. 1200-1958. The work shall be done as per ISS 456-1964 Para 1 to 5, 4, 2 and Para 7.0 to 8.0 and will be paid on cu. Mt. basis of the concrete members.

**Item No. 4, 5, 6:**

**Providing and casting in situ controlled cement concrete M-200 for R.C.C. return as per drawings including centering shuttering, scaffolding where necessary, laying vibrating, curing and finishing complete.(A) Height from 0.0 to 5.0 M.**

- a) Column footing up to plinth.
- b) Ground beam
- c) For columns in super structure
- d) For lintels
- e) For R.C.C. Hood
- f) R.C.C. beam/coping
- g) Slab
- h) Foundation for pump
- i) Thrust Block or Encasing of Pipes etc.

The work in general shall be carried out as per specification no. 160 and 161 of P.W.D.H.W.D. H.B. volume I.

The cement to be used shall be in bags, free from lump and shall be as general specification of materials.

The sand shall be clean, river sand free from all impurities as per the general specification of materials. The coarse aggregate shall be of machine crushed from approved sevalia quarry of black trap as approved by the Executive Engineer. The aggregate shall be as per specification of general materials. The concrete shall be mixed in concrete mixer to have uniform and homogeneous mix. In R.C.C work hand mixing shall not be allowed except in breakdown of the mixer. However, under unavoidable circumstances up to the construction joint hand mixing shall be permitted by adding extra 10% of cement at the cost of the contractor without claiming any extra cost. The hand mixing shall be done only to bring the work to the safe stage as directed by the Engineer-in-charge.

The concrete shall be laid in position immediately before the initial setting time of cement begins. Necessary safe scaffolding to lift the concrete to various floors shall be prepared by the contractor. The concrete after placing in position shall be well tempered by mechanical vibrators if necessary and wooden screeds, so that the whole mass becomes compact and homogeneous of concrete. While placing the concrete care should be taken that the position of reinforcement is not disturbed. Adequate cover should be provided by placing precast concrete cover blocks and not by metal pieces or brick bats. After the finishing of the concrete surface is done the same shall be protected by wet gunny bags till the surface is sufficient hard to receive final curing. The concrete work after proper setting shall be cured properly by water by providing dykes or bunds 8 cms to 10 cms high and filling them by water. The curing shall be continuously done for 14 days. In case of columns, beams, footings, curing by dykes or bund is not possible the RCC members shall be properly cured by wet gunny bags by continuous watering as directed by the Engineer-in-charge.

At the time of concreting, proper care shall be taken that honey combing is minimum.

After the form work is removed any such honey combing is found it shall be finished with cement mortar (1:2) so that all crevices are properly filled up and no reinforcement is exposed. If however, the honey combing is of very severe nature and is found throughout the surface concreting exposing the reinforcement the concrete work shall be rejected and redone without any extra cost.

In case of volume of concrete more than 5M<sup>3</sup> at a time contractor shall cast 15 cms x 15 cms x 15 cms test cubes and slump test shall be taken during the concreting as per I.S.S. **These cubes shall be tested in witness of Owner/ PMC/ TPI's Engineers at any Government approved laboratory or Engineering college at the cost of the contractor.** The strength of concrete shall be minimum as specified in ISI 456-1964 as specified by the design section. After the centering is removed, all exposed RCC members shall be lightly chiseled to have proper key with mortar for plastering work and shall be finished with cement mortar 1:3 cement plaster of required thickness to bring work in line and level including neeru finish and 3 coats of white wash. The slab when projected shall have to be provided drip molding and no extra payment shall be made on account of this.

The rate of concrete includes cost of all materials, labour and shall be paid as per size of the member cast and not finished. The rate is exclusive of the reinforcement. The rate is inclusive of the cost of finishing with cement plaster 1:3 the exposed faces such as to of lofts, cantilever and chhaja including neeru finishing 3 coats of white or colour wash etc. comp. The rate includes cost of all work as above for all type of RCC roof of any other work as per detailed drawing prepared by Architect.

In case of casting some of the member which were to be provided as precast, as cast in situ, such work shall be measured and paid against this item without any extra cost.

The measurement of various members of RCC shall be taken as per respective item and specification as per ISS No. 1200-1958. The work shall be done as per ISS 456-1964 Para 1 to 5, 4, 2 and Para 7.0 to 8.0 and will be paid on cu. Mt. basis of the concrete members.

**Item No. 7:**

**Providing TMT Bar FE 415 reinforcement for R.C.C. work including bending, binding and placing in position complete upto floor two level.**

All reinforcement steel shall be TMT tor steel conforming to relevant I.S. for all RCC structure with Fe-415 conforming to IS-1786.

All reinforcement shall be clean, free from pitting, oil, grease, paint, loose mill scales, rust, dirt, dust, or any other substance that will destroy or reduce bond. All Grade of reinforcement steel shall be as per Price bid.

The rate shall be paid per Metric ton.

**Item No. 8:**

**Brickwork using common burnt clay building bricks having crushing strength not less than 35 kg/sq.cm in cement mortar 1:6 ( 1 cement, 6 fine sand) (b) -do- -do- for brick work in super structure above plinth level up to floor two level.**

Brick masonry in cement mortar (1:6) including watering, etc. complete. The brick shall be well burnt of uniform color having crushing strength not less than 35 kg/sq. cm. as per general specification of materials and shall be got approved by the Dy. Executive Engineer. The bricks shall be well wetted for 24 hours before use by sprinkling the water over the bricks chattas.

The mortar for masonry shall be cement mortar of proportion of one part of cement and six parts of sand by volume. The cement, sand and water shall be used as per general specification of materials.

Brick masonry shall be uniformly laid and the whole work executed in a good manner. The mortar joint shall not exceed 1 cms in thickness. No brick bats or half bricks to be used in the work unless absolutely necessary as closer. Every joint should be neatly struck at the close of the days work and before the mortar has set. The brickwork shall be kept wet for at least 7 days. The masonry wall shall be in plumb, line and level.

If any of the portion of the work is found unsatisfactory and not confirming to the specification the portion shall be pulled down by the contractor at his own cost and risk immediately on materials obtained from the pulled down masonry shall not be allowed in work for reuse.

The rate is inclusive of cost of materials, labour centering curing, finishing, etc. complete The rate shall be paid on cu. mtr. Basis.

**Item No. 9:**

**Providing 15 mm thick cement plaster in single coat on fair side of brick/concrete walls for interior plastering up to floor two level and finished even and smooth in cement mortar (1:3) proportion (1 cement : 3sand) including finishing with floating coat of neat cement slurry.**

Cement and clean sand shall be thoroughly mixed dried in the proportion of 1:3 water shall be added gradually to make the mixture homogeneous. No more cement mortar shall be mixed then can be used within half an hour. The joints shall be first raked out 12 mm to 20 mm deep and the surface be watered properly for 12 hours the mixture of sand and cement shall be applied evenly of 10mm thick on the surface of the wall. The surface shall be finished off at once by rubbing with a towel after applying a thin coat of neat cement till a smooth surface is obtained.

The work shall be watered thrice a day for 10 days and then once a day for one month.

Measurement shall be in sq. mt. of actual dimensions opening shall be deducted in full and jambs and soffits shall be allowed. The rate also includes necessary scaffoldings as required and white or colored wash in three coats shall be carried out as directed.

The rate shall be paid in SQM basis.

**Item No. 10:**

**20 mm thick sand faced cement plaster on walls up to ht. 10mt. above ground level consisting of 12 mm thick backing coat of 1:3 ( 1 cement :3 sand) and 8 mm thick finishing coat of C.M. 1:1 (1 cement : 1sand) etc. complete.**

Materials: Cement aggregates and water provided by the contractor for the item shall confirm to the specifications of the materials in this tender and IS : 456 of 1967.

Smooth surface of concrete shall be suitably roughened to provide necessary bond, while in masonry work, joints shall be racked out when mortar is green, all dirt, soot, oil or any other material that might interfere with satisfactory bond shall be removed. The surface shall be screened and scrubbed with fresh water and kept wet for six hours prior to plastering, it shall be kept damp during the progress of work.

Patches of plaster 150mm x 150mm shall be put on about 3 meters apart as gauges to ensure even plastering in one plane. In all plaster work, the mortar shall be applied with some what more than the required thickness and well pressed into the joints, and the surface scrubber and leveled with a flat wooden rule to give required thickness. Long straight edges shall be freely used to ensure perfectly plane and even surface. All corners shall be finished to their true angles or rounded as directed by the Engineer-in-charge. Plastering shall be done from top to downwards. All exposed angles and junctions shall be carefully finished. The finished thickness shall not be less than in any place. Finishing coat shall be provided to the plaster as specified. A coat of cement and fine sand mortar or neeru (about 12mm thick) shall be applied to the surface with a trowel to provide uniform texture while the base coat is still plastic. All plaster work shall be kept damp continuously for 7 days. The rate shall be per square meter.

**Item No. 11:**

**Providing and fixing 5 nos of barbed wire fencing 600 High with long M.S. Angle posts 40mm x 40 mm x6 mm With Five holes and oil painting 3 coats fixed at 3.0 Mt,C/c. For Compound Wall**

**SCOPE**

1 Earth work for excavation for pit.

Please refer specification for Earth Work Section – 1.

2 Providing & laying Plain Cement Concrete 1:3:6. Please refer Specification for Concrete Section – 2.

**MATERIALS :-** Angle post 40 x 40 x 6 mm.

4 Structural steel post for Anticlimbing Device.

5 Structural steel shall conform to IS : 2062.

6 Structural steel work shall be fabricated and erected as shown in the drawing. Fabrication and erection shall conform to IS : 800.

7 All materials used for fabrication shall be new and unused stock and shall be free from twist, kinks, buckles or any defects. Maker's test certificate, shall be made available to the consultant/Engineer-in-Charge when called for.

8 Electrodes for welding shall conform to IS : 814 & 815 or equivalent welding shall conform to IS : 816.

9 M.S. angle post shall be embedded in P.C.C. 1:3:6.

- 10 Change in direction where the angle of deflection exceeds 200 shall be considered corner and angle post shall be installed.
- 11 All paints used shall be synthetic enamel conforming to IS : 293 & of approved manufacture.
- 12 All loose scales, dirt, rust, etc. shall be removed with steel wire brushes before supplying a coat of red oxide primer conforming to IS : 2074.
- 13 Two coats of approved synthetic paint over a coat of red oxide primer shall be applied unless otherwise specified.
- 14 Each coat shall be allowed to dry for sufficient time as per manufacture's directions.

**Item No. 12:**

**Finishing wall with weather proof exterior emulsion paint on wall surface (two coats) to give an required shape even shade after thoroughly brushing the surface to remove all dirt, and remains of loose powdered materials.etc complete**

As Per General Specification

**Item No. 13:**

**Demolition including stacking of serviceble materials and disposal of unserviceble materials with all lead & lift [i] Brick work.**

The contractor shall have to dismantle existing Brick work according to requirement and instruction of engineer- in-charge. The removed stuff shall be transported and placed without affecting the work and general peoples according to instruction of engineer-in-charge within VMC limit.

**Item No. 14:**

**Demolition including stacking of serviceble materials and disposal of unserviceble materials with all lead & lift [i] R.C.C. work**

The contractor shall have to dismantle existing RCC according to requirement and instruction of engineer- in-charge. The removed stuff shall be transported and placed without affecting the work and general peoples according to instruction of engineer-in-charge within VMC limit.

**Item No. 15:**

**Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm. In depth consolidating each deposited layer by ramming and watering.**

Workmanship

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

As soon as the work in foundation has been completed and measured the site of foundation shall be cleared of all debris, brick bats, mortar dropping etc., and filled with earth in layers not exceeding 20 cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is

laid. The earth shall be rammed with iron rammers where feasible and with the but ends of crow-bars, where rammer cannot be used.

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

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

In case off large heavy duty flooring like factory flooring,-the consolidation may be done by power rollers, where so specified.

The-extent of consolidation required shall also be as specified.

The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth.

Under no circumstances black cotton soil be used for filling the plinth.

#### Mode of Measurements & Payment

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

The rate shall be for a unit of one cubic metre

As Directed by EIC.