Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION
FOR
EARTHWORK IN SITE GRADING

VCS-SS-CS-6002

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ABBREVIATION

m	Metre
Mm	Millimetre
IS	Indian Standard
m2	Square metre
GPS	Global Positioning System
VCS	VCS Quality Services Pvt Ltd

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1.0 SCOPE

This specification and the method of measurements described thereon are applicable for earthwork involved in Site Grading & Rock Cutting

2.0 REFERENCES

2.1 BIS CODES

IS: 2720 Part IV - Methods of tests for soils, Part-V- Grain size Analysis

IS: 2720 Part V - Methods of tests for soils, Part 5- Determination of liquid & plastic limit.

IS: 2720 Part VI - Methods of tests for soils, Part 6- Determination of shrinkage factors.

IS: 2720 Part VII - Methods of tests for soils, Part 7- Determination of water content dry density relation using light compaction.

2.2 VCS SPECIFICATIONS

VCS-SS-CS-6003 Earthwork for underground piping

VCS-SS-CS-6022 Earthwork in Foundations

NOTE: - Latest Edition of all Codes and Standards shall be followed.

3.0 GENERAL

3.1 CONTRACTOR shall maintain adequate drainage facilities at SITE at all times during the execution of work. Additional ditches, drains & such other temporary means to achieve this, over and above what is shown in the drawings, shall be provided and maintained by CONTRACTOR at his own cost.

3.2 Adequate dewatering facilities like dewatering pumps and piping etc. shall also be provided by the CONTRACTOR for this work, including dewatering during excavation etc. as required, at his own cost.

4.0 MATERIAL FOR EARTHWORK

4.1 Only soil considered suitable by the Engineer-in-charge shall be deployed for the construction and that considered unsuitable shall be disposed off, as directed by Engineer-in-charge, at his own cost and no claim for compensation will be entertained.

4.2 The CONTRACTOR shall give the samples of soil he proposes to use for filling, along with the following characteristics of the samples, to Engineer-in-charge for approval, prior to collection and use. The tests for these characteristics shall be done in a laboratory / test house as approved by Engineer-in-charge.

a. Mechanical analysis or grain size analysis as per IS: 2720 Part IV.

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b. Liquid limit as per IS: 2720 Part V.

c. Plastic limit as per IS: 2720 Part V.

d. Determination of Shrinkage limit factors as per IS: 2720 Part VI.

e. Determination of water content dry density relation using light compaction as per IS: 2720 Part VII.

4.3 The soil used for filling shall be free from boulders, lumps, tree roots, rubbish or any organic deleterious matter.

4.4 Soil having plasticity index less than 20 shall be used for filling purpose.

4.5 Soil having laboratory maximum dry density of less than 1.5 gm/cc shall not be used.

4.6 Care shall be taken to see that unsuitable waste material is disposed off in such a manner that there is no likelihood of its getting mixed with the material, proposed to be used, for filling.

4.7 The work shall be so planned and executed that the best available soil is reserved for the top portion of Embankments.

5.0 CUTTING TREES

5.1 All trees having girth above 30 cms, which are not marked for preservation, shall be cut down and their roots dug up to a depth of 1 metre from the existing ground level.

5.2 All holes or hollows produced by digging up roots shall be carefully filled with approved soil, including all leads and lifts, rammed and compacted to obtain 90% of maximum laboratory dry density of soil and levelled as directed.

5.3 All uprooted trees shall be stacked or disposed off as directed by Engineer-in-charge.

5.4 PAYMENT

This clause shall apply to item rate tenders only.

Cutting of trees above 30 cms girth shall be paid per number. The rate quoted shall include cutting, uprooting removing the trees within plant boundary as directed, including filling holes or hollows produced by removal of roots etc. as per specifications.

6.0 CLEANING AND STRIPPING

6.1 All the areas, including depressions, where filling or cutting is to be carried out shall be cleared and stripped completely of bushes, roots, vegetation, plantation trees, shrubs, trees up to 30 cms girth, organic and other objectionable materials. All these shall be completely uprooted and virgin soil exposed and not merely scrapped at the surface. The roots of trees of girth up to 30 cms shall be removed to a minimum depth of 1m below existing ground level and holes, hollows filled up with selected approved available soil within all leads and lifts and compacted to obtain 90% of

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laboratory dry density of soil as per IS: 2720, Part VII and leveled as directed by Engineer-in-charge. All soft patches must be worked out to remove soft soil and selected approved earth must be filled back and the areas (areas coming under filling) compacted to obtain 90% of maximum laboratory dry density of soil, as per IS: 2720 Part VII. The depth of stripping shall be generally 50 to 150 mm as decided by Engineer-in-Charge.

6.2 Material obtained from clearing shall be stacked or disposed off as directed by Engineer-in-charge within a lead as per directions of Engineer-in-Charge.

6.3 PAYMENT

This clause shall apply to item rate tenders only.

No separate payment shall be made for clearing, stripping and disposal of materials obtained from clearing. This shall be considered as part of cutting work in areas of cutting and filling work in areas of filling and the rates quoted under the respective items of

a. Earthwork in Excavation/ Cutting

b. Earthwork in filling (both with available earth & earth obtained from approved borrow areas), shall be inclusive of clearing and stripping with all operations described above in clause no.6.0 in respective areas of cutting and filling.

No separate payment shall be made for clearing, stripping and disposal of materials obtained from clearing of borrow areas for earth. This shall be considered as part of filling work in area of filling and the rate quoted under the respective items.

7.0 EARTHWORK IN EXCAVATION/CUTTING

7.1 After clearing and stripping of areas as specified above in clause No.6.0, spot levels at intervals and pattern as decided by the Engineer-in-charge, shall be taken jointly by CONTRACTOR and Engineer-in-charge. Excavation / cutting shall commence only after the levels are signed by the contractor as a token of his acceptance.

7.2 Excavation/ cutting shall be carried out strictly as per the instruction of Engineer-in-charge.

7.3 If the contractor excavates/ cuts beyond the required level, additional quantity of earthwork shall not be paid for. The excavation taken below the specified level shall be made good by filling with approved material, to the required compaction, at Contractor's cost.

7.4 The final bed and sides of excavation must be levelled, dressed and compacted. In case of areas under excavation for site grading, the final surface shall be levelled, dressed and consolidated by means of sheep foot / power driven rollers to obtain maximum compaction. However, no test control is required in such areas.

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7.5 Shoring and strutting shall be adopted only with the permission of Engineer-in-charge in writing. Such shoring and strutting shall follow the necessary specification.

7.6 Provisions for dewatering shall be governed by the relevant clauses.

7.7 Payment

This clause shall apply to item rate tenders only.

Payment for Excavation shall be on the basis of volume of excavation calculated on the basis of joint level taken as per clause 7.1 and the final finished grade levels, the volume being calculated by the Trapezoidal rule including dewatering, if required. Intermediate payment will be on the basis of volume calculated based on spot levels taken during the time of the billing. Reference is also invited to clause 7.3.

8.0 EARTHWORK IN FILLING

8.1 After clearing, stripping and consolidation of areas as specified in clause 6.0, spot levels at intervals and pattern as decided by Engineer-in-charge shall be taken jointly by the CONTRACTOR and Engineer-in-Charge and filling shall commence only after the levels are signed by the CONTRACTOR as a token of his acceptance. Approved fill Material shall be spread in uniform layers not exceeding 30 cms in loose depth.

The contractor has to make his own approach and access roads from the borrow area to the demarcated filling areas. While the CONTRACTOR may make use of such short cuts as may be available to him for earth movement from borrow areas to the filling areas, the OWNER does not guarantee any passage way or right of way for the CONTRACTOR'S work other than available at site. No claim shall also be admissible to the CONTRACTOR on account of his having to take longer leads or routes for earth movement, than envisaged by him, either due to any road cuttings, non-availability of routes, or any other grounds whatsoever.

In case total filling required in any area consists of soil both from borrow areas and available approved excavated material from within plant area, then joint levels, shall be taken before commencing filling with earth from borrow area.

However, earth available from borrow areas required for filling can be used only after the available earth from excavation within demarcated area has been utilized and clearance to this effect obtained from the Engineer-in-charge.

8.2 All clods, lumps etc, shall be broken before compaction.

8.3 Successive layers of filling shall not be placed until the layer below has been thoroughly compacted and tested to satisfy the requirements laid down in this specification.

8.4 Prior to rolling, the moisture content of material shall be brought to within plus or minus 2% of the Optimum Moisture Content as described in IS: 2720 Part VII. The moisture content shall preferably be on the wet side for potentially expansive soil.

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8.5 After adjusting the Moisture Content as described in clause 8.4, the layers shall be thoroughly compacted by either sheep foot roller or power driven roller or vibratory roller, as approved by Engineer-in-charge, till the specified maximum laboratory dry density is obtained.

8.6 Each layer shall be tested in field for density and accepted by Engineer-in-charge, subject to achieving the required density, before laying the next layer. A minimum of one test per 500m2 for each layer shall be conducted.

8.7 If the layer fails to meet the required density, it shall be reworked or the material shall be replaced and method of construction altered as directed by Engineer-in-charge to obtain the required density.

8.8 The filling shall be finished in conformity with the alignment, levels, cross-section and dimensions as shown in the drawing.

Earthen embankment shall be filled 300mm more on both sides, where height is more than 1M and this extra filling shall be dressed, after compaction, in conformity with alignment, level, cross-section and dimension as shown in the drawing, to achieve proper compaction in the slope. No extra payment shall be made in this regard.

8.9 Extra material shall be removed and disposed off as directed by the Engineer-in-charge.

8.10 Tolerances

8.11 General site grading, including cutting and filling in depressions, shall be carried out to within up down tolerance of +5 cms of final lines, grades and slopes.

Earth Work In Filling In Open Lined/Unlined Wells

For earth work in filling in open lined/unlined wells, only locally available coarse sand shall be used, in layers of 500 mm thickness. Each layer shall be thoroughly wetted by sprinkling water, before next layer is filled up. Filling shall be done upto lm depth below NGL as above. Layers from a depth of lm below NGL, upto NGL, shall also comprise of locally available coarse sand and compacted with suitable Mechanical / manual means,

to obtain same level of compaction as required for filling above NGL. Filling above NGL shall be done as per CI. 8.1 to 8.10 above.

8.12 Payment

This clause shall apply to item rate tenders only.

a. Payment for filling shall be made on cubic metre of volume calculated on the basis of cross section plotted from the levels of ground, where filling is to be carried out and the levels reached after filling is duly consolidated, volume being calculated by Trapezoidal method.

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b. In case of simultaneous cut and fill operation, wherever specified, payment shall be made on the basis of one composite rate for cutting and filling. All other details about measurement etc. remaining same as above.

c. Payment for filling in open wells, lined or unlined, shall be made on the basis of volume calculated on the basis of average area multiplied with depth of open well

d. No extra payment shall be made towards testing.

9.0 REMOVAL OF SURPLUS EARTH

9.1 Surplus earth and soil from excavation and general site grading shall be removed from the construction areas to the area demarcated by the Engineer-in-charge.

9.2 Payment

This clause shall apply to item rate tenders only.

Payment shall be made only for lead beyond initial lead from construction area. Rate shall include loading, transportation, dumping, stacking the surplus earth and soil in the area demarcated by the Engineer-in-charge.

Payment shall be made on cubic metre basis of the difference of measurements of the volumes of the excavation and the measurement of the filling with the excavated earth. However, the contractor's entitlement to payment shall be restricted to the actual quantity of earth removed. Quantity generated due to void in back filled volume of earth shall also be removed by the contractor at no extra cost and this disposal of earth shall not be measured and paid under any item.

10.0 EXCAVATION IN ROCK

Blasting operations for site grading shall be carried out as per specification No. VCS-SS- CS-6022.

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STANDARD SPECIFICATION
FOR
EARTHWORK FOR UNDERGROUND PIPING

VCS-SS-CS-6003

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ABBREVIATION

m	Metre
Cm	Centimetre
Mm	Millimetre
Km	Kilometre
U/G	Underground

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1.0 SCOPE

This specification deals with earthwork in trenches and pits (for valves, manholes, catch pits etc.) for underground piping.

2.0 REFERENCES

BIS CODES

IS: 783	Code of practice for laying of RCC pipes.
IS: 1200 (Part-I)	Method of measurement of building and civil engineering works.
IS: 3764	Excavation work - code of safety.

2.2 SPECIFICATIONS

VCS-SS-CS-6002	Earthwork in Site Grading
VCS-SS-CS -6022	Earthwork in Foundations

NOTE: - Latest Edition of all Codes and Standards shall be followed.

3.0 MATERIAL

All workmanship and materials shall conform to the provisions of IS: 1200 (Part-1) and IS: 3764.

4.0 EARTHWORK IN EXCAVATION FOR TRENCHES / PITS FOR PIPELINES

4.1 Excavation

Plant, machinery and equipment's for excavation shall be selected and deployed to provide optimum mechanization in excavation of trenches and pits. The selection for excavation and earth movement machinery etc. shall take into account type of materials to be excavated, method of excavation, prevailing weather conditions and type of transport to be used.

The excavation of area of cut shall be so timed that the bottom level is not exposed to the deteriorating influence of the weather for longer duration.

Excavation and earth moving equipment shall be deployed such that minimum damage is caused to the natural sub-soil structure of exposed formations.

The monitoring of soil deformations, ground water levels during and possibly after construction work shall be taken into consideration.

In the event, when excavation works are carried out in the vicinity of structures of any importance, the above monitoring shall be carried out within a distance, from the edge of the excavation of 5 to 15 times the excavation depth, depending upon the subsoil conditions and the stability of the neighboring structures.

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4.2 Trenching work shall be carried out in all classes of soil including soft rock and excluding hard rock and shall be for all depths.

4.3 The trench shall be cut true to the line and level as per drawings.

4.4 If the trench is excavated below the required level than that indicated in the drawing, the extra depth shall be filled with concrete 1:5:10 or approved equivalent materials, as directed by the Engineer-in-Charge, at no extra cost to the owner.

4.5 In case of pressure piping, the trench shall be excavated generally as to provide a cover of 1000 mm or dia of pipe whichever is more. In case of gravity sewers/ pipes, the trench shall be excavated to conform to invert levels as per drawings. However in certain cases, the pipes may run at shallower levels or at deeper levels depending upon drawing, site condition etc. No rebate for lesser excavations, nor extra payment due to deeper excavations, shall be admissible in those cases where pipeline laying rates are inclusive of earthwork items. The rates quoted shall be deemed to cover all works connected with trenching, whether trenches are with single pipeline or have multiple pipelines in common trenches including road cutting and making good the same.

4.6 The width of the trench shall be sufficient to give free working space of personnel, equipment, supports and ancillaries on each side of the pipe. The free working space shall conform to IS: 783.Generally it shall not be less than 150 mm on either side or 1/3 dia of outer diameter of the pipe, whichever is greater.

4.7 When pipelines are running parallel, whether the trenching shall be individual or common, shall be decided by the Engineer-in-Charge and such decision shall be final and binding on the contractor. No extra shall be payable for common excavations.

4.8 All earthwork involved in excavations of all types of manholes, catch pits, valve chambers, inspection chambers, chambers for instrumentation tapping etc., which are coming on the alignment of U/G piping or as defined by drawing as a part of U/G piping work, shall be paid extra under Earth work in excavation, back filling and removal of surplus earth etc. under relevant clauses of the SOR.

4.9 Aspects such as variations in the soil conditions and the geological structure, depth of excavation, the existence of ground water and surface water, the type and extent of excavation, the topography of site, the proximity of items such as roads, buildings and buried services, construction traffic and activities near the excavation eg. stock piling shall be taken into account when determining whether the sides of excavation should be free standing, sloping or temporary supported.

Suitable drainage and / or dewatering system like Well Point method / Bore well method etc. shall be provided to prevent or limit ingress of surface or sub surface water into excavation.

Serviceable materials intended for reuse should be used as soon as possible after excavation otherwise they should be stock piled at a location beyond 1.5m from the top edge of the excavation or beyond a distance equal to the depth of the excavation whichever is higher at a location approved by the Engineer-in-charge. If excavated serviceable material is not possible to be stacked within the limits specified above, due to some constraint, it shall be stacked away at a location approved by Engineer-in-Charge and paid separately under relevant item.

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Areas used for temporary stockpiling of excavated material shall be kept clean and orderly, with excavated material kept by the side of road to avoid traffic movement. Excavated areas shall be restored to their original condition before completion of works.

types of shoring and strutting, wherever necessary, shall be adopted to with hold the face of earth or cutting in slope, as per site requirements and direction of Engineer-in-Charge. Supports shall be maintained such that the integrity of the sides of the excavation is not impaired.

4.10 Any obstacle encountered during excavation shall be reported immediately to the Engineer-in-Charge and shall be dealt with as instructed.

4.11 The contractor shall maintain all excavated trenches and pits, in a dry and trim condition.

4.12 Necessary barricading and protection of slopes against slips due to traffic movement shall be provided to the satisfaction of Engineer-in-Charge. Necessary warning flags and lights shall be provided to caution traffic in the areas where trenches and/ or pits are provided.

4.13 In case of road cutting, all road material i.e. metal etc., shall be taken out carefully and kept separately for reuse and road work shall be redone up to the original level, as it was prior to cutting the road, with the excavated road materials after laying and testing of the pipeline, within 10 days from the date of starting this work, at the cost of the contractor. The contractor shall provide suitable warning signs and barricades to prevent accidents.

Contractor shall also provide reasonable bye pass at his own cost when a road is cut for Laying pipeline. Tankage dykes cut due to laying of the pipes, shall be redone conforming to the original specifications, by the Contractor at his own cost. Secondary dykes, to take care of any eventuality during construction, shall be provided by the Contractor at his own cost.

4.14 Dewatering shall be done in advance of the installation of the pipe to allow adequate inspection of padding of the bottom, if required. Dewatering shall be continued throughout during installation and backfilling.

The trench shall follow the gradient of pipeline as specified in the drawing. The contractor shall keep the trench in good condition, until the pipe is laid and tested. No extra claim shall be entertained due to its caving or setting down, either before or after the pipe is laid.

In case, pipe is lowered in caved trench and backfilled before being inspected by the Engineer-in-Charge, the Contractor shall re-excavate the trench for inspection and backfill it at his own cost.

5.0 BACKFILLING AND COMPACTION IN TRENCHES AND AROUND VALVE PITS, MANHOLES ETC.

BACKFILLING

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Trenches shall be back filled with suitable materials which should be compacted to the same degree or better as the surrounding soils.

5.1 The soil used should be selected and approved by Engineer-in-Charge. Suitable material can be extracted from available excavated material. The soil should be free from rubbish, grass, organic matter, stones, building waste and Black Cotton Soil etc. It should be free from clods and hard lumps. In case good soil is not available from excavated material for back filling, trench shall be filled back with locally available coarse sand up to 30 cm. thick above the pipe and rest of trench shall be filled back with excavated soil up to required level.'

5.2 The filling should commence only after approval of Engineer-in-Charge is obtained and after the structures or pipes to be buried are tested and approved. Otherwise, if required, contractor shall uncover buried portion and refill at his own cost.

Temporary excavation supports should be removed as back filling and compaction proceeds, such that unacceptable movement of the supported ground does not occur.

Voids caused by extracted supports should be filled and compacted.

5.3 Filling should be done in layers. Each layer should be not more than 15 cm thick when loose and should be well rammed, with necessary watering, to obtain at least 90% of maximum laboratory dry density.

Compaction trials should be carried out on each soil type to be placed in backfill, in order to confirm the type of machine and number of passes required to obtain optimum compaction for given soil moisture contents. These trials should also be used to determine the variability of the proposed fill material for different weather conditions.

5.4 Care must be exercised to protect cables, pipes, joints, and other features from damage due to backfilling and consolidation.

5.5 Filling should extend up to the level of original ground surface or as per drawing or as directed by Engineer-in-Charge. The finished surface should be properly trimmed and dressed. The adjoining area should be cleaned and no heaps of surplus earth should be left out.

6.0 TRANSPORTATION OF SURPLUS EARTH

Unserviceable materials and serviceable materials not intended for re-use shall be removed from the work site and disposed off at a location as approved by Engineer-in-charge.

The surplus earth is generated due to pipe laying, valve chambers, and manhole construction etc. Surplus earth is also generated due to voids in the back filled volume of earth. The removal of surplus earth shall include excavation, loading, transportation, dumping, stacking or spreading, as per the directions of Engineer-in-charge.

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7.0 PAYMENT

This clause shall be applicable for item tender rate only.

7.1 Unless specifically stated in the schedule of rates, no separate payment for earthwork in excavation, backfilling, transportation, dewatering etc. shall be admissible and the payment for the same is deemed to have been included in the relevant items of the contract.

7.2 In case payment for earthwork is specified separately in the Schedule of Rates, the payment shall be based on the actual quantity of excavation, backfilling and transportation done, taking into consideration the slopes authorized by the Engineer-in-Charge for excavation, volume of backfilling calculated on the basis of excavation reduced by the volume of pipes.

7.3 In cases where hard rock excavation is involved, the matter shall be referred to Engineer-in-Charge, before proceeding with the work.

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STANDARD SPECIFICATION
FOR
ROADS & FLEXIBLE PAVEMENTS (UPTO WBM LAYER)

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ABBREVIATION

m	Metre
mm	Millimetre
Cm	Centimetre
IS	Indian Standard
IRC	Indian Road Congress
M^2	Square metre
M^3	Cubic metre
WBM	Water Bound Macadam

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1.0 SCOPE

This specification covers the material and construction details for earthwork in filling for embankments, filling with sand/murrum, WBM sub-base, WBM base course and shoulders for roads and flexible pavements.

2.0 REFERENCES

2.1 CODES & STANDARDS

IS: 460 Specifications for Test Sieves

IS: 2720 Methods of Test of Soil

IRC: 19 Standard Specifications and Code of Practice for Water Bound Macadam

IRC: 36 Recommended Practices for the Construction of Earth Embankments for Road Works

2.2 SPECIFICATIONS

Specifications for Road and Bridge Works - Ministry of Surface Transport (Road Wing)

NOTE: -Latest Edition of all Codes, Standards and Specifications shall be followed.

3.0 CONSTRUCTION OF EMBANKMENTS SUBGRADE AND SHOULDERS

3.1 MATERIALS

Only those materials, considered suitable by the Engineer-in-Charge shall be employed for the construction and that considered unsuitable shall be disposed off as directed by Engineer-in- Charge at contractor's cost and no claim for compensation will be entertained. The Contractor shall give the samples of earth, he proposes to use for filling along with the following characteristics of the sample to Engineer-in-Charge prior to collection and use, for approval.

a. Mechanical analysis or gain size analysis as per IS: 2720 Part IV.

b. Liquid limit as per IS: 2720 Part V.

c. Plastic limit as per IS: 2720 Part V.

d. Determination of Water content Dry density relation using Heavy compactions. IS: 2720 Part VIII.

The material (soil) used for filling shall be free from boulders, lumps, tree roots, rubbish or any organic deleterious matter.

Material (soil) having plasticity index less than 20 shall be used for filling purposes. Soil having laboratory maximum dry density of less than 1.5gm/cc shall not be used. Care shall be taken to see that unsuitable waste material is disposed off in such a

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manner that there is no likelihood of its getting mixed with the materials proposed to be used for filling.

The work shall be so planned and executed such that the best available material (soil) is reserved for the top portion of embankment.

3.2 FILLING AND COMPACTION

3.2.1 The area where filling is to be placed must be cleared of all loose material and virgin soil must be exposed. Such exposed surface must be consolidated properly to obtain 95 % of maximum laboratory dry density of the soil as per IS: 2720 Part VIII. All soft patches must be worked out to remove the soft soil and selected approved earth must be filled back and compacted.

3.2.2 Payment for the removal of loose top soil as described in clause 3.2.1 above shall be included in the item for earthwork in filling. No separate payment for consolidation of exposed ground surface will be made. The rate quoted for the earth fill shall be inclusive of the cost of clearing and stripping, consolidation, including watering, testing etc. of the exposed ground.

3.2.3 Approved fill material shall be spread in uniform layers not exceeding 20 cm in loose depth for embankment filling. Shoulder construction shall be so organized as to keep pace with the construction of different layers of the pavement, which may require earth fill thickness less than 20 cm. All clods, lumps etc. shall be broken before compaction.

3.2.4 In general the soil shall be spread uniformly over the entire width of embankment or shoulder as the case may be. For large embankments, the spreading of soil shall be as directed by Engineer-in-Charge.

3.2.5 Successive layers of filling shall not be placed until the layer under construction has been thoroughly compacted to satisfy the requirements laid down in this specification.

3.2.6 Prior to rolling, the moisture content of material shall be brought to within plus or minus 2% of the optimum moisture content as described in IS: 2720 - Part-VIII. The moisture content shall preferably be on the wet side for potentially expensive soils.

3.2.7 After adjusting the moisture content as described in Clause 3.2.6, the layers shall be thoroughly compacted by means of 8-10T rollers or equivalent vibratory rollers till 95% of maximum laboratory dry density for embankment and 97% of maximum laboratory dry density for sub-grade as per IS:2720 Part VIII is obtained.

3.2.8 Each layer shall be tested in field for density and accepted by Engineer-in-Charge subjected to achieving the required density before laying the next layer. A minimum of one test per 500m^2 area for each layer shall be conducted.

3.2.9 All type of rollers that should be employed for compaction shall be as per direction of Engineer-in-Charge.

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3.2.10 If the layer fails to meet the required density, it shall be reworked or the material shall be replaced and method of construction altered as directed by Engineer-in-Charge to obtain the required density.

3.2.11 The filling shall be finished in conformity with alignment, levels, cross-sections and dimensions as shown in the drawings.

3.2.12 Extra material shall be removed and disposed off as directed by Engineer-in-Charge.

3.3 TOLERANCE

Embankment and shoulders for roads, units etc. shall be carried to within a tolerance of plus minus 2.5 cm. from final lines but shall be to required grades and slopes.

4.0 FILLING WITH SAND/MURRUM

4.1 Sand for filling shall preferably be locally available sand, clean and free from any chemical or other impurities. Murrum for filling shall be clean and well graded. Sand/Murrum shall not contain any vegetation, organic, clayey or other material and shall be obtained from a source approved by Engineer-in-Charge.

4.2 Murrum/Sand shall be spread in layers not exceeding 15 cm in loose thickness over the areas. Each layer shall be uniform in density, quality of material and moisture content before compaction. The moisture content shall be within two percent of the optimum moisture content as per IS: 2720 Part VIII.

4.2.1 In case of pure sand, flooding with water is permissible.

4.3 Compaction of each layer shall be by mechanical means as per directions of Engineer-in-Charge. Only inaccessible reaches shall be worked manually. Each layer shall be uniformly compacted to obtain 85% relative density in case of sand and 95% of maximum laboratory dry density in case of murram. If the material fails to achieve the required density, the layer shall be reworked with necessary alteration in compaction, so that the required compaction is obtained. A minimum of one test per 500 m^2 area for each layer shall be conducted.

4.4 Subsequent layers shall be placed only after the layer already laid has been compacted to the required density-and approved by Engineer-in-Charge.

4.5 The finished surface must be dressed to required grade and slope. Excess material must be removed from compaction site, as directed by Engineer-in-Charge.

5.0 WATER BOUND MACADAM SUB BASE/BASE COURSE

The sub-base course shall consist of one or more layers, each of 100mm compacted thickness.

The base course shall consist of one or more layers, each of 75mm compacted thickness.

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5.1 MATERIALS

5.1.1 STONE AGGREGATE FOR WBM

5.1.1.1 The coarse aggregates shall be hard, crushed or broken stone metal from quarries approved by Engineer-in-Charge, it shall be hard durable and free from flat elongated, soft and disintegrated particles. It shall not have excess of dirt and other objectionable matter. The quality, size and grading of the coarse aggregate shall be conforming to IRC: 19.

a. The grading of the coarse aggregates for the sub-base course shall be as below:

Size Range	**Sieve Designation (IS: 460)**	**% by weight passing the sieve**
90mm to 45mm	125mm	100
Grade-I	90mm	90-100
	63mm	25-60
	45mm	0-15
	22.4mm	0-5

b. The grading of the coarse aggregate for the base course shall be as below:

Size Range	**Sieve Designation (IS: 460)**	**% by weight passing the sieve**
63mm to 45mm	90mm	100
Grade-2	63mm	90-100
	53mm	25-75
	45mm	0-15
	22.4mm	0-5

c. Physical requirement of coarse aggregates for sub-base course shall be as below:

i. Los Angles Abrasion Value 50% (Maximum)

or

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ii. Aggregate Impact Value 40% (Maximum)

d. Physical requirement of coarse aggregates for base course shall be as below:

i. Los Angles Abrasion Value 40% (Maximum)

or

Aggregate Impact value 30% (Maximum)

ii. Flakiness index value 20% (Maximum)

Samples of test shall be representative of the material to be used and collected as per IS: 2430.

5.1.1.2 The aggregates shall be unloaded at the road side on firm, well drained ground, as directed by Engineer-in-Charge. The various grades shall be placed separately and contamination by earth and other extraneous matter shall be prevented effectively.

5.1.2 SCREENINGS

5.1.2.1 Screening to fill voids in the course aggregates shall, as far as possible be the same material as the course aggregates where it is decided by the Engineer-in-Charge to use other materials, the same shall be predominantly non plastic materials such as kankar nodules gravel (other than river-borne rounded aggregate) or murrum provided that the liquid limit and plasticity index of such material is below 20 and 6 respectively and the fraction passing 75 micron sieve does not exceed 10 percent.

Grading Requirement of Screening

Size of Screening	**Sieve Designation (IS: 460)**	**Percentage by Weight Passing the Sieve**
13.2mm	13.2mm	100
	11.2mm	95-100
	5.6mm	15-35
	180micron	0-10

This grading, however, shall not be mandatory, in case either murrum or gravel is used as screening.

For procurement of quantities for coarse aggregates and screenings required for 100mm and 75mm compacted thickness of WBM sub base course and base course shall be as per the IRC- 19.

5.1.3 BINDING MATERIAL

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Binding material, to prevent reveling of WBM, shall consist of fine grained material possessing P.I value up to 6.

Application of binding material shall not be necessary where murrum or gravel is used as screenings.

Binding material shall be obtained from quarries/ sources approved by the Engineer-in-charge.

5.2 LAYING OF WBM

5.2.1 SPREADING CORASE AGGREGATES

a. The sub grade or sub-base to receive WBM course shall be prepared to the required grade and camber. Before starting with WBM construction, side shoulders shall be constructed in advance to a thickness corresponding to the compacted layer of the WBM course for lateral confinement of aggregate. After shoulders are ready, their inside edge shall be trimmed vertical to receive the aggregate. The practice of constructing WBM in a trench section excavated on the embankment/formation must be avoided.

b. The coarse aggregate shall be spread uniformly and evenly on the prepared base in required quantities from the stacks. The aggregate shall be spread to proper profiles by using templates across the road about 6 in apart.

c. The surface of the aggregate spread shall be carefully, trued up and all high or low spots remedied by removing or adding aggregate as may be required. The surface shall be checked from time to time, during the spreading and rolling of the coarse aggregate to ensure a finished surface without variation greater than 12 mm, when a 3 meter long straight edge is laid parallel to centre line of the road.

d. The WBM layer shall be tested by depth blocks. No segregation on large or fine particle shall be allowed and the coarse aggregate as spread shall be of uniform gradation with no pocket of fine materials.

e. The coarse aggregate shall not be spread in lengths more than 3 days average work in advance of the rolling, spreading murrum and bonding of the preceding section.

5.2.2 ROLLING ROAD METAL

a. Immediately following the spreading of the coarse aggregates, it shall be compacted to full width by rolling with either three wheeled power roller of 8 to 10 tonne weight or equivalent vibratory roller true to the line and camber as shown in the drawing. The course shall not be rolled when the sub-grade is soft or yielding or the rolling causes a wave like motion in the base course or sub-grade. When rolling develops irregularities that exceed 12mm when tested with a 3 meter straight edge, the irregular surface shall be loosened and then aggregate added to or removed from it as required and the area rolled until it gives uniform surface conforming to the desired cross-section and grade. The surface shall also be checked transversely by template and any

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irregularities corrected as above. The use of murrum to make up depression shall not be permitted.

b. The rolling shall begin from edges with roller running forward and backward until the edges have been firmly compacted. The rolling shall then progress gradually from edges to the centre parallel to the centre line of the road lapping uniformly each preceding rear wheel track by one half width and shall continue until the entire area of the course has been rolled by the rear wheel. On the super elevated portions of road, the rolling shall commence from the lower edge and progress gradually towards the upper edge of the road.

c. Rolling shall be discontinued when aggregate are thoroughly keyed and creating of stone wheel of roller is no longer visible partially compacted with sufficient void space in them to permit application of screenings. Slight sprinkling of water may be done if required.

5.2.3 APPLICATION OF SCREENING

a. After the coarse aggregate has been rolled as described in Clause 5.2.2, screenings shall be applied uniformly and gradually over the surface to completely fill the interstices. Dry rolling shall be continued while the screenings are being spread so that the jarring effect of the roll will cause them to settle into the voids of the coarse aggregates.

b. The screenings shall not be dumped in piles on coarse aggregate but shall be spread uniformly in successive thin layers either by the spreading motion of hand shovels or by mechanic spreaders.

c. The screenings shall be applied at a uniform and slow rate (in three or more applications so as to ensure filling of all voids. Rolling and brooming shall continue with the spreading of the screenings. Either mechanical brooms or hand brooms or both may be used. In no case shall the screenings be applied as fast and thick as to form cakes or ridges on the surface making the filling of voids difficult or preventing the direct bearings of the roller on the coarse aggregates. The spreading, rolling and brooming of screenings shall be performed on sections which can be completed within one day's operation and shall continue until no more screenings can be forced into the voids of the coarse aggregates. Damp and wet screening shall not be used under any circumstances.

d. The quantity of screenings used shall be such as to fill all voids in the water bound macadam courses.

5.2.4 SPRINKLING AND GROUTING

After spreading the screening, the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screenings into voids and to distribute them evenly. The sprinkling, sweeping and rolling shall be continued and additional screenings applied where necessary until the coarse aggregates are well compacted and grout of screenings and water form a wave ahead of wheels of the roller. Care shall be taken to see that the base of the sub-grade does not get

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damaged due to the addition of the excessive quantity of water during the construction.

5.2.5 APPLICATION OF BINDING MATERIAL

a. After the application of screenings as described above, the binding material shall be applied at a uniform and slow rate (in two or more successive thin layers) so as to ensure filling of all voids.

After each application of binding material, the surface shall be copiously sprinkled with water and the resulting slurry swept in with hand brooms/ mechanical brooms or both so as to fill the voids properly. This shall be followed by rolling with an 8-10 tone roller during which water shall be applied to the wheels to wash down the binding material that may get stuck to them. The spreading, rolling and brooming of binding material shall be performed on sections which can be completed within one day's operation and shall continue until no more binding material can be forced into the voids of the coarse aggregates and until the slurry of the binding material and water forms a wave ahead of the wheels of moving roller. Damp and wet binding material shall not be used under any circumstances.

b. The quantity of binding material used shall be such as to fill all voids in the water bound macadam.

5.2.6 SETTING AND DRYING

After final compaction of the course, the layer shall be allowed to dry overnight. Next morning, hungry spots shall be filled with screenings or binding material as directed, lightly sprinkled with water if necessary and rolled. No traffic shall be allowed on the road until the macadam has set.

5.2.7 SUBSEQUENT LAYERS OF WBM

Before laying the subsequent layers of WBM, the surface shall be scarified and reshaped to the required camber and profile, and all ruts, depressions, pot holes etc. made good. The second layer shall be laid after the surface preparation is approved by Engineer-in-Charge. The specification and mode of measurement for subsequent layers of WBM will be similar to that described before.

6.0 CONSTRUCTION OF SHOULDERS OR BERMS

After the WBM course is laid and compacted, the existing surface at side berms or shoulders of the roadway must be scarified. Fresh quantity of approved earth must be spread in layers for building up of berms up to the required level and scope.

The earth must be consolidated by at least three passes of an 8-10 tonne road roller. The edges must be well compacted by suitable means to prevent edge slips and the work properly trimmed and dressed.

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7.0 PAYMENT

This clause shall apply to item rate tenders only.

7.1 FILLING IN EMBANKMENT, SUB GRADE AND SHOULDERS

7.1.1 Payment for filling shall be made on cubic meter of volume calculated on the basis of cross section plotted from the level of the ground surface prepared as described in clause 3.2 above and from where filling is to be carried out and the levels reached after filling and due consolidation.

7.1.2 Rates for embankment, shoulder or fill formation shall include cost of breaking clods, watering, consolidation, providing testing apparatus and testing the degree of consolidation, providing and operating, including POL and operator charges of necessary road rollers and other equipment, dressing and levelling of sides and top surfaces etc.

7.2 FILLING WITH SAND / MURRUM

Payment for sand/murrum filling shall be made on the basis of volume of fill, after placement and compaction. The rate quoted shall include cost of sand/murrum, royalties, transportation, handling, compacting, watering, testing at various stages, dressing, removal of surplus material and any other work incidental to this.

7.3 WATER BOUND MACADAM SUB BASE/ BASE COURSE

Paying for laying WBM shall be made on square meter basis of each layer of WBM laid, measured after consolidation and finishing. Rate shall include supply of all materials, royalty, taxes, handling, transportation, spreading metal in layers, including screenings, consolidation by power roller, binding with murrum or other approved binding material, cost of carrying the material to work for all leads and lifts, providing and running roller etc. complete as per specifications and satisfaction of Engineer-in-Charge.

7.4 SUBSEQUENT LAYERS OF WBM

Payment for surface preparation, rectification of damaged portions of proceeding layers of water bound macadam and filling in ruts and depressions shall be made in M^2 or M^3 as % per schedule of items. Payment for subsequent layer of WBM shall be made on M^2 basis as per Cl. No.5.2.6.

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Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION
FOR
CONCRETE PAVEMENT

VCS-SS-CS-6006

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ABBREVIATION

m	Metre
mm	Millimetre
cm	Centimetre
IS	Indian Standard
IRC	Indian Road Congress
m^2	Square metre
WBM	Water Bound Macadam
RCC	Reinforcement Cement Concrete
PCC	Plain Cement Concrete
M.S	Mild Steel
$^{\circ}C$	Degree Celsius
BS	British Standard
Cl.	Clause

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1.0 SCOPE

This specification establishes the requirements of material, laying and finishing of concrete pavements.

2.0 REFERENCES

2.1 BIS CODES

IS: 456	:	Plain and Reinforced Concrete-Code of Practice.
IS: 1834	:	Specification for Hot Applied Sealing Compounds for Joints in Concrete.
IS: 1838	:	Part-1-Specification for Preformed Fillers for Expansion Joints in Pavements and Structures (Non Extruding and Resilient Type): Part 1 Bitumen Impregnated Fiber.
IS: 2720	:	Part-8-Method of Test for Soils-Part 8: Determination of Water Content-Dry Density Relation Using Heavy Compaction.
IS: 9214	:	Method of determination of modulus of sub-grade reaction (k value) of soils in the field.

2.2 VCS SPECIFICATIONS

VCS-STD-CS-6018	RCC pavement details
VCS-SS-CS-6007	Standard specification for roads and flexible pavement
VCS-SS-CS-6004	Standard specification for roads and flexible pavement (Up to WBM layer)
VCS-SS-CS-6021	Standard specification Materials
VCS-SS-CS-6023	Standard specification for plain and reinforced cement concrete

NOTE: - Latest Edition of all Codes and Standards shall be followed.

3.0 MATERIALS

For specification of materials, VCS document no. VCS-SS-CS -6021 shall be followed.

4.0 GRADES, TYPE OF CONCRETE MIX, PROPORTIONING AND BATCHING

4.1 The grades of concrete shall be as follows:

Type-I Pavement	-	M30
Type-II Pavement	-	M25
Type-III Pavement	-	M25

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4.2 Specification for Concrete mix, Mix Proportioning and Batching shall be as described in Specification no. VCS-SS-CS -6023 and IS: 456.

5.0 EQUIPMENTS

All equipment's like sub grade templates, hand tempers, vibrating screens, internal vibrators, longitudinal floats, bridges, push brooms, straight edges, edging tools etc. shall be on the worksite in first class working condition and shall have been inspected by the Engineer-in-Charge before paving operations are permitted to start. Throughout the construction period, the contractor shall maintain adequate equipment in first class working conditions to ensure the proper execution of the work.

6.0 PREPARATION OF SUB GRADE

6.1 The area where concrete is to be placed must be cleared of all loose material and virgin soil must be exposed. Such exposed surface must be consolidated properly to obtain 95% of Maximum Laboratory Dry Density of the soil. All soft patches must be worked out to remove the soft soil and selected approved earth must be filled back and compacted.

6.2 For areas, where pavement is to be laid on cutting / natural grade level, Sub grade shall be thoroughly compacted to 95% of laboratory dry density as per IS: 2720 Part VIII. For filled up areas, top 450 mm of the soil shall be compacted to 95% of laboratory dry density below pavement in layers of 150 mm.

6.3 The difference between the sub grade levels of Type-I, Type-II and Type-III Concrete pavements (due to difference in thickness of Type-I, Type-II and Type-III pavements) shall be achieved by stripping the grade level and not by filling. Hence, site-grading level below pavement shall be kept up to sub grade level of Type-II or Type-III as the case may be, to avoid filling of smaller thickness at later stage.

6.4 The sub grade or sub base for laying of the concrete pavement shall comply with the following requirements:

6.4.1 No soft spots shall be present in the sub grade.

6.4.2 The uniformly compacted sub grade or base course shall extend at least 300mm on either side of the area to be concreted.

6.4.3 The sub grade shall be properly drained.

6.4.4 The minimum modules of sub-grade, in wet condition, reaction obtained with a Plate Bearing Test as per IS: 9214 shall be 6.0 Kg/cm².

6.4.5 Sub grade shall be prepared to the lines and grades to match with the slope of pavement as shown on the drawings.

7.0 PREPARATION OF SUB BASE

7.1 WBM under Type - 1 Pavement (Ref Drawing no. VCS-STD-CS-6018)

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WBM Base Coarse shall consist of 2 layers of WBM Gr.-II, each of 75mm compacted thickness, as per IRC-19 and described in Specification no. VCS-SS-CS -6004

7.2 PCC 1:5:10 under Type-II and Type-III Pavement (Ref. Drawing no. VCS-STD-CS -6018)

7.3 PCC 1:5:10 in sub base layer shall be as described Specification no. VCS-SS-CS -6023

7.4 Sub Base layer shall be prepared to the lines and grades to match with the slope of pavement as shown on the drawings.

7.5 No concrete shall be placed around manholes or other structures until they have been brought to required grade and alignment. All sides of manholes / pits etc. shall have same elevation.

7.6 The sub base layer shall be in moist condition at the time of concrete placement.

8.0 FORMS

8.1 All side Forms shall be of mild steel unless use of wooden sections is specially permitted. The steel forms shall be of MS channel sections and their depth shall be equal to thickness of the pavement. The sections shall have a length of at least 3.0m except on curves, where shorter sections may be used. These forms should be provided with ample bracing and supports to prevent the springing of the forms under the concrete pressure or thrust of machinery operating nearby.

8.2 The forms should be in a sufficient number and they should not be removed until concrete has hardened sufficiently.

8.3 In case wooden forms are permitted, these shall have minimum base width of 100 mm for 150mm or lesser thick slabs and 150mm for 200mm thick slabs.

9.0 LAYING OF REINFORCEMENT, MIXING, PLACING, COMPACTION & FINISHING AND CURING

9.1 LAYING OF REINFORCEMENT

All reinforcement work shall confirm to IS: 456 and as described in Specification no. VCS-SS-CS -6023

9.2 MIXING

Mixing shall be as described in Specification no. VCS-SS-CS-6023.

9.3 PLACING

9.3.1 The place where concrete is to be poured should be clean and free from all loose dirt, wooden pieces, dust, standing water etc.

9.3.2 Walking on reinforcement layers is not permissible. Walkways of wooden planks or similar material can be placed with removable supports and should be independent of

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the reinforcement. The reinforcement position should not be disturbed nor should it sag during carriage and placement of concrete.

9.3.3 Placing and vibration should not take totally more than 20 minutes from time of mixing. Method of placing should be got approved by Engineer-in-Charge. Segregation during carriage and placement should be avoided. If during carriage concrete segregates, it should be remixed before placement.

9.3.4 Concrete should not be dropped from a height of over 1.5m.

9.3.5 To ensure bond and water tightness between old concrete surface and fresh concrete to be placed, the surface should be cleaned and roughened by "initial green cut" by wire brushing or chipping. The initial green may be done by wire brush after 6 hours of placing concrete in order to facilitate the work. Chipping can be done only after 48 hours. A layer of cement slurry with 1:1 mix (1 cement: 1 sand) should be poured to obtain a uniform coating on old concrete. Immediately thereafter, the fresh concrete should be poured.

9.3.6 Concrete shall be mixed in quantities required for immediate use and shall be deposited on the sub-grade in a single operation to the required depth and width of the pavement. Spreading shall be as uniform as possible to avoid re-handling of concrete. Where however, a certain amount of redistribution is necessary, it shall be done with shovels and not with rakes. Concrete shall be vibrated with internal vibrators. Concrete shall be placed continuously until completion of the part of the work between construction joints or as directed by Engineer-in-Charge continuously until completion of the part of the work between construction joints or as directed by Engineer-in-Charge.

9.3.7 PLACING IN INCLEMENT WEATHER

All precautions shall be taken for concreting in extreme weather in accordance with the relevant clauses of IS: 456. Due protection shall be provided to prevent cement being blown away while proportioning and mixing during windy weather. No concreting shall be carried out in continuous heavy rains. Necessary arrangements to cover the freshly poured concrete shall be provided, to protect it from the direct rays of the sun and from drying winds.

9.3.8 All concreting placement should be co-coordinated with placement of conduits, inserts, embedded parts etc. executed either by same agency or separately.

9.3.9 Concrete shall be laid in panels as shown in the standard drawing or as directed by Engineer-in-Charge.

9.4 COMPACTION & FINISHING

9.4.1 COMPACTION

The surface of the pavement shall be compacted either by means of power driven finish machine or a vibrating hand screed. For areas where width of the pavement is very small, hand consolidation and finishing shall be done as follows:

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9.4.1.1 Concrete as soon as placed, shall be struck off uniformly and screeded to the crown and cross-section shown on the plans and to such level above the base that when compacted and finished, the pavement shall conform to the grade and cross-section indicated by the plans. The entire surface shall then be tamped until a close-knit dense surface is obtained.

9.4.1.2 The Tamper shall rest on the side forms and shall be drawn ahead with a swing motion in combination with a series of lifts and drops alternating with lateral shifts. The aim of this operation is compaction and screeding to the approximate level required. Subsequent tamping should advance 75 mm at a time in the direction in which the work is proceeding and in final stages, the tamping should be closer, about 12 mm at a time, until a level and dense surface is obtained.

9.4.1.3 If so directed by Engineer-in-charge, hand operated vibrating tamper consisting of normal type of hand tamper attached to a pneumatic or electric vibrating unit shall be used for compaction.

9.4.1.4 Segregated particles of coarse aggregate, which collect in front of the tamper, shall be thrown outside the forms or thoroughly mixed by hand with a mass of concrete already on the base.

9.4.1.5 Compaction by tamping shall be carried on till the mortar in the mix just works up to the surface. The surface shall be examined after compaction correction. If needed correction shall be made by adding or removing concrete, followed by further compaction and finishing.

9.4.2 FLOATING

As soon as practicable, after concrete has been struck off and compacted, it shall be further smoothened and compacted by means of a longitudinal float, 1200 mm long and 75 mm wide, operated from a foot bridge.

9.4.3 STRAIGHT EDGING

After floating is completed and excess water removed but while concrete is still plastic, the slab surface shall be tested for trueness with a straight edge and rectified, if necessary.

9.4.4 BROOMING

After belting and as soon as surplus water has risen to the surface, the pavement shall be given a broom finish to produce corrugations of uniform appearance of not more than 1/16 inch in depth.

9.4.5 EDGING

Before the concrete has its initial set, the edges shall be carefully finished with an edge of the radius required and pavement edge shall be left smooth and true to line.

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9.5 CURING

Curing of concrete shall be as described in Specification no. VCS-SS-CS-6023.

10.0 JOINTS

10.1 Wherever called for on the drawings, expansion joints, construction joints and sealing joints shall be provided as per details indicated in the drawing and as directed by Engineer-in-Charge.

10.2 SEALING OF JOINTS

10.2.1 After the curing, the temporary seal or other intruded materials of all expansion and contraction joints shall be removed completely and the slots filled with approved joint sealing compound as conforming to IS: 1834, Type B. The filler material for Expansion and Sealing joints shall be preformed fillers of Bitumen Impregnated Fiber, conforming to IS: 1838, Part-I.

10.2.2 The edges of the joints shall be thoroughly cleaned and primed with a thin bituminous paint, which shall be allowed to dry before the sealing compound is applied.

10.2.3 The primer shall be applied with a brush. The composition of primer shall be as follows:

S.no.	Name Of Material	Percentage by weight
1.	200-Penetration Bitumen Blended	66
2.	Light creosote oil Hot/Cold	14
3.	Solvent Naphtha	20

The bitumen shall be melted and fluxed with oil. When cold, solvent Naphtha shall be added. BITUMINOUS emulsion shall not be used as primers. Care shall be taken to ensure that the sealing compound is not heated above 200°C and the temperature does not exceed 180°C for long periods.

10.2.4 Sealing compound shall be poured into the joint opening in such a manner that the material will not be spilled on the exposed surface of the concrete. When required to prevent pick up under traffic, the exposed surface of the sealing compound shall be dusted with hydrated lime.

11.0 OPENING TO TRAFFIC

11.1 Traffic shall not be allowed for a period of 28 days after laying of concrete in pavement.

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11.2 Before opening the pavement to traffic, all joints shall be filled and trimmed or topped out as required.

11.3 Sampling, testing and acceptance of concrete work shall be according to IS: 456-2000

12.0 METHOD AND BASIS FOR PAYMENT

12.1 PLAIN AND REINFORCED CONCRETE

This clause shall be applicable for item tender rate only.

12.1.1 Payment for plane and reinforced concrete in pavements shall be made on cubic meter basis of the volume of the actual finished work done and shall be inclusive of cost of providing Forms, Pockets, Chamfers, Fillets, Grooves, Cement wash, Curing by normal moist curing or using curing compound etc. as directed by Engineer-in-Charge. The rates shall be deemed to include complete cost of getting the respective mix designs approved, making and testing concrete cubes and carrying out other tests including tests of various ingredients, as per specifications and as directed by Engineer-in-Charge.

12.1.2 No separate payment shall be made for any admixture used by the contractor for accelerating or retarding the strength of concrete or for achieving specified workability / water tightness. The rate quoted shall be deemed to be inclusive of all costs related to any such additive / admixture.

12.1.3 The rate shall however be exclusive of reinforcement, metal inserts, pipe sleeves and any filler material in expansion / sealing joints.

12.1.4 Where the strength of concrete mix (nominal or design mix) as indicated by tests, lies in between the strengths of two grades given in VCS Specification no. VCS-SS-CS-6023 and it is accepted by owner/Engineer-in-charge, such concrete shall be classified as a grade belonging to the lower of the two grades between which it lies. In case the cube strength shows higher results than those specified for the particular grade of the concrete, it shall not be placed in the higher grade nor shall the Contractor be entitled for any extra payment on such account. The concrete giving lower strength than specified may be accepted at reduced rates after satisfying the safety of the structure by checking it with tests as specified or rejected entirely at the discretion of the Engineer-in Charge. The rejected concrete shall be dismantled at no extra cost to the owner and no payment or extension of time shall be granted for the concrete so rejected and the formwork and reinforcement used for the same. Cost of any material supplied by the Owner free of cost shall be recovered from the contractor at double the prevailing market rate. In case the concrete of lower strength can be improved by carrying out some strengthening measures entirely at the discretion of the Engineer-in-Charge, then Contractor shall carry out the said measures including all related tests at his own cost. If the Contractor is able to make up the strength to the required grade by such improvement measures to the entire satisfaction of Engineer-in-Charge, payment shall be made for the grade achieved. However, if the strength of concrete is not made up to the strength of required grade, payment shall be made only for the lower strength if such concrete is accepted by the Engineer-in-Charge.

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12.1.5 Deductions for openings, pockets etc. shall be as specified in relevant Indian Standard Codes.

12.2 REINFORCEMENT

12.2.1 Payment for plain round mild steel reinforcement bars and high strength deformed steel bars shall be on the basis of weight of bare steel, irrespective of any coating applied, in metric tons. The weight of the bar shall be derived from the sizes and corresponding unit weights given in hand book of Bureau of Indian Standards. Standard hook length, chairs, spacer bars and authorized laps only shall be included in the weight calculated. Binding wire shall not be weighed nor otherwise measured. Measurement for weight shall not include cutting allowance etc.

12.2.2 Rate quoted for reinforcement shall include cost of supplying, de-coiling, straightening, cleaning, cutting, bending, placing, binding, welding if required, and providing necessary cover blocks of concrete.

12.3 JOINTS

Payment for expansion joints, construction joints and sealing joints shall be made on running meter basis. The rate shall include cleaning of joints, filler material and sealing with approved compound, all material, labour etc. complete, as per drawing.

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STANDARD SPECIFICATION
FOR
FLEXIBLE PAVEMENT WITH BITUMEN PREMIX CARPET

VCS-SS-CS-6007

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ABBREVIATION

m	Metre
mm	Millimetre
cm	Centimetre
IS	Indian Standard
IRC	Indian Road Congress
m^2	Square metre
m^3	Cubic metre
Kg	Kilogram
Kg/m^2	Kilogram per Square Metre
Cm/yr	Centimetre per year
MOST	Ministry of Surface Transport

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1.0 SCOPE

This specification establishes the material, construction requirements and procedures for the flexible pavement with open-graded bitumen premix carpet.

2.0 REFERENCES

2.1 CODES & STANDARDS

IS: 73	Paving bitumen
IS: 269	Ordinary Portland cement, 33 grade
IS: 2116	Sand for masonry mortars
IRC: 37	Guidelines for the Design of Flexible Pavements

2.2 SPECIFICATIONS

Specifications for Road and Bridge Works - Ministry of Surface Transport (Road Wing)

NOTE: -Latest Edition of all Codes, Standards and Specifications shall be followed.

2.0 MATERIAL

3.1 COARSE AGGREGATE

The aggregate shall consist of crushed stone of clean, hard, tough, durable rock of uniform quality and shall be clean, free from excess of dust, flat or elongated pieces, soft or disintegrated stone, clay or other deleterious matter. The size of aggregate shall be as mentioned in the schedule of quantities. The aggregates shall conform to the physical requirements specified in Table 500.3 of MOST Specification except that the water absorption shall be limited to 1% maximum.

3.2 SAND

The sand for seal coat shall consist of clean, hard, durable, uncoated, coarse dry particles and shall be free from injurious amounts of dust, soft or flaky particles, organic matter or other deleterious substances. The sand shall pass 2.36mm sieve and be retained on 180micron sieve.

3.3 BINDER

The binder shall be bitumen of S65 (Grade 60/70 penetration) for Hot/ Moderate climate or S90 (Grade 80/100 penetration) for Cold climate (high altitude and snow bound regions). Physical and Chemical properties of Paving Bitumen shall be as per IS: 73. The bitumen shall be collected in drums. Any leaking or damaged drum shall not be accepted.

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4.0 QUANTITIES OF MATERIAL (PREMIX CARPET)

4.1 FOR PREMIX CARPET 20MM THICK

S. no.	Material	For Premix Carpet per100m²	For seal coat per100m²
1	Coarse aggregate 12mm and down size	2.75m³	-
2	Bitumen	150 Kg	68.3 Kg
3	Coarse sand as sealing aggregate	-	0.6 m³

4.2 FOR PREMIX CARPET 25MM THICK

S. no.	Material	For Premix Carpet per100m²	For seal coat per100m²
1	Coarse aggregate 12mm and down size	3.5m³	-
2	Bitumen	185 Kg	68.3 Kg
3	Coarse sand as sealing compound	-	0.6 m³

4.3 FOR PREMIX CARPET 50MM THICK

S. no.	Material	For Premix Carpet per100m²	For seal coat per100m²
1	Coarse aggregate 25mm and down size (For 35mm thick carpet 1 layer)	5.5m³	-
2	Coarse aggregate 12mm and down size (For 15mm thick carpet layer)	2.0m³	-
3	Bitumen		

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	a) For 35mm thick Carpet (1 layer)	269 kg	68.3 kg
	b) For 15mm thick Carpet (II layer)	110 kg	-
4	Coarse sand as sealing aggregate	-	0.6 m³

4.4 FOR PREMIX CARPET 75MM THICK

S. no.	Material	For Premix Carpet per100m²	For seal coat per100m²
1	Coarse aggregate 25mm and down size (For 50mm thick 1 layer)	8.5m³	-
2	Coarse aggregate 12mm and down size (For 25mm thick II layer)	3.5m³	-
3	Bitumen		
a	For 50mm thick (1 layer)	375 kg	68.3 kg
b	For 25mm thick (II layer)	185 kg	-
4	Coarse sand as sealing aggregate		0.6 m³

5.0 LAYING

5.1 PREPARATION OF ROAD SURFACE

The existing surface shall be thoroughly cleaned of dust, loose materials, caked mud and other foreign matter with the help of wire brush, chisel, picks etc. before laying the tack course. The cleaning shall be carried out in such a manner as to expose the stone metal to a depth of 1 to 2mm without dislodging the interlocking of the metal. All dust and other material thus removed shall be carried away and dumped at suitable places as directed by the Engineer-in-charge.

If pot holes or ruts are found on the existing road surface, these irregularities must be filled in with premix chippings and well rammed about a week before the carpet is laid.

5.2 TACK COAT

5.2.1 The binder shall be heated to the temperature appropriate to the grade of cutback bitumen /bituminous emulsion used and approved by the Engineer-in-Charge at the rate of 1 kg /m² by means of sprayers and shall be spread uniformly. The normal

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range of spraying temperature shall be 500 - 80° C for cutback of grade RC-70 / MC-70 and for bituminous emulsion 20° - 60° C.

5.2.2 The tack coat shall be applied just ahead, keeping pace with laying of premix carpet.

5.3 PREPARATION OF PREMIX

5.3.1 Mechanical mixers shall be generally used for preparation of premix. Improvised hand mixing drums may be used, if permitted by the Engineer-in-charge.

5.3.2 Stone chippings of specified size shall be thoroughly mixed dry in the mixer at the rate indicated above. Binder heated at a temperature 150°C-163°C and aggregates in the range of 155°C-163°C are added in the given proportions to the mixer drum and thoroughly mixed till the stone chips are completely coated with the binder. The discharge temperature of the mix shall be between 130 °C and 160 °C.

5.3.3 The premix mixture shall be transported from mixing plant to the work site in suitable tripper vehicles.

5.4 SPREADING OF PREMIX

The mix transferred from the tipper trucks at site to the paver shall be spread immediately by means of self-propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix true to the specified lines, grades and cross sections.

The mix shall be spread in such a manner that after compaction, the required thickness of the premix carpet is obtained. The camber should be checked by means of camber boards and irregularities leveled out. .

However, in restricted locations and in narrow widths where the available paver cannot be operated in the opinion of Engineer-in-Charge, manual laying of mix may be permitted.

5.5 ROLLING

5.5.1 When the premix has been laid for a length of 15-20 meters, rolling shall be commenced with tandem rollers (8 to 10 tones). Rolling should commence from edges and proceed towards centre longitudinally except that on super elevated and unidirectional cambered portions, it shall progress from the lower to the upper edge parallel to the centerline of the pavement. The roller shall move at a speed not more than 5Km/hr.

5.5.2 The wheels of roller shall be continuously moistened to prevent the premix adhering to the wheels and being picked up.

5.5.3 After the preliminary rolling and honey combing, high spot or depressions shall be rectified by adding or removing the premix as per requirements and the surface shall be rolled again to compaction. Camber shall be checked at every stage and any defects found shall be rectified. Excessive rolling shall be avoided.

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5.5.4 Rolling operation shall be completed in every respect before the temperature of the mix falls below 100 °C. Roller shall not remain stationary on freshly compacted surfaces.

5.6 SEAL COAT

5.6.1 Seal Coat (For low rainfall areas - under 150 cm/yr)

A premix seal coat, mix preferably in a mechanical mixer after heating the sand should be applied immediately after laying the carpet and rolled. Materials required for this seal coat are as per clause 4.

5.6.2 Seal Coat (For high rainfall areas- over 150 cm/yr)

The material requirement for seal coat in high rainfall areas is as under:-

Binder 80/100 = 98 kg /100m² of road surface
Coarse aggregates
6.3mm passing IS 10mm

Square mesh, retained on
IS sieve 2.36mm = 0.9m³/100m² of road surface.

A liquid seal coat, preferably with chippings as above (though coarse sand can also be used) should be applied after laying the carpet. The binder after being heated to permitted temperature, should be applied to the cleaned surface, blinded with chippings and rolled. Traffic may be allowed on the road preferably 24 hours after providing the seal coat.

6.0 REMOVAL OF SURPLUS EARTH

6.1 Surplus earth and soil from excavation shall be removed from construction area to the area demarcated by the Engineer-in-charge.

6.2 Payment shall be made only for lead beyond initial 50m from construction areas Rate shall include loading, transportation, dumping, stacking the surplus earth and soil in the area demarcated. Payment shall be made on cubic meter basis of the difference of measurements of the volumes of the excavated pits and the measurements of the backfilling.

7.0 BRICK PITCHING ON EMBANKMENT SLOPES

7.1 EXCAVATION

Trench shall be excavated / dressed true to line, section and grade as per drawings prior to starting the pitching work.

7.2 MATERIAL

7.2.1 Bricks shall be locally available best bricks.

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7.2.2 Cement, sand and water used shall be as per IS: 269 and 2116.

7.3 The concrete mix used for bedding shall be as per drawings and schedule of rates.

7.4 The work of pitching shall be done after the bottom concrete has been laid and sides properly trimmed to the required grade and thoroughly compacted.

7.5 Brick pitching shall be done in 1:4 cement mortar using best quality locally available bricks.

7.6 Bricks shall be laid in herring bone pattern with their length at 450 to the length of the ditch as shown in drawings.

7.7 Mortar joints shall never exceed 6mm in thickness and all bricks shall be laid with vertical joints quite full of mortar.

7.8 Bricks shall be soaked for a period of at least 12 hours immediately before use and no broken and damaged bricks shall be used in any part of the work except as required to close any line of bricks.

7.9 The face of pitching shall be made even and smooth.

7.10 The brickwork shall be raked and flush pointed with cement mortar 1:3 as specified.

8.0 PAYMENT

This clause shall be applicable for item tender rate only.

8.1 BITUMEN PREMIX CARPET

Payment shall be made on square metre (m^2) basis of finished surface including all labour & materials as per above specifications.

8.2 BRICK PITCHING

Payment for brick pitching shall be made on the basis of area paved. It shall include all operations described above, except the excavation item.

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STANDARD SPECIFICATION
FOR
RCC PIPE CULVERTS & ERC CROSSING

VCS-SS-CS-6008

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ABBREVIATION

m	Metre
mm	Millimetre
IS	Indian Standard
IRC	Instrumentation Road Crossings
ERC	Electrical Road Crossings
PVC	Poly Vinyl Chloride
RCC	Reinforcement Cement Concrete

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1.0 SCOPE

The scope of this specification covers R.C.C pipe culverts and ERC/ IRC crossings with RCC or PVC pipes.

2.0 REFERENCES

2.1 BIS CODES

IS: 458	:	Precast Concrete Pipes (with and without reinforcement)
IS: 783	:	Code of practice for laying of RCC pipes
IS: 4985	:	Un-plasticized PVC pipes for potable water supplies

NOTE:- Latest Edition of all Codes and Standards shall be followed.

2.2 SPECIFICATIONS

VCS-SS-CS-6002	Earthwork for Site Grading
VCS-SS-CS-6003	Earthwork for underground piping
VCS-SS-CS-6022	Earthwork in Foundations

3.0 MATERIALS

3.1 All pipes must be new and perfectly sound, free from cracks, cylindrically straight and of standard nominal diameter and length, with even texture. RCC Pipes shall be of collar type only and each pipe shall have one collar with it. PVC Pipes shall be Class-I as per IS: 4985.

For pipe culverts, class of RCC pipe shall be NP3 / NP4 or as mentioned in the drawings.

3.2 The Contractor shall submit manufacturer's test certificate for acceptance of RCC/PVC pipes.

3.3 Spun yarn for pipe joints shall be of best quality. It shall be free from dust etc.

4.0 TRANSPORTATION AND STACKING

4.1 The transportation of materials to the worksite and stacking shall be done in a manner to cause minimum inconvenience to the traffic and other construction work.

4.2 The pipe shall be protected during handling against impact, shocks and free fall to avoid cracks and damage.

4.3 The Contractor shall be fully responsible for the safety and security of materials transported and stacked in the field.

4.4 EARTHWORK

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Refer standard VCS-SS-CS-6002, VCS-SS-CS-6022 for earthwork.

5.0 LOWERING AND LAYING OF RCC PIPES

5.1 GENERAL

The laying and jointing of RCC pipes shall confirm to IS: 783. Pipes shall be jointed by collar joints.

The trench shall be checked for proper level, grade and alignment before lowering the pipes.

5.2 LOWERING

The RCC pipe shall be lowered cautiously to prevent disturbance to the bed and sides of the trench. The heavy RCC pipes shall be lowered by means of proper tripods, chain pulley blocks or as directed by Engineer-in-charge. Great care should be taken to prevent sand etc. from entering the pipes.

5.3 LAYING

5.3.1 Laying of RCC pipes shall proceed upgrade of slopes.

5.3.2 The error of grade shall not be rectified by packing up earth underneath the pipe. If required, concrete shall be used for packing.

5.3.3 The end of RCC pipes shall be kept closed to keep dirt, mud and foreign materials out. Adequate provision shall be made to prevent floating of pipes in the event of flooding of trenches.

The body of RCC pipe, for its entire length, shall rest on an even bed in the trench and places shall be excavated to receive the collar for the purpose of jointing.

5.4 JOINTING OF RCC PIPES

5.4.1 A few skeins of spun yarn, soaked in neat cement wash shall be inserted in the groove at the end of the pipe and the two adjoining pipes butted against each other. The collar shall then be slipped over the joint covering equally both the pipes. Spun yarn soaked in neat cement wash shall be passed round the pipes and inserted in the joint by means of caulking tools from both ends of the collar. More skeins of yarn shall be added and well rammed home. The object of the yarn is to center the two ends of the pipes within the collar and to prevent the cement mortar of the joint penetrating into the pipes.

5.4.2 Cement mortar 1:2 (1 cement: 2 sand) shall be slightly moistened and must on no account be soft or sloppy and shall be carefully inserted by hand into the joint. The mortar shall than be punched and caulked into the joint and more cement mortar added until the space of the joint has been filled completely with tightly caulked mortar. The joint shall be finished off neatly outside the collar on both side at an angle 45°

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5.4.3 Any surplus mortar projecting inside the joint is to be removed and guarded against any damage. Sack or gunny bags shall be drawn past each joint after completion.

5.5 CURING

The Cement mortar joints in RCC pipes shall be cured at least for seven days.

5.6 TESTING

All joints in culvert pipelines shall be tested to a head of 1.5 m of water above the top of the highest pipe, if required, by Engineer-in-Charge.

5.7 PAYMENT

This clause shall be applicable for item tender rate only.

Payment shall be made on running meter basis, which includes supplying, transporting, lowering, laying, jointing and curing, concreting around RCC pipes etc., all complete.

6.0 LOWERING AND LAYING OF PVC PIPES

6.1 Lowering and laying of PVC pipes shall be done as per IS: 4985. The jointing of the pipes shall be done by expanding one end after heating and using solvent cement.

6.2 PAYMENT

Payment shall be made on running meter basis of PVC pipes, which includes supplying, transporting, lowering, laying and jointing, concreting around PVC pipes etc., all complete.

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STANDARD SPECIFICATION
FOR
GRAVEL FILLING

VCS-SS-CS-6010

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ABBREVIATION

m	Metre
mm	Millimetre
IS	Indian Standard
SOR	Schedule of Rates
HDPE	High Density Polyethylene
HM	High Molecular

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1.0 SCOPE

This specification covers gravel filling over PE Film in open areas, within unit battery limits or at any other location.

2.0 REFERENCES

2.1 BIS CODES

IS: 383	Specification for coarse and fine aggregates from natural sources for concrete
IS: 2720 Part VII	Methods of tests for soils, Part 7, Determination of water content - dry density relation using light compaction
IS: 10889	Specification for HDPE films

2.2 VCS SPECIFICATIONS

VCS-SS-CS-6002	Earthwork in Site Grading
VCS-SS-CS-6022	Earthwork in Foundations

NOTE: - Latest Edition of all Codes and Standards shall be followed

3.0 MATERIAL

3.1 GRAVEL

3.1.1 The material to be used for gravel filling shall be either gravel or hard durable crushed stone from source/ quarries approved by Engineer-in-charge. It shall be free from flat, elongated, soft and disintegrated particles without any fissures. It shall also be free from clay and weathering action. The size of gravel/ crushed stone shall range from 27 mm to 50 mm.

3.1.2 The gravel/ crushed stone shall be stacked by the side of gravel fill area on firm, well drained ground in regular stacks, as directed by Engineer-in-charge and contamination by earth and other extraneous matter shall be prevented effectively.

3.2 FILM SPECIFICATION

Film specification shall be generally as per IS: 10889. The various requirements shall be as follows:

a.	Material	:	HM HDPE Grade-I
b.	Appearance	:	Uniform in color, texture and finish. No visible defects, free from un-dispersed raw material, streaks and foreign matter particles
c.	Film form	:	In flat sheets or rolls

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d.	Odour	:	Free from objectionable odour.
e.	Density (mass)	:	i 180 gms/ sq.m.(for film)
			ii 0.954 gms/ ml @ 27° ± 2°C.(for compound)
f.	Film thickness	:	600 gauge (0.15mm) minimum or more to achieve above density.
g.	Melt flow index	:	As per clause no. 4.1.5 of IS: 10889
h.	Tensile strength at break		
	Machine direction	:	300 kgf/cm²
	Transverse direction	:	250 kgf/cm²
i.	Elongation at break		
	Machine direction	:	300 %
	Transverse direction	:	300 %
j.	Yield tolerance	:	As per clause no.4.3 of IS:10889
k.	Impact resistance (falling dart) for 600 gauge (.006")	:	Less than 420 gf
l.	Water penetration	:	Nil
m.	Carbon black content	:	2.5±0.5% by mass
n.	Nominal width	:	5 to 10 m
o.	Joint breaking strength	:	10KN/m

4.0 CONSTRUCTION DETAILS

4.1 PREPARATION OF SUB GRADE

The area to be filled with gravel shall be cleared of all loose material and virgin soil shall be exposed. Such exposed surface shall be consolidated properly to obtain 90% of maximum laboratory dry density of the soil as per IS: 2720 Part VII. All soft patches shall be worked out to remove the soft soil and selected approved earth shall be filled back and compacted. The sub grade shall be free from sharp objects such as stone, weed roots etc. and shall be smooth without any depressions and humps etc. The surfaces so prepared shall be leveled and sloped as per drawings, for effective drainage.

4.2 FILM LAYING

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The film shall be spread over the prepared sub grade and laid loose so as to provide for the thermal contraction etc. The adjacent layer of film should be jointed firmly. A minimum of 200 mm overlap and jointing by heat sealing shall be done. The loose ends of the film shall be firmly anchored at the ends as per the instructions of the Engineer-in-Charge. The joints of the film shall be kept to the minimum.

4.3 GRAVEL FILLING

4.3.1 The gravel / crushed stone aggregate shall be spread uniformly and evenly, on the prepared base covered with film, in required quantities from the stacks. The aggregate shall be spread to proper profiles and slopes / gradients, in such a way that it will not damage or pierce the film.

4.3.2 The surface of the aggregate spread shall be carefully trued up and all high and low spots remedied by removing or adding aggregates, as may be required. The thickness of layer of aggregate so spread shall be 100mm.

5.0 PAYMENT

This clause shall be applicable for item tender rate only.

5.1 Payment of gravel filling shall be made on the basis of area covered with 100mm thick (or as specified in Item description in SOR) layer of gravel / crushed stone. The rate quoted shall include cost of PE Film, gravel / crushed stone, transportation, handling, laying & dressing etc. over consolidated and exposed ground including the cost of clearing and stripping, leveling, consolidation, watering, testing of exposed ground, removal of waste / surplus earth within plant battery limit and covering of prepared sub base with film etc., as directed by Engineer-in-charge, all complete.

5.2 Payment for the removal of loose top soil, as described in Cl. 4.1 above, shall be included in the item for gravel filling. No separate payment for consolidation of exposed ground surface shall be made.

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STANDARD SPECIFICATION

FOR

MISC. CIVIL & STRUCTURAL WORKS FOR UNDERGROUND SERVICES

VCS-SS-CS-6011

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ABBREVIATION

m	Metre
mm	Millimetre
cm	Centimetre
IS	Indian Standard
m^2	Square metre
U/G	Underground
Cl	Cast Iron
M.S.	Mild Steel

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1.0 SCOPE

This specification covers the material and construction details for various civil works as given below:

a. All earthworks except for Site Grading and U/G Piping.

b. Plain and reinforced cement concrete work in catch pits clean outs manholes, pipe supports, water monitors, hydrant pedestals, Thrust block etc.

c. Brick work for various structures such as Manholes, Catch basins, Valve Chambers, instrument tapping chambers, Flushing chambers, etc

d. Plastering for the above structures as applicable.

e. Manhole frames, manhole covers, ladder rungs etc. for the above structures as applicable.

f. Miscellaneous structure steel work such as ladders, platforms, chequered plate c overs, gratings etc.

The work shall include supply of various materials as per relevant standards, required for the execution of work except for those items designated as Owner's scope of supply in the special conditions of contract or elsewhere in the contract documents. Contractor shall transport from Owner's stores those materials which are a part of owner's supply.

All materials not fully specified herein and which may be used in the WORK shall be of quality approved by the Engineer-in-charge and he shall have the right to determine whether all or any of the materials offered or delivered for use in the WORK are suitable for the purpose. CONTRACTOR shall give the samples of material to the Engineer-in-charge and shall get it approved before procurement and use.

2.0 REFERENCES

2.1 BIS CODES

IS: 5455 Cast Iron Steps for man holes

IS: 3502 Steel Chequered Plates

IS: 2062 Hot Rolled medium and High tensile structural steel

IS: 1726 Cast Iron Manhole covers and frames

IS: 1239 Specification for Steel tubes, Tubulars and Other wrought steel fittings

2.2 SPECIFICATIONS

VCS-SS-CS-6002, VCS-SS-CS-6003, VCS-SS-CS-6022 Earth work

VCS-SS-CS-6023 Plain and Reinforced Cement Concrete

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VCS-SS-CS-6027 Brick Masonry

VCS-SS-CS-6043 Plastering & Pointing

3.0 EARTHWORK & BACKFILLING

3.1 Refer specification no VCS-SS-CS-002, VCS-SS-CS-003 & VCS-SS-CS-022

4.0 PLAIN AND REINFORCED CEMENT CONCRETE

4.1 Refer specification No. VCS-SS-CS-6023

5.0 BRICK WORK

Refer specification no. VCS-SS-CS-6027

6.0 CEMENT PLASTERING

6.1 MATERIALS

The specifications for cement, sand and water shall be as given in spec. No. VCS-SS-CS -6021 Cement mortar shall be of grade and thickness specified in drawing or as directed by the Engineer-in-Charge, if not specified. The surface on which plastering is to be done shall be thoroughly cleaned from dust, dirt, oil, etc. It should be washed properly and watered for 4 hours before plastering. The joints of brick work shall be raked out to a depth of at least 12mm when plastering has to be done. On cement concrete surface, the surface shall be scarified by lines with trowel when it is still green or hacked if concrete is hard as directed by Engineer-in-Charge.

6.2 Plaster shall not in any case, be thinner than specified. It shall have uniform specified thickness. Any extra thickness of plaster done by contractor will not be paid for. When smooth finishing is required the cement plaster shall be floated over with neat cement within 15 minutes of the application of the final coat.

During the process of plastering all corners shall be rounded to a radius of 25mm unless otherwise specified.

6.3 The plaster shall be protected from sun and rain by such means as the Engineer-in-Charge may approved. The plaster shall be cured for 7 days.

6.4 Construction joint shall be kept in plastering work at places approved by Engineer-in-Charge.

6.5 PAYMENT

This clause shall apply to item rate tender only.

6.5.1 Payment for plastering shall be made on basis of the area of surface plastered, measured before plastering. All Measurements shall be separately made for each face of walls.

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6.5.2 The rate of plastering shall include cost of scaffolding, swings, cleaning the surface, raking out joints, hacking concrete surfaces, etc. needed for carrying the work and shall cover the extra labour for plastering the jambs, sills, and soffits or opening except for plastering bands, cornices and skirting up to 30 cm width.

7.0 M.S. RUNGS/C.I. STEPS

The rungs for valve pits/manholes shall be of M.S. conforming to Indian Standard and to the shape and size as shown drawings. C.I. steps for manholes if used shall be as per IS: 5455. M.S. Rungs or CI steps shall be coated with 2 coats approved bituminous paint.

Payment for steps/rungs shall be made per number and the rate shall include supply and fixing, finishing the wall etc. complete.

8.0 CHEQUERED PLATES & STRUCTURAL STEEL WORKS

Chequered plates shall be 6mm (7mm moreover chequers and shall conform to IS: 3502). Steel for chequered plate shall conform to IS: 2062 and shall be clearly rolled and free from harmful surface defects such as crack surface flaws etc. The plate shall be cut to shape and fixed to the bearing members as shown in relevant drawings and as directed by Engineer-in-Charge. The edges shall be made smooth, no burrs or gagged ends shall be left. The plates may be spliced with prior consent of the Engineer-in-Charge. But in that case care should be taken so that there is continuity in the pattern of the plates between the portions. Lifting arrangements shall be provided including lifting rods.

Grating shall be fabricated out of M.S flats, angles and rounds etc., as per drawings and as approved by Engineer-in-Charge. Steel for grating plates shall conform to IS: 2062 of general weldable quality and shall be clearly rolled and shall be free from harmful surface defects.

Payment shall be made on the basis of weight of M.S Gratings/chequered plate and supporting frame actually laid. The rate shall include supply of all necessary, steel materials cutting to size, fabricating, smoothening edge if necessary, transporting and fixing at all positions and providing lifting arrangements. Full deductions shall be made for all opening above 30mm square and the rate shall include making of opening of all sizes and supplying and painting 2 coats of anticorrosive paint over a coat of red oxide zinc chromate primer. The exposed surface of grating and frame shall be painted with two thick coats of coal tar. The rate shall include providing and laying M.S grating and frame, breaking and making good existing concrete/brick masonry surface if necessary finishing, painting etc. complete with all labour and materials. Payment shall be on number basis.

9.0 C.I. MANHOLE FRAME AND COVER

C I manhole frame and covers shall conform to IS: 1726 with size and grade as shown in drawing.

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10.0 VENT PIPES

These shall be M.S. Black Steel Tube conforming to IS: 1239 Medium grade or as specified in drawing. The pipe bends shall be embedded in 1:3:6 grade cement concrete or as shown in drawing.

All pipes shall be 25mm clear of wall or column with M.S. holder bat clamp as per instructions of the Engineer-in-Charge. All holes in walls and column shall be made good by 1:2:4 grade cement concrete. All pipes and clamps shall be painted with two coats of paints of approved make.

Payment shall be made on running meter basis and the rate shall include supply of all materials, cutting, edge preparation, jointing by welding, fixing in concrete block, cutting of walls or concrete and making good the same, painting with 2 coats of anticorrosive paint necessary scaffolding etc. complete.

The rate shall also include excavation and backfilling if any.

11.0 FUNNELS, CLEAN OUTS, PLUGS

These shall be fabricated from M.S Plates, pipes chequered Plates, rounds, angles etc., to be supplied by the contractor. The fabric action shall be in accordance with the approved drawing.

Payment for these items shall be made on weight basis and rate shall include fabrication, erection, welding jointing and painting etc. all complete.

12.0 BRICK BAT FILL

11.1 The brick bats used as filling in valve pits shall be from common burnt clay building bricks. A sample of brickbats used shall be got approved from Engineer-in-charge.

11.2 The compaction of the layer of brick bats shall be proper so that brickbats are not disturbed and do not sink in the soil.

11.3 The payment for brick-bat fill shall be made on m2 basis as shown in drawing and the rate shall include supply, laying, compacting etc. complete with all materials & labour.

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Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION
FOR
PLUMBING AND DRAINAGE

VCS-SS-CS-6012

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ABBREVIATION

m	Metre
mm	Millimetre
CM	Cement Motar
IS	Indian Standard
CP	Chrome Plated
M.S.	Mild Steel
G.I.	Galvanised Iron
Kg	Kilogram
Kg/cm^2	Kilogram Per Square Centimetre
Psi	Pounds Per Square Inch
HCI	Heavy Cast Iron
CI	Cast Iron

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1.0 SCOPE

1.1 This specification is intended to establish and define the materials and constructional requirements for plumbing & building drainage work.

1.2 All materials, fixtures and workmanship shall be in accordance with the relevant Indian Standard, specifications and codes of practices.

2.0 REFERENCES

2.1 BIS CODES

IS: 269	:	Ordinary Portland cement, 33 grade
IS: 554	:	Dimensions for pipe threads where pressure-tight joints are made on threads
IS: 651	:	Specification for Glazed Stoneware pipes and fittings
IS: 778	:	Copper alloy gate, globe and check valves for water works purposes
IS: 782	:	Specification for Caulking lead
IS: 1239	:	Mild steel tubes, tubulars and other wrought steel fittings
IS: 1726	:	Cast iron manholes covers and frames
IS: 1729	:	Cast Iron/Ductile Iron drainage pipes and pipe fittings for Over ground non pressure pipeline and spigot series
IS: 2470	:	Code of practice for installation of septic tanks
IS: 3486	:	Cast iron spigot and socket drain pipes
IS: 3950	:	Surface boxes for sluice valves
IS: 3989	:	Centrifugally cast (spun) iron spigot and socket soil, waste and Ventilating pipes, fittings and accessories
IS: 5455	:	Cast iron steps for manholes

2.2 VCS SPECIFICATIONS

VCS-STD-CS-6003	Details of Soak Pit
VCS-STD-CS -6004	Details of Septic Tank

NOTE: - Latest Edition of all Codes and Standards shall be followed.

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3.0 H.C.I. NAHNI TRAP (FLOOR TRAP)

Nahni trap shall be of heavy cast iron as per IS: 3989 with 100mm inlet and 80/ 100mm outlet with CP pressed steel grating. It shall be of self-cleaning design. Grating shall be of either hinged or screwed down type.

It shall be fixed in cement mortar 1:2, as directed by Engineer-in-Charge.

4.0 STONEWARE GULLY TRAP CHAMBER

The square mouth gully trap shall be of 100mm dia, conforming to IS: 651, of specified and/ or approved quality stoneware, complete with cast iron grating, and shall be got approved from Engineer-in-Charge. The size of CI frame and cover shall be of 300 x 300mm. It shall be properly fixed, as directed by the Engineer-in-Charge.

The size of the chamber shall be 300 x 300 x 675mm (internal). It shall be constructed of brick masonry walls, 125mm thick, in 1:4 cement mortar and M-20 concrete foundations. Inside & outside faces of the masonry walls shall be plastered with 1:3 cement mortar. The top of the chamber shall be provided with Cl cover and frame.

5.0 VALVE CHAMBER, INSPECTION CHAMBER & MANHOLES

The size and type of construction of valve chamber, inspection chamber and manholes shall be as specified in the drawings or items.

6.0 C.I. SOIL / WASTE PIPES

Cl pipes shall be socket and spigot of standard quality conforming to IS: 1729. The supply shall include all necessary accessories e.g. bends, Y- Junction, T- Junction, including plugs, shoes, cowls etc. complete.

Cl soil / waste pipe below ground or floor shall be encased with 50mm thick PCC M20 concrete.

The spigot of the pipe shall be placed fully resting inside the socket and hemp caulked home to leave space for lead depth as specified. Lead conforming to IS:782 in molten state shall then be poured into the joint filling the same in one pouring. The lead shall be caulked by proper tools to make it even all round. Depths of lead in the joints from the top of the socket shall be 37mm for 150mm dia pipes, 25mm for 100 mm and 50mm dia pipes. All pipes shall be fixed 25mm clear of the wall with MS bat clamps or as approved by the Engineer - in Charge. All holes in walls and floors shall be made good by cement concrete M-15 grade and should be leak proof. All soil and waste pipes shall be tested for leakage by hydraulic test.

All Cl pipes shall be painted with two coats of paint of approve make and shade over a coat of primer. Earthwork in excavation, backfilling and removal of surplus earth/ debris shall be considered as a part of the work. No separate payment shall be made for the same.

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7.0 C.I. SOIL / WASTE VENT PIPES

CI pipes shall be standard quality conforming to IS: 1729. The supply shall include all necessary accessories e.g. bends, Y- Junction, T- Junction, including plugs, shoes, cowls etc. complete.

Jute yarn gasket of suitable diameter shall be used as required to support the spigot of the pipe at the proper grade and make truly concentric joints. Single piece of sufficient length shall be used to pass around the pipe and lap at the top and shall be thoroughly saturated in bitumen. This gasket shall be laid in the socket for lower third of the circumference of the joint and covered with cement mortar. The spigot of the pipe thoroughly cleaned with wet brush, inserted and carefully driven home after which a small amount of cement mortar (1:2) shall be inserted in the annular space around the entire circumference of pipe and solidly rammed into the joint with caulking tool. The joint shall then be completely filled with mortar and beveled off at angle of 45^0 with outside of the pipe. Cement used to join shall conform to IS: 269.

All holes in walls and floors shall be made good by cement concrete M- 15 grade. all soil and waste pipes shall be tested for leakage by hydraulic test.

All Cl pipes shall be painted with two coats of anticorrosive bituminous paint externally.

8.0 GI PIPES AND FITTINGS

8.1 All G.I. pipes and fittings shall conform to IS: 1239 and shall be of heavy grade for water supply system.

All screwed tubes and sockets shall have pipe threads in accordance with the requirements specified in IS: 554. Unless specified otherwise, pipes shall be supplied screwed with taper threads and sockets with parallel thread.

All fittings shall be malleable galvanized iron, approved by the Engineer-in-Charge. Fittings in G.I. line shall include all couplings, elbows, tees, bends, unions, nipples, reducers, flanges with nuts, bolts and rubber insertions, bushes and all other fittings to make a complete job.

Screwed G.I. pipes shall be jointed with screwed socket joints using screwed fittings. Care shall be taken to remove any burr from the end of the pipes after threading. White lead with a few strands of fine hemp shall be applied while tightening. Compounds containing red lead shall not be used.

All pipes above ground shall be fixed with G.I. holder bat clamps, clear off the wall, at 1.2 in centre to center. If the pipes are encased or embedded in wall, they shall be secured in position by iron hooks at 1.2 in centre to center. All visible pipes and clamps within and outside building shall be painted with two coats of white paint or aluminium paint as directed by the Engineer-in-Charge. No extra payment shall be made for clamps, hooks, cutting holes in walls, chasing and making good the same.

All underground pipes shall have a minimum earth cover of 600mm or as directed by the Engineer-in-Charge. No extra payment shall be made for excavation in trenches,

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backfilling the same and removal of surplus earth. Before any pipes are painted or covered up, they shall be tested to a hydrostatic pressure of minimum 6 kg/ Sqcm. or 1.5 times of Design Pressure.

8.2 TESTING

Testing of GI pipes shall be done in accordance with IS: 1239 (Part 1).

9.0 GUN METAL VALVE

All full way and globe valves shall be of heavy gunmetal and tested at 300 psi and shall be approved by the Engineer-in-Charge. Valves shall conform to IS: 778. Size of valve chamber shall be as per item description. Construction of valve chamber shall be carried out as per clause 5.0 above. Valve chamber shall be provided & fixed with heavy duty C.I. surface box conforming to IS: 3950. The surface box shall be hinged pin open type & shall be fixed in the chamber slab. It shall have a hole for opening.

10.0 M.S. RUNGS/ C.I. STEPS

The rungs for pits, manholes and septic tanks etc. shall be made out of M.S. bars conforming to Indian Standard and to the shape and size as shown in drawings.

CI steps for manholes, if needed shall be as per IS: 5455

M.S. rungs shall be coated with 2 coats of approved bituminous paint.

11.0 SOAK PITS

All earthworks in excavation, brick work etc. shall conform to relevant I.S. standard.

The brickbats should preferably be slightly over burnt or thoroughly well burnt, deep red in colour with some proportion of deep blue or black veins. Spongy or vitrified material, as a result of excessive over burning, is useless and shall be rejected. Brickbats bigger than specified size shall be reduced to required size (40 to 50mm) before filling in soak pit and no extra payment shall be made for this. It shall be stacked at site as directed by Engineer-in-Charge. Soak pit & septic tank shall be connected with required piping.

12.0 SEPTIC TANK

Septic tanks shall be provided as per drawings and directions of Engineer-in-Charge. The sizes shall vary depending on the no. of users.

Alternatively, readymade RCC pipe septic tank, consisting of sewage receiving chamber, inspection door, vent pipe, inlet & outlet connections, manhole cover, C.I. steps etc. shall be used.

Design, testing & commissioning shall conform to IS: 2470 Part-I.

Access opening shall be provided for desludging & inspection.

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The ventilating pipe shall be provided with pipe of at least 50mm dia extended 2 meters above the nearest working platform level.

In case where water table is shallow and soak pits are not recommended, up-flow filters, as per drawings shall be provided.

13.0 PAYMENT

This clause shall apply to item rate tender only.

13.1 H.C.I. NAHNI TRAP (FLOOR TRAP)

Payment shall be made per number basis. The rate shall include supplying and fixing Nahni trap, including cement mortar, cutting walls and floors and making good the same, providing and fixing chromium plated pressed steel grating etc. all complete.

13.2 STONEWARE GULLY TRAP CHAMBER

Payment shall be made on per number basis. The rate shall include supplying and fixing of stoneware gully trap, Cl grating, construction of masonry chamber, providing and fixing Cl frame and cover, earthwork in excavation, foundation concrete, backfilling and removal of surplus earth up to a lead of 30m and labour and material etc. all complete.

13.3 VALVE CHAMBER, INSPECTION CHAMBER & MANHOLES

Payment shall be made as per number basis including excavation, backfilling, removal of earth, construction of the valve chamber, inspection chamber and manhole, making connections of pipes through the walls including grouting, cost of M.S. rungs, cover slab, cost of CI cover and frame etc. as per specifications and directions of the Engineer-in-Charge.

The rate shall include breaking concrete or brick masonry work and making good the same with 1:4 cement mortar if necessary, finishing, painting, etc. as per directions of Engineer-in-Charge.

13.4 C.I. SOIL / WASTE PIPES

The payment shall be on running meter basis of pipes laid with fittings as required on site. The rate shall include supplying and fixing of pipes and necessary specials including cowl with hemp and lead, jointing & testing, bat clamps, fixtures, painting, cutting of walls, floor and making good the same and necessary scaffolding, encasing of pipes below ground or floor with 50mm thick PCC M20 concrete earth work in excavation, backfilling & removal of surplus earth etc. complete.

13.5 C.I. SOIL / WASTE VENT PIPES

The payment shall be on running meter basis of pipes laid. The rate shall include supplying and fixing pipes, jute gaskets dipped into bitumen and cement mortar and necessary specials including jointing with clamps, painting, cutting of walls, floor and making good the same, necessary scaffolding etc. complete.

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13.6 GI PIPES AND FITTINGS

Payment shall be made on running meter basis of actual pipeline laid. In addition to the sectional testing of water supply piping, the contractor shall test entire installation on completion of the job, to the entire satisfaction of the Engineer-in-Charge. No extra payment shall be made for testing. The contractor shall make his own arrangement for supply of water for testing, at his own cost. The rate for this item shall include supply and laying of G.I. pipes with necessary fittings, cutting of pipes to required lengths, threading, making holes in walls and floors and making good the same, jointing, painting, excavation and refilling including testing as directed by the Engineer-in-Charge.

13.7 GUN METAL VALVE

The payment shall be made per number basis, including surface box. The rate shall include, supplying and fixing valve & surface box in position, as per drawings and directions of Engineer-in-Charge.

13.8 M.S. RUNGS/ C.I. STEPS

Payment for rungs shall be made on per number basis and the rate shall include supply, fixing, finishing the walls, painting etc. all complete.

13.9 SOAK PITS

Payment of soak pit/ up flow filter shall be made per number basis. Rate quoted shall include brick masonry work, providing & filling brick bats, earthwork in excavation, backfilling, making inlet connection with pipe and connecting the same to septic tank etc. complete as shown in drawing.

13.10 SEPTIC TANK

Payment of septic tank shall be made per number basis & rate shall include all accessories like inlet, outlet, vent pipe, manhole cover & C.I. steps, earthwork in excavation & back filling, removal of surplus earth etc. all complete.

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