

1 **TECHNICAL SPECIFICATIONS**
2 **for**
3 **PLANTATION TENDER**
4 **INDIAN INSTITUTE OF MANAGEMENT UDAIPUR**
5 **7th June 2017**

6 **Vastu-Shilpa Consultants**
7 **Earthscapes Consultancy Pvt Ltd**

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Abbreviations:

Client (s)	Indian Institute of Management Udaipur and / or its authorized EIC
Architect (s)	Project Architect or its authorized EIC
EIC	Project Engineer in Charge
Plumbing Consultant (s)	Project Consultant or its authorized EIC
Electrical Consultant (s)	Project Consultant or his authorized EIC
Structural Consultant (s)	Project Consultant or its authorized EIC
Project Management Consultant / PMC	Project Management Consultant or its authorized EIC
EIC	Engineer-in-Charge of supervision / management of site development works, as authorized by client / PMC
Landscape Contractor	Contractor awarded this tender for landscape development works
Site	Indian Institute of Management Udaipur Village Balicha, Dist. Udaipur

1 **General:**

2 The contractor is assumed to have understood the nature of existing terrain, the
3 characteristics of soil and other related aspects so that he clearly understands
4 the scope of work and assess the manpower and resource requirements.
5 Charges made in consequences of any misunderstanding or incorrect
6 information on any of these points on the grounds of insufficient description will
7 not be allowed.

8 The rates quoted shall be inclusive of all taxes, levies and payments made by the
9 contractor in execution of the contract.

10 Landscape development work consists of two phases:

11 Development Period consisting of development works like clearing of site,
12 grading, planting, irrigation, etc. up to a period of 120 (one hundred and twenty)
13 days from date of plantation of last plant.

14 Maintenance Period consisting of all works required in order to establish the
15 plant material including cutting / pruning, fertilizing, cleaning, weeding,
16 applying weedicide, mowing of lawn, watering, etc up to a period of 2 (two)
17 years from date of completion of Landscape Development Period

18 Defects Liability Period shall be up to a period of two years after completion of
19 Development Period, but concurrent with Maintenance Period. Rectification
20 works under Defects Liability shall not in any way preclude the responsibilities of
21 the Contractor specified under Maintenance Period.

22 Maintenance period shall be 2 (two) years from completion of Development
23 period as mentioned in the specification, in a specified zone or till the time the
24 planting is established, whichever is later. This will include timely watering,
25 manuring, weeding, pruning, staking, spraying of insecticides, weedicides,
26 pesticides, fungicides. If the plant/shrub/bulb/flower seedling dies then the
27 same must be replaced, immediately free of all charges, with plant/bulb etc. of
28 same species and size. Lawn rolling, lawn cutting, dressing, soil working, plant
29 replacement, application of manure, watering, etc. are routine operations and in
30 event that these are not followed properly and/or on regular basis, and as
31 observed during the periodic visits to the check the quantity and quality of
32 development, the EICs can recommend extension of development period.

33 Contractor must keep a site diary/site record (in triplicate). This diary shall be
34 used to give any instructions for site work; either by the EICs / EIC. The
35 Contractor must get all instructions in writing, at first possible opportunity, even
36 if any instructions are given orally.

37 Contractor must submit a weekly report indicating the progress done/reasons
38 for delay in completion of any works. The weekly report should consist of a daily
39 log regarding number of labourers employed at site and delivery notes for all
40 materials delivered to the site, and works completed on daily basis should be
41 e-mailed to the client and the EICs.

42 All instructions written in the diary shall be presumed to have been given to the
43 Contractor and the Contractor shall be responsible for carrying out the same.

44 The work shall be carried out according to the specifications/ and drawings
45 irrespective of whether it is specifically mentioned in the bills of quantities or not.
46 All works shall be done according to the drawing and instructions of the EICs.

1 Figures / dimensions on drawings shall supersede measurement in scale and
2 drawings to large scale takes precedence over those to a smaller scale.

3 No trees shall be cut without permission. If any tree has to be cut, it shall be paid
4 for extra. For this purpose, a tree shall be defined with a growth, which is more
5 than 3 meters high and whose trunk diameter at the base is not less than 30 cm.
6 If the tree is to be transplanted in the same location, it shall be paid separately,
7 depending upon the size of the tree and distance to be carried.

8 Samples of each type of materials and workmanship shall be submitted /shown
9 by the Contractor for the approval of the EICs; these samples shall be
10 maintained at the site. The Contractor will be required to perform all the works
11 of this contract in accordance with these samples.

12 Contractor shall make suitable arrangement for storage of plant material before
13 planting.

14 Workers will not be allowed to stay in any part of the site, and Contractor will
15 have to make arrangements for them independently.

16 All quoted rates will remain valid for a period of contract.

17 The Contractor shall not set fire to any standing jungle, trees, brushwood or
18 grass without a written permit from the client's designated EIC In-charge and
19 Forest officer. When such permit is given, and in all cases when destroying out
20 or dug up trees, brushwood, grass, etc. by fire, the Contractor shall take
21 necessary measures to prevent such fire spreading to or otherwise damaging
22 surrounding property.

1 **Scope of work:**

2 The site cleaning / removal of unwanted ground covers, weeds, plants, existing
3 babul trees, etc. would be inclusive of the total rates quoted by the contractor.

4 The rates shall be inclusive of the removal of unwanted plants/weed material
5 and breaking the clods to the satisfaction of the Engineer in Charge.

6 Work shall consist of development and maintenance of all the plants specified in
7 the detailed drawings by the consultant.

8 The Contractor is required to maintain weekly progress report on progress of the
9 work as well as growth parameters of the various species as specified by the
10 consultants from time to time.

11 During the maintenance period the growth of plant material according to its
12 natural behaviour in the particular climatic conditions is also expected as part of
13 the proper performance from the contractor. In case of death of a plant or major
14 decay of the plant due to contractor's negligence or inadequate efforts, the
15 contractor shall replace the same with a properly grown healthy plant of
16 equivalent height and types.

17 Costs of all and any materials required during the development and
18 maintenance periods such as plants, grasses, lawns, groundcovers, manures
19 and fertilizers, weedicides, pesticides, fungicides, any other pest and disease
20 control chemicals as may be prescribed by the EIC from time to time, good soil
21 required of the qualities mentioned earlier, stakes, etc. will be borne by the
22 contractor, except where specified.

23 Delivery of above materials at the site without additional cost is also a part of
24 scope of work.

25 All the tools and equipments, such as trolleys, secateurs, hedge sheers, forest
26 sheers, pruning saw, spades, kodali, khurpi, forking, racks, sprayers, sprinklers,
27 water cans, hosepipes etc., required for the development and maintenance will
28 have to be brought by the contractor.

29 All the cost of labour transport, food, accommodation and other welfare
30 activities for his employees shall be borne by the contractor.

31 The contractor shall employ qualified and experienced supervisors, preferably
32 Agriculture/Forestry graduates, skilled, semi-skilled and unskilled workers
33 depending upon the nature of job.

34 The contractor must visit the site at least once a week.

35 In case water facility is not proper, watering should be done by water tanker or
36 by pumping from the nearest water reservoir or point provided.

37 Contractor shall provide all safety gears to his workers at his cost.

38 Wherever green net is required for providing necessary shade for the growth of
39 specific plants, or to reduce scorching, the required material shall
40 be provided by the client free of cost. However, the shifting and erection of
41 these structures shall be done by the contractor. No labour charge shall be paid
42 for the same.

1 The contractor will need to establish a nursery on site since the
2 work is expected to be executed in phases. Maintenance and
3 safety of the plant material shall be the responsibility of the contractor.
4 All cost, wages of workers equipment required for the development work will be
5 borne by the Contractor. The Contractor shall employ experienced workers only.

6 The Contractor will have to provide the following items at no extra cost to client:
7 The Contractor will supply and install 3.0 metres high barricades for
8 safeguarding landscape development area and works, as specified by the Site
9 Supervisor / client / EICs from time to time. He may also install the barricades
10 in the landscape development area according to his own understanding if he
11 feels that any part of the landscape area is bound to be damaged for any reason,
12 after taking prior permission from the Site Supervisor / client / EICs.

13 The Contractor will maintain the entire landscape development area for a period
14 of two years after completion of development period as certified by the client's
15 designated EIC in-charge in consultation with the EICs

16 The Contractor will supply electricity for landscape development work at his own
17 cost during the development period

18 For routine development, the rates quoted shall be inclusive of material supply
19 and will except in case of items like grass/hedge cuttings that may be supplied
20 by client /or form part of separate contract.

21 All equipment required for development shall be made available by Contractor,
22 and its maintenance shall be his responsibility. This includes Tagara, Phawdas,
23 Hose Pipes, Ground Roller, Manual and/or Electric lawn Mowers, Sprinklers, etc.

24 Contractor will take full care to ensure that no service lines (water supply,
25 Electrical) or civil work is damaged during the course of work. client can recover
26 cost of damaged works from Contractor if required.

27 In the event of Landscape work being disturbed during course of work due to
28 other agencies the Contractor will make good the damage immediately. Rate,
29 cost and amount to be paid for repairing the damage and its impact on the
30 completion date shall be determined by the EICs only.

31 Contractor will attend weekly/meetings during course of work as and when
32 scheduled without fail, in addition to carrying out regular visits as and when may
33 be required for carrying out the work.

34 Contractor will ensure that all plants remain free of diseases, pests, etc during
35 development and maintenance periods.

1 **General Items**

2 Setting out the works

3 The Contractor shall supply without additional charges the requisite number of
4 persons with the means and material necessary for the purpose of setting out
5 works and checking, weighing and assisting in the measurement or examination
6 at any time and from time to time, of the work or the materials. Failing this, the
7 same may be provided by the client's designated EIC In-charge at the expense
8 of the Contractor and the expenses shall be deducted from any money due to
9 the Contractor under the contract or from his security deposit.

10 The Contractor shall arrange for a qualified surveyor to set out the works and
11 obtain certification of its accuracy from the surveyor. The Contractor shall then
12 set out the works and shall be responsible for the true and perfect setting out of
13 the same and for the correctness of the positions, levels, dimensions, and
14 alignment of all parts thereof and for provision of all necessary instruments,
15 appliances and labour in connection therewith. The Contractor shall submit to
16 the client and the EICs, margins and the verifications of layout within seven days
17 from the date of getting site layout from EICs / client.

18 Mark the layout on the site. All bench marks, levels should be properly
19 established and preserved for future use.

20 Clearly check the surveyed map provided by the client and mark all drainage
21 lines, water pipe lines, electrical lines, etc. client has been asked to remove the
22 electrical lines and electrical poles. It needs to be checked by Contractor to
23 satisfy him / herself from safety point of view before starting of work.

24 The checking of any setting out or of any line or level by the EICs and client's EIC
25 or their EIC shall not in any way relieve the Contractor of his responsibilities, for
26 the correctness thereof. The Contractor shall carefully protect and preserve all
27 benchmarks and other things used in setting out of the work.

28 **Landscape Development Technique**

29 The contractor will not be allowed to use different techniques or quality criteria
30 or materials other than those mentioned in the Technical Specifications unless
31 his alternative system has been confirmed in writing by the EIC. No cost
32 increases for alternative specifications will be entertained unless formally
33 submitted in writing as an improvement in the quality of a product and accepted
34 in writing, following Employer's EIC approval, by the EIC.

35 **Quality of Workmanship and Materials**

36 All materials and workmanship shall be of the high standards and quality
37 demanded by this specification. Sub-standard work and materials identified by
38 the EIC will be rejected and will be required to be rebuilt or replaced at the
39 Contractor's costs. All plant material shall be of the genus, species and variety
40 specified and substitutions will not be permitted unless authorized in writing by
41 the EIC. The sizes and plant description set out in the section headed Plant
42 Material.

43 All trees and shrubs supplied for the contract shall be free of pest, disease,
44 discolouration and damage. Plants shall be well branched with vigorous shoots.
45 The root system of each plant shall contain a good proportion of fibrous roots.

1 All materials are to be approved by the EIC prior to use on site. Materials shall be
2 obtained from approved sources/manufacturers and/or suppliers. All
3 guarantees and warranties shall be copied and submitted to the EIC prior to
4 requests for approval.

5 Where particular products are specified, the Contractor if he wishes to use
6 similar products from other manufacturers must seek prior confirmation from
7 the EIC.

8 **Site Responsibilities**

9 From the commencement of the works until the Certificate of Completion has
10 been issued by the EIC, the Contractor shall, in respect of all areas of soft
11 landscape works, adjacent areas and parts of the site used by him, be
12 responsible as follows:

- 13 ● For adequate protection to grassed areas, planted areas and trees and for
14 making good softworks on removal of any protective measures at
15 completion.
- 16 ● For any damage to existing works and features and any necessary
17 rectification work required to obtain approval from Employer EIC.
- 18 ● For keeping all paved surfaces used by him in a clean and tidy condition.
- 19 ● For periodic removal of all surplus excavations and waste matter produced
20 by his operations to a Local Authority registered tip off site, to be found by
21 the Contractor .
- 22 ● For keeping all soft landscape areas in a weed-free and tidy condition and
23 adequately watered.
- 24 ● The Main contractor's shall make appropriate allowance for these
25 requirements in his rates.
- 26 ● The Main contractor's shall, within 24 hours of notification and as directed
27 by the EIC, undertake at his own expense any remedial works arising from
28 the stated requirements.

29 **Plant Protection**

30 All plant material is to be carefully protected and if necessary wrapped in the
31 nursery during lifting, awaiting transportation, during transportation, unloading
32 and during storage on site.

33 Any evidence of unsatisfactory protection to roots, stem, branches and leaves
34 will result in plants being rejected. Unprotected plants must not be transported
35 during very hot weather, and all plants must be kept moist during transportation
36 and storage. No plant material shall be left on site unplanted for more than two
37 days.

38 **Work by Machine or Hand**

39 All operations herein described shall be carried out by suitable approved
40 machines or by hand. Any work around the base of existing trees, in confined
41 spaces or which is impractical to carry out by machine for any reason shall
42 executed by hand and the contractor shall include for this in his rates.

43 **Notice of Intentions**

44 The contractor shall give forty-eight hours written notice to the EIC of his
45 intention to commence any of the following operations: Setting out; planting;

1 topsoiling; turfing; sprigging; fertilising; and maintenance visits.

2 **Heavy Machinery**

3 Heavy machinery, which would excessively consolidate the sub-soil, shall not be
4 used during any operations nor shall heavy machinery be taken over areas
5 prepared for planting or grassing.

6 **Substitutions**

7 If the Contractor is unable to supply a particular species of plant he is to notify
8 the EIC in advance of his intention to make a substitution. No substitution will be
9 allowed without prior written agreement of the EIC.

10 Notices of substitutions are to be made sufficiently for in advance of installation
11 to ensure that the substituted material conforms to specifications. Substitutions
12 requested by the Contractor after work has started on site will not be
13 entertained.

14 **Setting Out**

15 The Contractor shall be responsible for accurately setting out all the works prior
16 to the commencement of the works and shall rectify errors in setting out at his
17 own expense.

18 Any discrepancy in site area between that shown on the plans and the actual
19 area on the ground shall be notified to the EIC.

20 The Contractor shall supply all necessary materials, equipment and labour to
21 enable the EIC to check the setting out, levels and dimensions on the site.

22 **Tools and Equipment**

23 The Contractor shall use proper tools and equipment for the carrying out of the
24 works and is to ensure that the work force is fully and properly equipped with the
25 correct equipment and experience for the job at hand.

26 **Failures of Plants (during development period)**

27 Any trees, shrubs, grass or other plants (other than those found to be missing or
28 not in accordance with the Contract Documents as a result of theft or malicious
29 damage and which shall be replaced), which are dead, dying, missing or found
30 not to be have been in accordance with the Contract Documents at completion of
31 the development period shall be replaced by the Contractor entirely at his own
32 cost unless the Contract Administrator shall otherwise instruct. The Contract
33 Administrator shall certify the dates when in his opinion the Contractor's
34 obligations under this clause have been discharged.

35 **Plants Defects Liability**

36 Any grass which is found to be defective within 24 months, any shrubs, ordinary
37 nursery stock trees or other plants found to be defective within 24 months and
38 any semi-mature, advanced or extra-large nursery stock trees found to be
39 defective within 24 months of the date of practical completion due to materials
40 or workmanship not in accordance with the Contract Documents shall be
41 replaced by the Contractor entirely at his own cost unless the Contract
42 Administrator shall otherwise instruct. The Contract Administrator shall certify
43 the dates when in his opinion the Contractor's obligations under this clause have
44 been discharged.

45 **Malicious Damage or Theft (during development period)**

1 All loss or damage arising from any theft or malicious damage prior to practical
2 completion shall be made good by the Contractor at his own expense.

3 **Submittals**

4 The Contractor shall:

5 Submit for review shop drawings completely dimensioned, indicating any
6 pattern layouts, special installation procedure, cutting, fitting, sinking and
7 adjacent equipment materials for coordination.

8 Submit for approval samples of all materials and samples of workmanship

9 The Contractor shall be responsible for producing and submitting for comment
10 and approval to the Employer's EIC the shop drawings and samples of all
11 elements indicated in this section. All should be based on schematic drawings
12 provided within the tender package. All submissions should be reviewed,
13 approved and endorsed by the Contractor.

14 **Handling, Storage And Delivery**

15 The Contractor shall:

- 16 ● Coordinate delivery with suppliers, to minimize handling.
- 17 ● Handle and store equipment and materials in such a manner that no damage
18 will be done to the materials or the work of other trades.
- 19 ● Store packaged materials, undamaged in their original wrappings, or
20 containers with manufacturer's labels and seals intact.
- 21 ● Stack equipment and materials on wooden platforms at least 150mm clear
22 of the ground and protect with weatherproof covers.
- 23 ● Damaged equipment, material or works will be rejected by the Employer's
24 EIC whether built-in or not.
- 25 ● For equipment, materials and work, covering shall be of suitable material
26 containing nothing that may injure or stain the materials.

27 **Protection of Work**

28 The Contractor shall protect all equipment, materials and completed work from
29 damage until final completion of the work. Remove and replace damaged work.

30 **Reference Standards**

31 The Contractor shall comply with all relevant Indian Standards, ASTM, British
32 Standard Code of Practice, Draft BS or DIN Standard applicable to elements
33 indicated in this section, the recommendations and requirements of such
34 documents shall be considered a minimum standard of such work described and
35 must be complied with.

36 Nothing shall relieve the Contractor of his responsibility for providing a higher
37 standard than the relevant Code or Standard where it is required to comply with
38 other sections of the Specification.

1 **LANDSCAPE EARTH WORKS**

2 **Scope**

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

8 **Applicable codes**

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

11 IS 783 - Code of practice for laying of concrete pipes.

12 IS 1200 - Method of measurement of building and civil engineering works.

13 (Part 1) - Part 1 Earthwork

14 (Part 27) - Part 27 Earthwork done by mechanical appliances.

15 IS 3764 - Excavation work-code of safety.

16 IS 2720 - Methods of test for soils:

17 (Part 1) - Part 1 Preparation of dry soil samples for various tests

18 (Part 2) - Part 2 Determination of water content

19 (Part 4) - Part 4 Grain size analysis

20 (Part 5) - Part 5 Determination of liquid and plastic limit

21 (Part 7) - Part 7 Determination of water content-dry density relation using light
22 compaction

23 (Part 8) - Part 8 Determination of water content-dry density relation using heavy
24 compaction

25 Part (9) - Part 9 Determination of dry density - moisture content relation by
26 constant weight of soil method

27 (Part 14) - Part 14 Determination of density index (relative density) of
28 cohesionless soils

29 (Part 28) - Part 28 Determination of dry density of soils in place, by the sand
30 replacement method

31 (Part 29) - Part 29 Determination of Dry Density of Soils In-place by the
32 Corecutter Method

33 (Part 33) - Part 33 Determination of the density in place by the ring and water
34 replacement method

35 (Part 34) - Part 34 Determination of density of soil in place by rubber balloon
36 method

37 (Part 38) - Part 38 Compaction control test (Hilf Method)

38 **Drawings**

39 The Contractor shall furnish drawings wherever, such drawings are required to
40 show areas to be excavated/ filled grade level, sequence of priorities etc. The
41 Contractor shall obtain Engineer's approval before proceeding with works and
42 follow strictly such approved drawings.

43 **General**

44 The Contractor shall furnish all tools, plants, instruments, qualified supervisory
45 personnel, labour, materials any temporary works, consumables, any and
46 everything necessary, whether or not such items are specifically stated herein
47 for completion of the job in accordance with the specification requirements.

48 The Contractor shall carry out the survey of the site before excavation and set
49 properly all lines and establish levels for various works such as earthwork in

1 excavation for grading, foundations, plinth filling, roads, drains, cable trenches,
2 pipelines etc. Such survey shall be carried out by taking accurate cross sections
3 of the area perpendicular to established reference/ grid lines at 8 m. intervals or
4 nearer as determined by the Engineer based on ground profile. These shall be
5 checked by the Engineer and thereafter properly recorded.

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

10 Rock/ soil excavated shall be stacked properly as directed by the Engineer. As a
11 rule, all softer material shall be laid along the centre of heaps, the harder and
12 more weather resisting materials forming the casing on the sides and the top.
13 Rock shall be stacked separately.

14 **Clearing**

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

22 **Precious objects, relics, objects of antiquity, etc.**

23 All gold, silver, oil, minerals, archaeological and other findings of importance,
24 trees cut or other materials of any description and all precious stones, coins,
25 treasures, relics, antiquities and other similar things which may be found in or
26 upon the site shall be the property of the Owner and the Contractor shall duly
27 preserve the same to the satisfaction of the Owner and from time to time deliver
28 the same to such person or persons as the Owner may from time to time
29 authorise or appoint to receive the same.

30 **Classification**

31 All materials to be excavated shall be classified by the Engineer, into one of the
32 following classes. No distinction shall be made whether the material is dry, moist
33 or wet. The decision of the Engineer regarding the classification of the material
34 shall be final and binding on the Contractor and not be a subject matter of any
35 appeal or arbitration.

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

37 **Ordinary and Hard Soils**

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

44 **Soft and Decomposed Rock**

45 This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite and
46 all other materials which in the opinion of Engineer is rock, but does not need

1 blasting and could be removed with picks, hammer, crow bars, wedges, and
2 pneumatic breaking equipment. The mere fact that the Contractor resorts to
3 blasting for reasons of his own, shall not qualify for classification under 'Hard
4 Rock'. This shall also include excavation in macadam and tarred roads and
5 pavements. This shall also include rock boulders not longer than 1 metre in any
6 direction and not more than 500 mm in any one of the other two directions.
7 Masonry to be dismantled will also be measured under this item.

8 ***Hard Rock***

9 This shall include all rock occurring in large continuous masses which cannot be
10 removed except by blasting for loosening it. Harder varieties of rock with or
11 without veins and secondary minerals which, in the opinion of the Engineer
12 require blasting shall be considered as hard rock. Boulders of rock occurring in
13 such sizes and not classified under 7.2.1 and 7.2.2 above shall also be classified
14 as hard rock. Concrete work both reinforced and unreinforced to be dismantled
15 will be measured under this item, unless a separate provision is made in the
16 Schedule of Quantities.

17 **Excavation**

18 All excavation work shall be carried out by mechanical equipment unless, in the
19 opinion of the Engineer, the work involved and time schedule permit manual
20 work.

21 Excavation for permanent work shall be taken out to such widths, lengths,
22 depths and profiles as are shown on the drawings or such other lines and grades
23 as may be specified by the Engineer. Rough excavation shall be carried out to a
24 depth 150 mm above the final level. The balance shall be excavated with special
25 care. Soft pockets shall be removed even below the final level and extra
26 excavation filled up as directed by the Engineer. The final excavation if so
27 instructed by the Engineer should be carried out just prior to laying the
28 mud-mat.

29 The Contractor may, for facility of work or similar other reasons excavate, and
30 also backfill later, if so approved by the Engineer, at his own cost outside the
31 lines shown on the drawings or directed by the Engineer. Should any excavation
32 be taken below the specified elevations, the Contractor shall fill it up, with
33 concrete of the same class as in the foundation resting thereon, up to the
34 required elevation. No extra shall be claimed by the Contractor on this account.
35 All excavation shall be done to the minimum dimensions as required for safety
36 and working facility. Prior approval of the Engineer shall be obtained by the
37 Contractor in each individual case, for the method he proposes to adopt for the
38 excavation, including dimensions, side slopes, dewatering, disposal, etc. This
39 approval, however, shall not in any way relieve the Contractor of his
40 responsibility for any consequent loss or damage. The excavation must be
41 carried out in the most expeditious and efficient manner. Side slopes shall be as
42 steep as will stand safely for the actual soil conditions encountered. Every
43 precaution shall be taken to prevent slips. Should slips occur, the slipped
44 material shall be removed and the slope dressed to a modified stable slope.
45 Removal of the slipped earth will not be paid for if the slips are due to the
46 negligence of the Contractor.

1 Excavation shall be carried out with such tools, tackles and equipment as
2 described herein before. Blasting or other methods may be resorted to in the
3 case of hard rock; however not without the specific permission of the Engineer.
4 The Engineer may also direct that in some extreme case, the rock may be
5 excavated by heating and sudden quenching for splitting the rock. Fire-wood
6 shall be used for burning and payment shall be made for such work as called for
7 in the schedule of quantities.

8 **Stripping loose rock**

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

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

21 **Fill, back filling and site grading**

22 **General**

23 All fill material will be subject to the Engineer's approval. If any material is
24 rejected by the Engineer, the Contractor shall remove the same forthwith from
25 the site at no extra cost to the Owner. Surplus fill material shall be deposited/
26 disposed off as directed by the Engineer after the fill work is completed.

27 No earth fill shall commence until surface water discharges and streams have
28 been properly intercepted or otherwise dealt with as directed by the Engineer.

29 **Material**

30 To the extent available, selected surplus soils from excavated materials shall be
31 used as backfill. Fill material shall be free from clods, salts, sulphates, organic or
32 other foreign material. All clods of earth shall be broken or removed. Where
33 excavated material is mostly rock, the boulders shall be broken into pieces not
34 larger than 150 mm size, mixed with properly graded fine material consisting of
35 murrum or earth to fill up the voids and the mixture used for filling.

36 If any selected fill material is required to be borrowed, the Contractor shall make
37 arrangements for bringing such material from outside borrow pits. The material
38 and source shall be subject to prior approval of the Engineer. The approved
39 borrow pit area shall be cleared of all bushes, roots of trees, plants, rubbish etc.
40 Top soil containing salts/ sulphate and other foreign material shall be removed.
41 The materials so removed shall be burnt or disposed off as directed by the
42 Engineer.

43 The Contractor shall make necessary access roads to borrow areas and maintain
44 the same, if such access road does not exist, at his cost.

45 Filling in pits and trenches around foundations of structures, walls etc.

1 As soon as the work in foundations has been accepted and measured, the spaces
2 around the foundations, structures, pits, trenches etc. shall be cleared of all
3 debris, and filled with earth in layers not exceeding 15 cm., each layer being
4 watered, rammed and properly consolidated, before the succeeding one is laid.
5 Each layer shall be consolidated to the satisfaction of the Engineer. Earth shall be
6 rammed with approved mechanical compaction machines. Usually no manual
7 compaction shall be allowed unless the Engineer is satisfied that in some cases
8 manual compaction by tampers cannot be avoided. The final backfill surface
9 shall be trimmed and levelled to proper profile as directed by the Engineer or
10 indicated on the drawings.

11 **Filling in trenches**

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

16 Where the trenches are excavated in soil, the filling from the bottom of the
17 trench to the level of the centreline of the pipe shall be done by hand compaction
18 with selected approved earth in layers not exceeding 8 cm; backfilling above the
19 level of the centreline of the pipe shall be done with selected earth by hand
20 compaction or other approved means in layers not exceeding 15 cm.

21 In case of excavation of trenches in rock, the filling up to a level 30 cm. above
22 the top of the pipe shall be done with fine materials, such as earth, murrum, etc.
23 The filling up of the level of the centreline of the pipe shall be done by hand
24 compaction in layers not exceeding 8 cm. whereas the filling above the
25 centreline of the pipe shall be done by hand compaction or approved means in
26 layers not exceeding 15 cm. The filling from a level 30 cm. above the top of the
27 pipe to the top of the trench shall be done by hand or other approved mechanical
28 methods with broken rock filling of size not exceeding 15 cm mixed with fine
29 material as available to fill up the voids.

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

32 **General site grading**

33 Site grading shall be carried out as indicated in the drawings and as directed by
34 the Engineer. Excavation shall be carried out as specified in the specification.
35 Filling and compaction shall be carried out as specified under relevant clause and
36 elsewhere unless otherwise indicated below.

37 If no compaction is called for, the fill may be deposited to the full height in one
38 operation and levelled. If the fill has to be compacted, it shall be placed in layers
39 not exceeding 225 mm and levelled uniformly and compacted as indicated in
40 relevant clause before the next layer is deposited.

41 To ensure that the fill has been compacted as specified, field and laboratory tests
42 shall be carried out by the Contractor at his cost.

43 Field compaction test shall be carried out at different stages of filling and also
44 after the fill to the entire height has been completed. This shall hold good for
45 embankments as well.

46 The Contractor shall protect the earth fill from being washed away by rain
47 damaged in any other way. Should any slip occur, the Contractor shall remove
48 the affected material and make good the slip at his cost.

49 The fill shall be carried out to such dimensions and levels as indicated on the
50 drawings after the stipulated compaction. The fill will be considered as
51 incomplete if the desired compaction has not been obtained.

52 If so specified, the rock as obtained from excavation may be used for filling and
53 levelling to indicated grades without further breaking. In such an event, filling

1 shall be done in layers not exceeding 50 cms approximately. After rock filling to
2 the approximate level, indicated above has been carried out, the void in the
3 rocks shall be filled with finer materials such as earth, broken stone, etc. and the
4 area flooded so that the finer materials fill up the voids. Care shall be taken to
5 ensure that the finer fill material does not get washed out. Over the layer so
6 filled, a 100 mm thick mixed layer of broken material and earth shall be laid and
7 consolidation carried out by a 12 tonne roller. No less than twelve passes of the
8 roller shall be accepted before subsequent similar operations are taken up.

9 **Fill density**

10 The compaction, only where so called for, in the schedule of quantities/ items
11 shall comply with the specified (Standard Proctor/ Modified Proctor) density at
12 moisture content differing not more than 4 percent from the optimum moisture
13 content. The Contractor shall demonstrate adequately at his cost, by field and
14 laboratory tests that the specified density has been obtained.

15 **Lead**

16 Lead for deposition/ disposal of excavated material, shall be as specified in the
17 respective item of work. For the purpose of measurement of lead, the area to be
18 excavated or filled or area on which excavated material is to be deposited/
19 disposed off shall be divided into suitable blocks and for each of the blocks, the
20 distance between centrelines shall be taken as the lead which shall be measured
21 by the shortest straight line route on the plan and not the actual route taken by
22 the Contractor. No extra compensation is admissible on the grounds that the
23 lead including that for borrowed material had to be transported over marshy or
24 'katcha' land/ route.

25 **Site filling**

26 **Scope**

27 Apart from any other work/ purpose for which this specification may be made
28 applicable by the Engineer, this shall generally govern work involving filling site/
29 plant over the entire area/ most of the area to raise the general grade level to
30 the desired elevation. This work shall be carried out as per applicable clauses of
31 section "Earthwork in Grading, Excavation and Backfilling" as per relevant
32 Clauses.

33 **Fill material**

34 **General**

35 All fill material whether such material is brought from outside borrow areas or
36 from excavation from within the site, will be subject to the Engineer's approval.
37 Notwithstanding any approval given to the fill material of borrow areas from
38 which fill material is proposed to be brought, the Engineer/ Owner reserves the
39 right to reject such material which in his opinion either does not meet the
40 specification requirements or is unsuitable for the purpose for which it is
41 intended.

42 **Borrow areas**

43 It shall be Contractor's responsibility to locate suitable borrow areas for
44 borrowing fill material. Such area will be inspected by the Engineer and
45 approved before the Contractor makes arrangements to borrow the fill material.
46 The top soil which may contain vegetation, rubbish, slush, etc. shall not be used.
47 If demanded by the Engineer, the Contractor shall arrange to have trial pits of
48 specified dimensions and numbers dug at locations specified, for the Engineer to
49 examine the nature and type of material likely to be obtained from the borrow

1 area.

2 **Lead, lift and transportation**

3 Unless separately provided for, all lead, lift and transportation required for
4 bringing in the fill material from borrow areas or from excavation from within the
5 site shall be included.

6 **Quality**

7 The borrowed soil shall be generally granular, and non-cohesive. It shall consist
8 of sand, silty sand, murrum, ordinary soil, gravel and shingle. Dredged material
9 shall also be free from sulphates, salts, organic, foreign and other harmful or
10 objectionable materials. Any material rejected by the Engineer shall be removed
11 from the site immediately.

12 **Access road**

13 Roads, whether of temporary or other nature, required to be constructed for
14 access and for movement of men, materials, equipment, transport vehicles,
15 vehicles carrying fill material etc. to or over borrow areas and/or to or over areas
16 on which fill has to be deposited shall be constructed by the Contractor at his
17 cost. Such costs shall be deemed to have been included in the unit rates quoted
18 by the Contractor. Such access in roads shall be maintained in good condition
19 during all seasons to ensure completion of work according to time schedule.

20 **Clearing**

21 Site clearing before filling shall be carried out as specified in the section
22 "Earthwork in Grading, Excavation and Backfilling".

23 **Filling**

24 **Sand fill**

25 Sandy fill shall be deposited to bring the grade level to desired elevation after
26 compaction of fill.

27 Sandy fill shall be compacted, where so specified, by 12 tonne vibratory rollers
28 as indicated in relevant Clause below. The fill material shall be compacted to the
29 specified density, where so specified.

30 Compaction of sandy fill by flooding the area shall be carried out where so
31 specified. In this case, the Contractor should ensure that the fill material is not
32 washed away. This work shall be carried out as directed by the Engineer.

33 **Soil fill**

34 Approved soil fill consisting of ordinary soil, murrum, soil containing gravel,
35 shingle etc. shall be deposited in layers not exceeding 200 mm. The Contractor
36 should ensure that all clods of earth are broken down to a size not larger than
37 100 mm.

38 Where density of fill or use of rollers is not specified the fill shall be carried out
39 as specified in Clause above.

40 Where the fill material has to be compacted by use of rollers procedure as
41 specified in Clause of section "Earthwork in Grading, Excavation and Backfilling"
42 shall be followed.

43 Where specified, the required density of fill shall be obtained by proper
44 compaction.

45 **Dewatering**

46 **Scope:**

1 This section covers the general requirements of dewatering excavations in
2 general.

3 All excavations shall be kept free of water. Grading in the vicinity of excavation
4 shall be properly closed to prevent surface water running into excavated areas.
5 Contractor shall remove by pumping or other means approved by Engineer any
6 water inclusive of rain water and subsoil water accumulated in excavation and
7 keep all excavations dewatered until the foundation work is completed and
8 backfilled. Sumps made for dewatering must be kept clear of the excavations /
9 trenches required for further work. Method of pumping shall be approved by
10 Engineer; but in any case, the pumping arrangement shall be such that there
11 shall be no movement of subsoil or blowing in due to differential head of water
12 during pumping. Pumping arrangements shall be adequate to ensure no delays
13 in construction.

14 When there is a continuous inflow of water and quantum of water to be handled
15 is considered in the opinion of Engineer, as large, well point system - Single
16 stage or multi stage, shall be adopted. Contractor shall submit to Engineer his
17 scheme of well point system including the stages, the spacing, number and
18 diameter of well points, headers etc., and the numbers, capacity and location of
19 pumps of approvals. Unless separately provided for in the Schedule of prices,
20 the cost of dewatering shall be included in the item rate for excavation.

21 **Rain water drainage**

22 **Scope:** This section covers the drainage of rain water in excavated areas.
23 Grading in the vicinity of excavation shall be such as to exclude rain/ surface
24 water draining into excavated areas. Excavation shall be kept clean of rain and
25 such water as the Contractor may be using for his work by suitably pumping out
26 the same at no extra cost to the Owner. The scheme for pumping and discharge
27 of such water shall be approved by the Engineer.
28 Contractor shall ensure that the surface runoff outside the excavated pit/
29 working area shall be collected through a catch drain excavated around the
30 working area and led away to a natural stream, at no extra cost to the Owner.
31 Contractor shall maintain the catch drains in proper condition during the
32 construction period at no extra cost to the Owner.

1 **2.12**

2 **Uprooting rank vegetation and weeds by digging the area to a depth of**
3 **60 cm, removing all weeds and other growth with roots by forking**
4 **repeatedly, breaking clods, rough dressing, flooding with water,**
5 **uprooting fresh growths after 10 to 15 days and then fine dressing for**
6 **planting new grass, including disposal of all rubbish with all leads and**
7 **lifts.**

8 Contractor shall mark all areas proposed for planting development as per
9 drawings provided. The same shall be approved by EIC.

10 Areas marked for site clearance only shall be cleared, rest of areas shall be
11 maintained in pristine condition along with existing native vegetation. Care
12 should be exerted for retaining actively growing native flora present at the time
13 of soil preparation. It should be retained unharmed and undamaged.

14 The area approved by EIC shall be dug upto a depth of 60cm or till depth of soil,
15 whichever is lesser. All existing vegetation in the area shall be removed along
16 with all roots by forking repeatedly. Tilling or ripping of the soil shall be done
17 across the slope using farming or construction equipment. A contour line is
18 marked about 1/3 the way down the slope to establish a key line. The machines
19 are operated parallel to the key line. Scarification must not be performed up and
20 down the slope. The entire slope may be scarified to accomplish the maximum
21 effect.

22 Soil shall be loosened by breaking clods and flooding with water.

23 The area shall be watered for 10-15 days and new plant growth shall be
24 removed as well including roots. Cleaning of area will include the removal of
25 unwanted material, debris, weeds, bushes and stones. This can be achieved by:

26 Weeding can be carried out either by employing labours, or spraying approved
27 weedicides. During this stage, hand weeding, mulch or chemical control of
28 active root zone (1.2 m diameter) is required. Spraying of mixture of Glyphosate
29 at the rate of 30 ml per litre of water + 2,4-D at the rate of 5 g per litre of water
30 should be used to control weeds.

31 After the process is complete, fine dressing shall be carried out on this area. The
32 refilled soil shall be graded to slope and level as per drawings and directed by
33 EIC. Level differences more than 5 cm shall be smoothed out to provide a
34 uniform grade and slope.

35 Measurement shall be in square metres of surface area treated with above
36 process, accurate to the nearest centimeter.

1 **2.7**

2 **Earth work in excavation by mechanical means (Hydraulic**
3 **excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m**
4 **in width as well as 10 sqm on plan) including getting out and disposal of**
5 **excavated earth lead upto 50 m and lift upto 1.5 m, as directed by**
6 **Engineer-in-charge.**

7 **2.7.1 Ordinary soil**

8 **2.7.2 Hard rock (blasting prohibited)**

9 Any finds of archaeological interest such as relics of antiquity, coins, fossils or
10 other articles of value shall be delivered to the Engineer-in-Charge and shall be
11 the property of the Government.

12 Any material obtained from the excavation which in the opinion of the
13 Engineer-in-Charge is useful shall be stacked separately in regular stacks as
14 directed by the Engineer-in-Charge and shall be the property of the
15 Government.

16 Excavation where directed by the Engineer-in-Charge shall be securely
17 barricaded and provided with proper caution signs, conspicuously displayed
18 during the day and properly illuminated with red lights and/or written using
19 fluorescent reflective paint as directed by engineer in charge during the night to
20 avoid accident.

21 The Contractor shall take adequate protective measures to see that the
22 excavation operations do not damage the adjoining structures or dislocate the
23 services. Water supply pipes, sluice valve chambers, sewerage pipes, manholes,
24 drainage pipes and chambers, communication cables, power supply cables etc.
25 met within the course of excavation shall be properly supported and adequately
26 protected, so that these services remain functional. However, if any service is
27 damaged during excavation shall be restored in reasonable time.

28 Excavation shall not be carried out below the foundation level of the adjacent
29 buildings until underpinning, shoring etc. is done as per the directions of the
30 Engineer-in-Charge for which payment shall be made separately.

31 Existing structures and services such as old buildings, culverts, fencing, water
32 supply pipe lines, sewers, power cables, communication cables, drainage pipes
33 etc. within or adjacent to the area if required to be diverted/removed, shall be
34 diverted/dismantled as per directions of the Engineer-in-Charge and payment
35 for such diversion/dismantling works shall be made separately.

36 Any damages done by the contractor to any existing work shall be made good by
37 him at his own cost. Existing drains pipes, culverts, over head wires, water
38 supply lines and similar services encountered during the course of execution
39 shall be protected against damage by the contractor. The contractor shall not
40 store material or otherwise occupy any part of the site in manner likely to hinder
41 the operations of such services.

42 Disposal of Earth shall be disposed off at the specified location or as decided by
43 the Engineer-in- Charge. The contractor has to take written permission about
44 place of disposal of earth before the earth is disposed off, from
45 Engineer-in-Charge.

1 **Setting out and making profiles**

2 A masonry pillar to serve as a bench mark will be erected at a suitable point in
3 the area, which is visible from the largest area. This bench mark shall be
4 constructed and connected with the standard bench mark as approved by the
5 Engineer-in-Charge. Necessary profiles with strings stretched on pegs,
6 bamboos or 'Burjis' shall be made to indicate the correct formation levels before
7 the work is started. The contractor shall supply labour and material for
8 constructing bench mark, setting out and making profiles and connecting bench
9 mark with the standard bench mark at his own cost. The pegs, bamboos or
10 'Burjis' and the bench mark shall be maintained by the contractor at his own cost
11 during the excavation to check the profiles.

12 The ground levels shall be taken at 5 to 15 metres intervals (as directed by the
13 Engineer-in- Charge) in uniformly sloping ground and at closer intervals where
14 local mounds, pits or undulations are met with. The ground levels shall be
15 recorded in field books and plotted on plans. The plans shall be drawn to a scale
16 of 5 metres to one cm or any other suitable scale decided by the
17 Engineer-in-Charge.

18 North direction line and position of bench mark shall invariable be shown on the
19 plans. These plans shall be signed by the contractor and the Engineer-in-Charge
20 or their authorized EICs before the earth work is started. The labour required for
21 taking levels shall be supplied by the contractor at his own cost.

22 All excavation operations manually or by mechanical means shall include
23 excavation and 'getting out' the excavated materials. In case of excavation for
24 trenches, basements, water tanks etc. 'getting out' shall include throwing the
25 excavated materials at a distance of at least one metre or half the depth of
26 excavation, whichever is more, clear off the edge of excavation. In all other
27 cases 'getting out' shall include depositing the excavated materials as specified.
28 The subsequent disposal of the excavated material shall be either stated as a
29 separate item or included with the items of excavation stating lead.

30 During the excavation the natural drainage of the area shall be maintained.
31 Excavation shall be done from top to bottom. Undermining or undercutting shall
32 not be done.

33 In firm soils, the sides of the trenches shall be kept vertical upto a depth of 2
34 metres from the bottom. For greater depths, the excavation profiles shall be
35 widened by allowing steps of 50 cms on either side after every 2 metres from the
36 bottom. Alternatively, the excavation can be done so as to give slope of 1:4 (1
37 horizontal : 4 vertical). Where the soil is soft, loose or slushy, the width of steps
38 shall be suitably increased or sides sloped or the soil shored up as directed by
39 the Engineer-in- Charge. It shall be the responsibility of the contractor to take
40 complete instructions in writing from the Engineer-in-Charge regarding the
41 stepping , sloping or shoring to be done for excavation deeper than 2 metres.

42 In case of excavation for foundation in trenches or over areas, the bed of
43 excavation shall be to the correct level or slope and consolidated by watering
44 and ramming. If the excavation for foundation is done to a depth greater than
45 that shown in the drawings or as required by the Engineer-in-Charge, the excess
46 depth shall be made good by the contractor at his own cost with the concrete of
47 the mix used for levelling/ bed concrete for foundations. Soft/defective spots at
48 the bed of the foundations shall be dug out and filled with concrete (to be paid
49 separately) as directed by the Engineer-in-Charge.

1 While carrying out the excavation for drain work care shall be taken to cut the
2 side and bottom to the required shape, slope and gradient. The surface shall
3 then be properly dressed. If the excavation is done to a depth greater than that
4 shown on the drawing or as required by the Engineer-in-Charge, the excess
5 depth shall be made good by the contractor at his own cost with stiff clay puddle
6 at places where the drains are required to be pitched and with ordinary earth,
7 properly watered and rammed, where the drains are not required to be pitched.
8 In case the drain is required to be pitched, the back filling with clay puddle, if
9 required, shall be done simultaneously as the pitching work proceeds. The brick
10 pitched storm water drains should be avoided as far as possible in filled-up areas
11 and loose soils.

12 The excavation shall be done true to levels, slope, shape and pattern indicated
13 by the Engineer-in-Charge. Only the excavation shown on the drawings with
14 additional allowances for centering and shuttering or as required by the
15 Engineer-in-Charge shall be measured and recorded for payment.

16 Where the excavation is taken deeper or wider by the contractor, it shall be
17 brought to the required level by the contractor at his own cost by filling in with
18 earth duly watered, consolidated and rammed.

19 The excavation shall be done manually or by mechanical means as directed by
20 Engineer-in-charge considering feasibility, urgency of work, availability of labour
21 /mechanical equipments and other factors involved. Contractor shall ensure
22 every safety measures for the workers. Neither any deduction will be made nor
23 any extra payment will be made on this account.

24 The length and breadth of excavation shall be measured with a steel tape correct
25 to the nearest cm. The depth of cutting or height of filling shall be measured,
26 correct to 5 mm, by recording levels before the start of the work and after the
27 completion of the work. The cubical contents shall be worked out to the nearest
28 two places of decimal in cubic metres. The rate includes the cost of all materials,
29 equipment, labour, carting, loading & unloading, removal of debris to local
30 specified within the site, involved in all the operations described above.

1 **2.2.1**

2 **Earth work in rough excavation, banking excavated earth in layers not**
3 **exceeding 20 cm in depth, breaking clods, watering, rolling each layer**
4 **with ½ tonne roller or wooden or steel rammers, and rolling every 3rd**
5 **and top-most layer with power roller of minimum 8 tonnes and dressing**
6 **up in embankments for roads, flood banks, marginal banks and guide**
7 **banks or filling up ground depressions, lead upto 50 m and lift upto 1.5**
8 **m : All kinds of soil**

9 The earth used for filling shall be free from all roots, grass, shrubs, rank
10 vegetation, brushwood, tress, sapling and rubbish.

11 Filling with excavated earth shall be done in regular horizontal layers each not
12 exceeding 20 cm in depth. All lumps and clods exceeding 8 cm in any direction
13 shall be broken. Each layer shall be watered and consolidated with steel rammer
14 or ½ tonne roller. Where specified, every third and top must layer shall also be
15 consolidated with power roller of minimum 8 tonnes. Wherever depth of filling
16 exceeds 1.5 metre vibratory power roller shall be used to consolidate the filing
17 unless otherwise directed by Engineer-in-charge. The top and sides of filling
18 shall be neatly dressed. The contractor shall make good all subsidence and
19 shrinkage in earth fillings, embankments, traverses etc. during execution and till
20 the completion of work unless otherwise specified.

21 The length and breadth of excavation or filling shall be measured with a steel
22 tape correct to the nearest cm. The depth of cutting or height of filling shall be
23 measured, correct to 5 mm, by recording levels before the start of the work and
24 after the completion of the work. The cubical contents shall be worked out to the
25 nearest two places of decimal in cubic metres. The rate includes the cost of all
26 materials, equipment, labour, carting, loading & unloading, removal of debris to
27 local specified within the site, involved in all the operations described above.

1 **2.27**2 **Supplying and filling in plinth with Jamuna / River sand under floors,**
3 **including watering, ramming, consolidating and dressing complete.**

4 Sand shall be naturally occurring river sand, clean and free from dust organic and
5 foreign matter and its grading shall be within the limits of grading zone IV or V
6 Sand shall be naturally occurring river sand, well graded down from 5mm.

7 Depth of filling shall be the consolidated depth. The dimensions of filling shall be
8 on the basis of pre-measurement correct to the nearest cm and cubical content
9 worked out in cubic metres correct to two places of decimal.

10 The length, breadth and depth of consolidated sand shall be measured with steel
11 tape correct to the nearest cm and cubical contents worked out in cubic metres
12 correct to two places of decimal.

13 The rate includes the cost of all materials, equipment, labour, carting, loading &
14 unloading, removal of debris to local specified within the site, involved in all the
15 operations described above.

1 **Supplying, filling, spreading & leveling gravels of size range 5 mm to 10**
2 **mm, in the recharge pit, over the existing layer of boulders, in required**
3 **thickness, for all leads & lifts, all complete as per direction of**
4 **Engineer-in-charge.**

5 Gravel shall pass through 10mm sieve and stay on 5mm sieve. Gravel shall be
6 naturally occurring or developed by crushing stone. It shall be free of dust and
7 grime.

8 Depth of filling shall be the consolidated depth. The dimensions of filling shall be
9 on the basis of pre-measurement correct to the nearest cm and cubical content
10 worked out in cubic metres correct to two places of decimal.

11 The length, breadth and depth of consolidated sand shall be measured with steel
12 tape correct to the nearest cm and cubical contents worked out in cubic metres
13 correct to two places of decimal.

14 The rate includes the cost of all materials, equipment, labour, carting, loading &
15 unloading, removal of debris to local specified within the site, involved in all the
16 operations described above.

1 **MR**

2 **Supply & installation of Coir based Geotextile 700 gsm conforming to IS**
3 **15868 : Part 1 to 6, for covering top of erosion prone slopes or**
4 **embankments as per IS 15872:2009; fixed to the ground with SS**
5 **staples of 11 guage diaMetre and 220mm length at every 0.50m to**
6 **0.75m in longitudinal and transverse direction including supply of all**
7 **material, labour and equipment as required, upto any lead and lift; as**
8 **directed by Engineer-in-Charge**

9 Material shall be supplied conforming to IS 15868: Part 1 to 6. Contractor is
10 required to provide certification for the same along with sample of material for
11 approval of Engineer-in-Charge before supply of material to site.

12 This item shall be carried out for coir geotextile lining works of excavated areas
13 surrounding water body, as per IS15872:2009 - Application of Coir Geotextiles
14 (Coir Woven Bhoovastra) for Rain Water Erosion Control in Roads, Railway
15 Embankments and Hill Slopes – Guidelines.

16 Geotextile shall be unrolled downhill from top of slope to be applied.

17 Overlaps on all sides between two geotextile pieces shall be minimum 15 cm.

18 Coir geotextile shall be clamped on the steep slopes using U shaped Stainless
19 Steel staples, having minimum 220 mm length and 11 gauge. Geotextile shall
20 be pinned to the ground using these staples at every 1.0m in longitudinal and
21 transverse direction.

22 Measurement shall be in square metres of area covered on site by
23 coir-geotextile lining.

1 **MR**

2 **Supply & installation of Geo Green Blanket {Coir Mat(GECB 2.5-22-875)}**
3 **with Anchoring Hook (12" x 3" x 12") 4mm & Transportation from**
4 **manufacturer to Site Stores**

5 Material shall be supplied conforming to IS 15868: Part 1 to 6. Contractor is
6 required to provide certification for the same along with sample of material for
7 approval of Engineer-in-Charge before supply of material to site. Material
8 specifications:

9 Width 2m

10 Length 30m roll

11 Density 875 gsm

12 Thickness 7 mm-10mm (Compressed thickness 5mm-8mm)

13 Tensile Strength Warp (Machine Direction) 7-9 kN/m

14 Tensile Strength Weft (Cross Direction) 1.5 -2 kN/m

15 Liquid Absorptive Capacity 83%

16 Material: Coconut fibre with 12-15% woven polymer net of 2mmx2mm grid on
17 both sides

18 This item shall be carried out for coir geotextile lining works of excavated areas
19 surrounding water body, as per IS15872:2009 - Application of Coir Geotextiles
20 (Coir Woven Bhoovastra) for Rain Water Erosion Control in Roads, Railway
21 Embankments and Hill Slopes – Guidelines.

22 Geotextile shall be unrolled downhill from top of slope to be applied.

23 Overlaps on all sides between two geotextile pieces shall be minimum 15 cm.

24 Coir geotextile shall be clamped on the steep slopes using U shaped Stainless
25 Steel hooks, having minimum 300 mm length and 11 gauge. Geotextile shall be
26 pinned to the ground using these staples at every 1.0m in longitudinal and
27 transverse direction.

28 Measurement shall be in square metres of area covered on site by
29 coir-geotextile lining.

1 **Supply and Installation of GeoGrid comprise biaxial geogrids**
2 **manufactured from select grades of high tenacity, high molecular**
3 **weight, and low carboxyl end group polyester yarn to ensure high**
4 **strengths, low creep and excellent durability. The yarns are formed into**
5 **a dimensionally stable grid structure with uniform apertures, using an**
6 **advanced weft insertion warp knitting process and are then given a**
7 **tough and durable polymeric coating to enhance dimensional stability,**
8 **resistance to installation damage and durability. GeoGrid 60 x 60 Km &**
9 **including installation.**

10 Geogrids must be biaxial geogrids manufactured from select grades of high
11 tenacity, high molecular weight, and low carboxyl end group polyester yarn to
12 ensure high strengths, low creep and excellent durability. The yarns are formed
13 into a dimensionally stable grid structure with uniform apertures, using an
14 advanced weft insertion warp knitting process and are then given a tough and
15 durable polymeric coating to enhance dimensional stability, resistance to
16 installation damage and durability.

17 Material specifications as tested with ASTM D 6637 / EN ISO -10319 must
18 conform to following:

19 MD- machine direction / CD - cross direction
20 Ultimate tensile strength MD 60 kN/m / CD 60 kN/m
21 Elongation at break (Tolerance ± 4) MD 13% / CD 13%
22 Tensile strength at 2 % strain MD 11 kN/m / CD 9.5 kN/m
23 Tensile strength at 5 % strain MD 20 kN/m / CD 17 kN/m
24 Aperture size MD x CD : 25 x 25 mm
25 Roll length: 50 metres minimum
26 Roll width : 5.0 metres

27 This item shall be carried out for coir geotextile lining works of excavated areas
28 surrounding water body, as per IS15872:2009 - Application of Coir Geotextiles
29 (Coir Woven Bhoovastra) for Rain Water Erosion Control in Roads, Railway
30 Embankments and Hill Slopes – Guidelines.

31 Geogrid shall be unrolled downhill from top of slope to be applied.

32 Overlaps on all sides between two geotextile pieces shall be minimum 15 cm.

33 Coir geotextile shall be clamped on the steep slopes using U shaped Stainless
34 Steel hooks, having minimum 300 mm length and 11 gauge. Geotextile shall be
35 pinned to the ground using these staples at every 1.0m in longitudinal and
36 transverse direction.

37 Measurement shall be in square metres of area covered on site by geogrid lining.

1 **HORTICULTURAL WORKS**2 **2.2**

3 **Supplying and stacking of selected good earth for horticulture work at**
 4 **site including royalty and carriage up to 1 km (earth measured in stacks**
 5 **will be reduced by 20% for payment).**

6 Good earth shall consist of a free draining organic soil from horizons less than
 7 300mm from the original surface, of a workable crumbly and lump free loamy
 8 character and shall contain no grass or weed growth of any kind or other foreign
 9 material or stones exceeding 25mm in diameter. Total stone content shall be
 10 no greater than 15% by volume. A 1 litre sample with back up soil test data is
 11 required before installation, or mixing. Soil test reports to be provided by
 12 contractor for each source of good earth.

13 The following criteria shall be tested at an approved laboratory before use on
 14 site

15 pH 7.0 - 7.8

16 Electrical conductivity below 0.75 dS/m

17 Soil-water extract not exceeding 1500 micromho/cm

18 Soil texture

19 Sand (0.05 - 2.00mm) Max. 75% Min. 20%

20 Silt (0.002 - 0.05mm) Max. 60% Min. 5%

21 Clay (less than 0.002mm) Max. 30% Min. 5%

22 The earth shall be stacked at site in stacks not less than 50 cm high and of
 23 volume not less than 3.0 cum.

24 Measurements: Length, breadth and height of stacks shall be measured correct
 25 to a cm. The volume of the stacks shall be reduced by 20% for voids before
 26 payment, unless otherwise described. The rate shall include the cost of
 27 excavating the earth from source, transporting the same at site breaking of
 28 clods and stacking at places indicated. The rate shall also include royalty if
 29 payable. The rate includes the cost of all materials, equipment, labour, carting,
 30 loading & unloading, removal of debris to local specified within the site, involved
 31 in all the operations described above.

1 **2.25**

2 **Supplying and stacking of well decayed cow dung manure at site**
3 **including royalty and carriage upto 1 km (Cow dung manure measured**
4 **in stacks will reduced by 8% for Payment).**

5 Contractor shall supply only well composted, dried, well screened good quality
6 cow dung manure in powdered form. Cow dung manure, shall be free from soil
7 clods, fresh mung grass, and dry. Sample will be approved by Engineer in
8 Charge for each source.

9 It shall be transported to the site in lorries with efficient arrangement to prevent
10 spilling enroute. It shall be stacked at site. Each stack shall not be less than 50
11 cm height and volume not less than 3 cum.

12 **Measurements**

13 Length, breadth and depth of stacks shall be measured correct to a cm. The
14 volume of the stack shall be reduced by 8% for looseness in stacking and to
15 arrive at the net quantity for payment. The rate includes the cost of all materials,
16 equipment, labour, carting, loading & unloading, removal of debris to local
17 specified within the site, involved in all the operations described above.

1 **2.8**

2 **Spreading of sludge, dump manure and / or good earth in required**
3 **thickness as per direction of Officer-in-charge (Cost of sludge, dump**
4 **manure and / or good earth to be paid separately).**

5 Material shall be spread to the thickness ordered and in manner instructed by
6 the Engineer-in-Charge.

7 The rate shall include of all the labour and material involved in all the operations
8 described above, but does not include the cost of good earth sludge or manure
9 which shall be paid for separately, unless otherwise described in the item. The
10 rate includes the cost of all materials, equipment, labour, carting, loading &
11 unloading, removal of debris to local specified within the site, involved in all the
12 operations described above.

13 The quantity of good earth and sludge or manure spread shall be determined by
14 the difference in the volume of good earth and sludge or manure in stack, before
15 and after spreading duly accounted for voids and looseness in stack.

16 **Measurements**

17 Length, breadth and depth of stacks shall be measured correct to a cm. The
18 volume of the stack shall be reduced by 8% for looseness in stacking and to
19 arrive at the net quantity for payment.

1 **2.9**
2 **Mixing earth and sludge or manure in the required proportion specified**
3 **or directed by the Officer-in-charge.**

4 Good earth shall be thoroughly mixed with manure in specified proportion as
5 described in the item or as directed by the Engineer-in-Charge.

6 The quantity of good earth and sludge or manure mixed shall be determined by
7 the difference in the volume of good earth and sludge or manure in stack, before
8 and after mixing duly accounted for voids and looseness in stack.

9 The rate shall include of all the labour and material involved in all the operations
10 described above, but does not include the cost of good earth sludge or manure
11 which shall be paid for separately, unless otherwise described in the item. The
12 rate includes the cost of all materials, equipment, labour, carting, loading &
13 unloading, removal of debris to local specified within the site, involved in all the
14 operations described above.

15 **Measurements**

16 Length, breadth and depth of stacks shall be measured correct to a cm. The
17 volume of the stack shall be reduced by 8% for looseness in stacking and to
18 arrive at the net quantity for payment.

1 **2.20**

2 **Filling mixture of earth and sludge or manure in the desired proportion**
3 **in trenches, flooding with water and leveling (cost of supplying earth**
4 **and sludge or manure and mixing excluded).**

5 Material shall be filled in layers of 10cm thickness to the thickness ordered and
6 in manner instructed by the Engineer-in-Charge. After filling of each 10cm layer,
7 the filled in material shall be tamped using a hand-tamping tool until compaction
8 is achieved as decided by EIC.

9 The rate shall include of all the labour and material involved in all the operations
10 described above, but does not include the cost of good earth sludge or manure
11 which shall be paid for separately, unless otherwise described in the item. The
12 rate includes the cost of all materials, equipment, labour, carting, loading &
13 unloading, removal of debris to local specified within the site, involved in all the
14 operations described above.

15 Measurements

16 The quantity of good earth and sludge or manure spread shall be determined by
17 the difference in the volume of good earth and sludge or manure in stack, before
18 and after spreading duly accounted for voids and looseness in stack.

2.28

Preparation of mounds of various size and shape by available excavated / supplied earth in layers not exceeding 20 cm in depth, breaking clods, watering of each layer, dressing etc., lead upto 50 meter and lift upto 1.5 m complete as per direction of Engineer-in-charge.

Area where mounds are to be prepared shall be marked as per drawing, complete with curves and edges as shown. The same shall be approved by EIC. Soil excavated at the site etc., shall be collected and spread over areas marked on the drawings or as directed by the Engineer-in-Charge.

Earth slopes are to be formed from the compacted mounds to the gradients and levels shown on the drawings, accounting for the topsoil depths to be included after subsoil formation is complete. If insufficient fill is available to complete the levels shown, additional suitable subsoil is to be imported to make up the required quantities. Importation of additional fill shall only be carried out with written permission of EIC.

Earthworks levels are to be carried out to the contours shown on the drawings to a maximum tolerance of 150mm measured vertically, and to a maximum gradient as permissible based on soil testing. If the gradient exceeds the permissible gradient of soil type, a geotextile membrane should be used to hold the soil. All subsoil levels are to account for the later additional of specified depths of topsoil.

The Contractor shall be responsible for protection of completed subsoil mounds and shall take preventative measures to control erosion and siltation, restore or replace any portion of the earthwork areas which erodes, slumps, silts or is otherwise damaged by the out-washing of soil.

Mound preparation shall be carried out manually, and shall involve final modelling of the earth contours produced by the major grading exercise. Soil filling shall be done in layers only.

Each layer shall be watered and well compacted, so that there are no air pockets or loose soil. Mounds shall be developed in layers of 10cm thickness spread manually in a swirling movement, over which watering and rolling shall be done to compact them before the next layer is laid.

The shaping will follow the contours shown on the plans in general terms, but the final forms will be developed by eye to create smoothly flowing and pleasing contours. Mounds to have distinct concave slope transitions at the foot of slopes, and convex slope transitions at the top of slopes.

Maximum gradient to be as permissible based on soil testing. Final grading of the mounds shall be done in such a way as to allow free movement of lawn mower all over the hillock.

The finished level of the hillock should be such that it shall accommodate 300 mm. compacted layer of mixture of good quality loamy, sandy loam soil and screened Cow dung manure.

Any deformity/settling of soil in the mounds will be rectified immediately during

1 the course of work at no extra cost whatsoever.

2 **Measurements**

3 Measurements shall be cubic metres, using dimensions in each direction,
4 accurate to the nearest centimetre. The rate includes the cost of all materials,
5 equipment, labour, carting, loading & unloading, removal of debris to local
6 specified within the site, involved in all the operations described above.

1 **MR**

2 **Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes**
3 **vertically in tree-pits complete as directed by EIC including supply of all**
4 **material, labour and equipment upto any lead and lift 900 mm dia R.C.C.**
5 **pipe**

6 Cement concrete pipes shall be installed in tree-pits along roads and near
7 structures as shown in contract drawings to prevent tree roots from damaging
8 constructed areas.

9 Supply of precast cement concrete pipes

10 Precast cement concrete pipes of diameter as specified in contract drawings
11 shall be supplied conforming to IS 458.

12 Laying pipes

13 Contractor shall unload the pipes on location of laying only just before laying is
14 about to begin, and trench is prepared. Contractor shall unload the pipes with
15 great care. Any crack and chipping shall not be accepted, and Contractor shall
16 replace the pipe at his own cost.

17 Contractor shall lay the pipe using pulley mechanism such that the pipe is
18 absolutely vertical, checked with plumb line. Contractor shall level the pipe such
19 that its finished level matches that shown in contract drawings.

20 Contractor shall refill the outside portion of the trench manually with excavated
21 soil with great care not to disturb the laid pipe. Filling shall be done in layers 100
22 mm thick, and light tamping shall be done such that the pipe is not disturbed.

23 Contractor shall keep checking the level and alignment of the pipe periodically
24 with plumb line and correct any errors found.

25 Measurement

26 Precast cement concrete pipes shall be measured in length just before laying,
27 accurate to the nearest centimetre. This work shall include transport, loading,
28 installation and soil filling around the pipe.

1 **2.14**

2 **Digging holes in ordinary soil and refilling the same with the excavated**
 3 **earth mixed with manure or sludge in the ratio of 2:1 by volume (2**
 4 **parts of stacked volume of earth after reduction by 20% : 1 part of**
 5 **stacked volume of manure after reduction by 8%) flooding with water,**
 6 **dressing including removal of rubbish and surplus earth, if any, with all**
 7 **leads and lifts (cost of manure, sludge or extra good earth if needed to**
 8 **be paid for separately) :**

9 **2.14.2 Holes 0.9 m dia and 0.9 m deep**

10 **2.14.3 Holes 0.6 m dia and 0.6 m deep**

11 **2.13**

12 **Preparation of beds for hedging and shrubbery by excavating 60 cm**
 13 **deep and trenching the excavated base to a further depth of 30 cm,**
 14 **refilling the excavated earth after breaking clods and mixing with**
 15 **sludge or manure in the ratio of 8:1 (8 parts of stacked volume of earth**
 16 **after reduction by 20% : one part of stacked volume of sludge or**
 17 **manure after reduction by 8%), flooding with water, filling with earth if**
 18 **necessary, watering and finally fine dressing, leveling etc. including**
 19 **stacking and disposal of materials declared unserviceable and surplus**
 20 **earth by spreading and leveling as directed, within a lead of 50 m, lift up**
 21 **to 1.5 m complete (cost of sludge, manure or extra earth to be paid for**
 22 **separately).**

23 **2.57**

24 **Plantation of Trees, Shrubs, and Hedge at site i/c watering and removal**
 25 **of unserviceable materials as per direction of officer in charge**
 26 **(excluding cost of plant & water)**

27 **2.57.1 Trees plant**

28 **2.57.2 Shrubs plant (ground cover, bulbous plants, creeper, palms,**
 29 **bamboos, succulents)**

30 **MR**

31 **Staking of trees, palms and large shrubs using quadrapod staking made**
 32 **of 4 nos Bamboo 25 mm dia 2.5 metre long, fixed 0.3m in the soil and**
 33 **joined at 2/3 height of plant stem using jute rope, fixed to plant using**
 34 **rubber sheath; plant stem to be covered with gunny / jute cloth at**
 35 **fixing point to prevent damage, complete including supply of all**
 36 **material, labour and equipment, upto any lead and lift as directed by**
 37 **EIC**

38 **Excavation:**

39 Trees for site development shall be planted in pits admeasuring
 40 600x600x600mm

41 Trees for detailed plantation shall be planted in pits admeasuring
 42 900x900x900mm

43 Shrubs shall be planted in a 600mm deep bed

44 Ground covers and lawn shall be planted in a 300mm deep bed

45 Planting pits and trenches shall be prepared at least 15 days in advance. The
 46 top-soil of up to half of each pit / trench should be dug up and placed to one side
 47 of the pit, separate from the sub-soil from the remaining half part of pit.

- 1 For hard rock, EIC may decide to dig only half the depth and add the other half
 2 by banking.
 3 Soil at edge and bottom of pits / trenches should be loosened using a spade, and
 4 the area should be left open to dry
 5 Anti-termite treatment should be done if termites are observed directly or
 6 through soil condition

7 **Soil mixture to be added to pit / trench:**

- 8 The entire plantation shall be done in the refilled pits or trenches containing a
 9 well-mixed composition of following ingredients.
 10 2 parts of Good earth [pH: between 7.0 to 7.9; Electrical conductivity (EC):
 11 below 0.75 dS/m]
 12 1 part of Farm yard manure [well composted and free of weeds and debris]
 13 plus other items as under:

item	for trees/ per pit	for other plants/ per square metre
N-P-K 12:32:16 or 10:26:26 (Gram)	50	25
Neem cake (Gram)	150	100
Castor cake (Gram)	150	50
Micro nutrients (Gram)	10	10
Methyl parathion powder, 2% dust (Gram)	5	5
Humic acid granules (Gram)	20	10

14 **Planting process:**

- 15 Watering of plants kept in nursery should be stopped a day before the actual
 16 plantation day. This will help to make soil harder and prevent loosening of soil
 17 during the transportation of plant in the field.

- 18 The bottom 150mm of the pit / trench is to be forked loose prior to backfilling.

- 19 All required plants should be shifted at the site of plantation using wheel burrows,
 20 tractor trolleys, or head loads. Planting shall be carried out in accordance with
 21 the schedule of plants and drawings supplied. The number of each species and
 22 variety shall be evenly distributed over the area as indicated on the drawings.

- 23 For large areas the outer rows are to be set out first to ensure the correct shape
 24 to the bed is established. The remaining plants are then to be evenly distributed
 25 to cover the planting area. The EIC is to be notified in advance if there are too
 26 many or too few plants to fill the area required and an assessment of setting out
 27 adjustments will be directed accordingly. Setting out of plants is to be
 28 completed and approved before planting into the soil bed can commence.

- 29 All plants shall be planted to accommodate the spreading root system of the
 30 plant to the same soil depth as in the nursery and shall be well watered before
 31 removing them from containers. Plants are to be positioned upright and the soil
 32 firmed around the roots.

- 33 Small shrubs, ground cover and herbaceous plants shall be planted in pockets
 34 formed by a trowel or spade. The pocket shall be deep enough and wide
 35 enough to accommodate the root of the plant. The sides and base of the pocket
 36 shall be loosened and the plant roots lightly loosened from the rootball. The
 37 plant shall be placed upright in the pocket and firmed into the ground by

1 backfilling and treading or hand pressure.

2 Fill soil in pit / trench upto height of root ball of plants to be planted. At time of
3 planting, poly bags need to be cut longitudinally from either sides of bag from
4 top to the bottom direction with the help of sharp blade. Holding of bag in the
5 palm of one hand, carefully remove entire cut plastic making sure to keep root
6 ball intact. Then, place plant upright in the centre of pit such that top of root ball
7 matches the proposed finished ground level.

8 Fill up the rest of pit with soil and manure mixture as per soil mixture mentioned
9 in soil mixture section. The soil is to be consolidated during backfilling in layers
10 to ensure that the plant is firmly held in the ground and that voids are not left
11 around the roots. Care shall be taken during planting to avoid damage to the
12 root system, branches or leaves.

13 The ground shall then be firmed by lightly treading or hand pressure around the
14 roots, taking care not to damage the shoots, to ensure good contact with the
15 soil.

16 For trees and single stemmed palms, create a 50mm high earthen bund around
17 the pit. For other plants, create earthen bunds in a 1.0m x 1.0m grid or at edge
18 of planter, whichever is smaller. Water the pit at the end.

19 Watering shall take place immediately after planting, using a fine spray. The
20 firmed up area is to be tightly cultivated after completion of this operation to
21 leave an even tilth before mulching.

22 Climber pits shall be 150 - 200mm away from the supporting structure with the
23 roots spread away from the wall or adjacent supporting structure. The climbing
24 plants shall be trained through the wire mesh with leading shoots directed
25 upwards and tied.

26 For loose grass sods/clump/sucker etc., the same procedure should be followed.
27 Each clump should be buried 30-50 mm beneath the soil.

28 **Staking:**

29 Stakes shall always be used when planting trees, single stemmed palms and for
30 large shrubs or as directed by the EIC. Stakes shall be in bamboo of an approved
31 type and be carried out according to the size of plant to be supported.

32 Each plant shall have quadropod staking. Plant shall be secured to stout square
33 base pyramidal bamboo stakes of average diameter of 25 mm and 2.5m long.

34 Four bamboo stakes each having 25mm diameter shall be positioned
35 equidistantly around the tree and firmly driven into the ground at angles of
36 between 30 - 40 degrees from the vertical. The inner ends of the stakes shall
37 extend beyond the tree stem by not more than 150mm. The tree stem shall be
38 wrapped in jute sacking at the point where the tree stakes are to be fastened in
39 order to prevent bark damage. Stakes shall be tied at 2/3 height of stem. The
40 stakes shall be neatly and firmly fastened to the tree stem using rubber hose or
41 cord. String is not be used. The stakes are to be adjusted and the position of the
42 protective wrapping is to be altered up or down every month.

43 **Post plantation cares:**

44 Development period for trees / shrubs / ground cover / grass shall be a period of

1 12 months. It is very important that the satisfactory development of saplings
2 continues and special care is taken during summer months, in order to attain the
3 appropriate height and growth. This shall include timely watering, pruning,
4 stacking, weeding, mulching, soil work and spraying of weedicides, fungicides
5 and pesticides as and when necessary. Some of the important cares are as
6 under:

7 Climber wires for training climbing plants against walls shall be approved coir
8 geotextile or lightweight PVC mesh, fixed at 600mm intervals to screw eyes. The
9 climbing plants shall be trained through the wire mesh with the shoots directed
10 upwards and tied.

11 After planting all plants are to be thoroughly watered using enough water to
12 soak the ground all around the rootball. After watering and the water has
13 percolated away leaving the surface relatively dry the soil is to be lightly
14 cultivated to give an even soil tilth.

15 After completion of planting and watering and light cultivation operations a
16 25mm deep layer of approved mulch shall be spread and forked in over all
17 cultivated planting areas. Around each tree and palm and around the base of
18 each climber, additional mulch is to be applied to a 25mm depth to a diameter of
19 600mm. Mulching is to be done within 2 days of completing planting and
20 watering in. Approved mulches shall be saw dust, wood chips or coco-peat.

21 After a period of settling in of at least one month, all pit planted materials shall
22 be fertilized with an approved slow release fertilizer at the rates of fertilization
23 mentioned in maintenance section. All fertilized areas are to be watered
24 immediately after fertilizer application.

25 The Contractor shall take all necessary precautions to prevent or eradicate any
26 outbreak of disease or insect attack.

27 Where planting is to be carried out in areas of turf, the turf shall be carefully cut
28 to the size of the tree or shrub pit, rolled and stored for re-use, being kept moist
29 and in shade. After planting the turves shall be re-laid around the base of the
30 plant. The Contractor shall replace at his own expense, any turves which are
31 damaged during planting operations.

32 The contractor shall be responsible for protecting all planted areas. If it is
33 necessary for the Contractor to erect protective fencing, the Contractor shall be
34 responsible for keeping the fencing in position and in good repair until the end of
35 the maintenance period.

36 During development period of 120 days, ie after planting and prior to the onset
37 of the maintenance period, the Contractor shall be responsible for carrying out
38 all necessary measures to ensure that the plant material thrives and becomes
39 established and that the landscape areas are kept in a clean and tidy condition.

40 The Contractor shall allow for carrying out the following development operations
41 for a period of 120 days from date of planting:

- 42 Replacement of dead/missing plants
- 43 Grass cutting around trees
- 44 Watering
- 45 Cultivation and loosening of soil
- 46 Weeding

- 1 Pruning and clipping
- 2 Firming up and adjusting stakes and ties
- 3 Eradication of pest or insect attack
- 4 Topdressing and mulching
- 5 Fertilizing

6 The Contractor shall be responsible for replacing any plants which fail to survive
7 as a result of inadequate maintenance operations, poor workmanship or poor
8 quality of plant material prior to completion.

9 The Completion Certificate will not be issued until all plants scheduled on the
10 Drawings and Schedule of Works are installed in a healthy condition in the
11 manner specified.

12 **Special notes for site plantation:**

13 For site development plantation, animal damage can be caused by smaller
14 animals, such as rodents, and larger animals, like goats, cows and deers. Left
15 unprotected, seedlings may be subject to browsing and trampling by both wild
16 and domestic herds. Domestic animals, such as goats pose severe problem.
17 Several means are commonly used to protect the plants. Control may be done
18 by physical barriers, or by removal of the offending animals. Physical barriers
19 include fences, walls, thorn hedges and ditches. For individual stems, protective
20 staking or thorn-bush wrapping can help discourage goats or other animals from
21 eating the seedlings during the first few years.

22 Insect and disease control: Trees in natural stands are generally in balance with
23 native insects and diseases. To counter potential hazards, preventative
24 measures are the first line of defence. Proper tending operations that promote a
25 healthy, vigorous growth of the plants are a must.

26 Chemical insecticides or fungicides can be applied to check the advance of
27 damaging pathogens. These compounds are applied as liquids, dusting powders,
28 or mists. They may be applied using portable sprayers, blowers, etc. Products
29 from the neem tree seed kernels are cost effective option against pathogens.

30 Biological methods include the use of insect predators, parasites, or diseases of
31 insects. The advantage of biological controls over chemicals is a reduced risk of
32 toxicity to non-target plants and animals.

33 **Measurement**

34 Measurement for pit preparation of tree and single stemmed palm pits shall be
35 in numbers.

36 Measurement for pit preparation of shrubs and other plants shall be in square
37 metres, accurate to the nearest metre.

38 Measurement for planting all plants shall be in numbers.

39 Measurement for staking shall be in number of plants staked

40 The rate includes the cost of all materials, equipment, labour, carting, loading &
41 unloading, removal of debris to local specified within the site, involved in all the
42 operations described above.

1 2.34

2 **Providing & laying selection no. 1 grass turf with earth 50mm to 60mm**
3 **thickness on existing ground prepared with proper level and ramming**
4 **with required tools wooden and then rolling the surface with light roller**
5 **make the surface smoothen and light watering the same, as per**
6 **direction of officer in charge**

7 2.33

8 **Providing and laying Neelgiri/Mexican grass turf with earth 50mm to**
9 **60mm thickness of existing ground prepared with proper level and**
10 **ramming with tools wooden (Dhurmos) and then rolling the surface**
11 **with light roller make the surface smoothen and light watering with**
12 **sprinkler and maintenance for 30 days or more till the grass establish**
13 **properly, as per direction of officer-in-charge.**

14 Close Turf shall be a live grass sod or mat at least 300mm square with a well
15 developed root system growing in a minimum of 25mm soil bed, free from
16 stones or extraneous roots, cut mechanically or by hand to give an extra
17 thickness and texture. A sample of one square metre of Turf shall be submitted
18 to the EIC for approval before Turf is brought in for use on site.

19 The source of the material shall be stated by the Contractor. Turf shall be free
20 from weeds, fungus, pest or disease and contamination or pollutants. Turf sods
21 shall be kept moist and in shade and shall be planted within 24 hours after
22 lifting.

23 In exceptionally dry weather, the turf must be kept well watered at the nursery or
24 turf farm in order to keep full green leaf structure. Dry, brown or wilting grass
25 turf will be rejected and growth or recovery on site will not be permitted.

26 Close turfing materials are to be obtained from a bona-fide horticultural source
27 or private landowner. No turf is to be removed from unauthorised locations,
28 roadside, riverbanks or private property without permission of the owner. The
29 Contractor is to inform source of all turf delivered to the site before any turf is
30 laid.

31 Rake the topsoil mix area to a smooth and uniform grade free of any slight
32 mounds or depressions to achieve a uniformly flat surface. Re-grade any
33 depressions or humps that may occur until a satisfactory grade is achieved.

34 The area to be turfed is to be brought to a fine tilth by approved mechanical
35 means or by hand raking. Any stones over 25mm in diameter shall be removed
36 from the site. Watering of the area shall be carried out to produce a moist
37 condition of the soil and to consolidate the soil. If consolidation occurs to
38 produce any areas with topsoil depths less than 100mm these areas shall have
39 extra topsoil spread to produce finished levels.

40 fertilizer shall be applied to all areas to be turfed prior to turfing at the rate of
41 40gm per square meter, evenly spread over the whole area and lightly worked
42 into the soil.

43 Close turf sods shall be laid onto the surface of the prepared ground with leaf
44 turfs upwards, butt jointed as closely as possible to achieve a uniform cover.
45 The turf shall be laid off planks working over turves previously laid. The whole

1 area is then to be top dressed with finely sifted topsoil mix to give an evenly
2 smooth surface. The finished close turfing shall be lightly compacted by
3 treading or with a wooden beater to ensure even coverage and compaction.

4 Watering shall take place over the area that has been turfed immediately after
5 planting. Watering shall be undertaken by use of a fine spray to avoid
6 disturbance of soil particles.

7 Close Turfing shall be only aced as complete after the growth of an even sward
8 is evident. Any areas not covered by green healthy grass to the satisfaction of
9 the EIC within 28 days after turfing shall be re-laid as specified at the
10 Contractor's own expense.

11 For the period of 28 days after turfing the vegetative cover shall:

- 12 ● evenly cover at least 90% of the areas with leaves and spreading shoots of
- 13 specified grass variety
- 14 ● be free of perennial weeds or disease
- 15 ● be healthy and vigorous and showing a strongly developed root system

16 Should there be any settlement due to lack of even compaction this will be
17 corrected by application of topdressing of finely sifted soil to maximum depth of
18 25mm. If the depression is greater than 25mm the grass in the affected area
19 shall be lifted, the depression filled with sifted topsoil, lightly compacted and the
20 affected area re-turfed as specified. These operations shall be done as often as
21 necessary to produce an even and smooth surface free from bumps and hollows.

22 All close turfing operations shall be carried out from wooden planks or plywood
23 boards, with the workers moving away from completed turfed areas, raking any
24 compressed soil or footprints before laying of sods. All access onto soil areas
25 shall be on wooden boards or plywood sheets. Areas compacted by working
26 are to be re-cultivated and re-laid.

27 The following operations are to be carried out as often as required to achieve the
28 specified quality of turf:

- 29 ● Cutting before Completion shall be carried out as necessary to keep the
- 30 grass to a maximum height of 30mm.
- 31 ● Watering shall be carried out as often as necessary before Completion to
- 32 allow a satisfactory green sward to develop over the whole close turfed area.
- 33 ● One fertilizer application per month is to be carried out for before
- 34 Completion.
- 35 ● Topdressing as specified as often as required to establish smooth even
- 36 grades and levels free of hollows.

37 If compaction or consolidation takes place or hard passing or baking of the soil
38 occurs, the soil areas are to be well watered first and lightly loosened by
39 mechanical means such as spiking, slitting or hollow tinning using approved
40 equipment.

41 Completed close turfed areas are to be kept in a weed free insect free, fungus
42 free and tidy condition until Completion (that is start of maintenance period).
43 The rate includes the cost of all materials, equipment, labour, carting, loading &
44 unloading, removal of debris to local specified within the site, involved in all the
45 operations described above.

46 Measurements

- 1 Area shall be measured in square metres accurate to the nearest metre

- 1 **Supplying Trees - saplings, well developed, min 2.1m high, well**
2 **branched crown, well developed, in 12" pot or polybag, disease free**
3 **(Type T1)**
- 4 **Supplying Trees - saplings, well developed, min 2.1m high, well**
5 **branched crown, well developed, in 12" pot or polybag, disease free**
6 **(Type T2)**
- 7 **Supplying Trees - saplings, well developed, min 2.1m high, well**
8 **branched crown, well developed, in 12" pot or polybag, disease free**
9 **(Type T3)**
- 10 **Supplying Trees - saplings, well developed, min 2.1m high, well**
11 **branched crown, well developed, in 12" pot or polybag, disease free**
12 **(Type T4)**
- 13 **Supplying Trees - saplings, well developed, min 2.1m high, well**
14 **branched crown, well developed, in 12" pot or polybag, disease free**
15 **(Type T5)**
- 16 **Supplying of shrubs - saplings, well developed, min. 0.6m high, well**
17 **branched, preferably in bloom, in polybag of 30x20cm size, disease free**
18 **and development including excavation upto 450mm deep (Type S1)**
- 19 **Supplying of shrubs - saplings, well developed, min. 0.6m high, well**
20 **branched, preferably in bloom, in polybag of 30x20cm size, disease free**
21 **and development including excavation upto 450mm deep (Type S2)**
- 22 **Supplying of shrubs - saplings, well developed, min. 0.6m high, well**
23 **branched, preferably in bloom, in polybag of 30x20cm size, disease free**
24 **and development including excavation upto 450mm deep (Type S3)**
- 25 **Supplying of shrubs - saplings, well developed, min. 0.6m high, well**
26 **branched, preferably in bloom, in polybag of 30x20cm size, disease free**
27 **and development including excavation upto 450mm deep (Type S4)**
- 28 **Supplying of shrubs - saplings, well developed, min. 0.6m high, well**
29 **branched, preferably in bloom, in polybag of 30x20cm size, disease free**
30 **and development including excavation upto 450mm deep (Type S5)**
- 31 **Supplying Palms - saplings, well developed, min 1.2m high, well**
32 **developed, in 12" pot or polybag, disease free (Type P1)**
- 33 **Supplying Palms - saplings, well developed, min 1.2m high, well**
34 **developed, in 12" pot or polybag, disease free (Type P2)**
- 35 **Supplying Palms - saplings, well developed, min 1.2m high, well**
36 **developed, in 12" pot or polybag, disease free (Type P3)**
- 37 **Supplying of grass - Saplings, well developed, min. 0.30m high, in**
38 **polybag of 20x15cm size, disease free (Type GR1)**
- 39 **Supplying of grass - Saplings, well developed, min. 0.30m high, in**
40 **polybag of 20x15cm size, disease free (Type GR2)**

1 **Supplying of grass - Saplings, well developed, min. 0.30m high, in**
2 **polybag of 20x15cm size, disease free (Type GR3)**

3 **Supplying of ground covers / creepers - Saplings, well developed, min.**
4 **0.15m high, in polybag of 20x15cm size, disease free (Type GC1)**

5 **Supplying of ground covers / creepers - Saplings, well developed, min.**
6 **0.15m high, in polybag of 20x15cm size, disease free (Type GC2)**

7 **Supplying of ground covers / creepers - Saplings, well developed, min.**
8 **0.15m high, in polybag of 20x15cm size, disease free (Type GC3)**

9 Planting materials are to be supplied as specified below:

10 **General Specifications for plant procurement**

11 Plant to be procured healthy, disease and pest free (please check for black spots,
12 white fungus)

13 Plant must be procured from a nursery located in a semi-arid climate. If the
14 plant is procured from a nursery in other climates, it must be kept in site nursery
15 for at least 30 days for acclimation and mortality check.

16 All plants are to be well formed, healthy and with vigorous root system. All
17 plants should be well settled, hardened, and at the time of supply should be free
18 from any root shock.

19 Ideally, all required planting materials (except loose grass stock) should be
20 procured at least 2 months prior to the plantation. This will allow plants much
21 required hardening and acclimatization to local climatic conditions. In case of
22 loose grass stock, it should be dug up only 2 to 4 days prior to the plantation.
23 However, at its original location, from where this stock is going to be dug up,
24 stock should be watered regularly for a period of 3 to 4 weeks in order to get
25 vigorous growing stock. Pruning at the time of removal from the nursery will
26 not be permitted. In dry weather conditions, trees are to be sprayed with
27 approved Anti-transpirant.

28 **Trees for site development:**

29 Trees shall be nursery grown trees pruned during growth to produce a tight well
30 rounded head and a straight stem clear of leaves or twigs.

31 Age: at least 2 years

32 Height: 900 to 1200 mm straight stems (collar to start of top branch)

33 Stem: Trunk diameter should not be less than 15 mm at 1000 mm above the soil
34 level in the bag. The stem shall be straight and without any bends, knots or
35 notches.

36 Canopy: The head shall be well balanced and rounded and contain at least four
37 main branches with a well-developed secondary branch system and a defined
38 central leader that has not been pruned. Each branch shall have 4-5 leaves, and
39 stem should be greenish and flexible (showing no signs of water stress). The
40 canopy should be well balanced (each branch having similar size) and minimum
41 0.9 metres diameter.

42 Root: Trees shall have a strong fibrous root system.

43 Bag size: Ideally, trees should be in the bag sizes of 150x200 mm (6"x8") or
44 larger with root ball of size 100mm diameter x 150mm depth

45 **Trees for other areas (promenade, courtyards, housing, etc)**

46 Trees shall be nursery grown trees pruned during growth to produce a tight well

1 rounded head and a straight stem clear of leaves or twigs.

2 Age: at least 4 years

3 Height: 2100 to 3000 mm straight stems (collar to start of top branch)

4 Stem: Trunk diameter should not be less than 75 mm at 1000 mm above the soil
5 level in the bag. The stem shall be straight and without any bends, knots or
6 notches.

7 Canopy: The head shall be well balanced and rounded and contain at least four
8 main branches with a well-developed secondary branch system and a defined
9 central leader that has not been pruned. Each branch shall have 4-5 well grown
10 branches, each having 8-10 leaves, and stem should be greenish and flexible
11 (showing no signs of water stress). The canopy should be well balanced (each
12 branch having similar size) and minimum 1.5 metres diameter.

13 Root: Trees shall have a strong fibrous root system.

14 Bag size: Ideally, trees shall be grown in a minimum 18" pot with root ball size
15 400mm diameter x 300mm depth

16 **Palms (large, single stemmed)**

17 Age: atleast 3 years

18 Height: 2000 mm straight stems (collar to base of lowest sheath)

19 Stem: The stem girth shall be of dimension normally found for palms for the
20 stem height and species specified.

21 Canopy: The heads of palms shall be well balanced with at least 7 leaves and a
22 healthy growing apical shoot all free from pest and disease.

23 Bag size: Ideally, trees shall be grown in a minimum 36" pot with root ball size
24 750mm diameter x 600mm depth

25 **Shrubs & multi-stemmed palms:**

26 Age: at least 1 year

27 Height: small shrubs: 150 to 300 mm, medium shrubs: 450-600mm, large
28 shrubs: 750-900mm

29 Stems: no less than three main stems

30 Canopy: Each saplings should have healthy (free of pest and diseases) foliage
31 and should have at least 3-4 well grown branches with 3-4 leaves each, well
32 balanced and bushy, with strongly developed fibrous root systems, and shall be
33 pruned in advance as required to achieve the specified height tolerances.
34 Branches shall break from the base of the plant just above the root collar, and
35 shall be well furnished with leaves right down to ground level

36 Bag size: All plants are to be grown in bags of suitable dimensions for the
37 species. Typical sizes are:

38 small shrubs: 75x125 mm (3"x5"), medium shrubs 100x150 mm (4" x 6"), large
39 shrubs: 200 x 250mm (8" x 10")

40 **Bulbous plants:**

41 Age: at least 1 year

42 Height: small : 150 to 300 mm, medium : 450-600mm, large : 750-900mm

43 Stem: Plants shall have a well-developed main stem or bulb, with good
44 symmetry, a healthy root system, free from pest or disease.

45 Canopy: well formed and well balanced canopy with atleast 4-6 large leaves /
46 stalks

47 Bag size: All plants are to be grown in bags of suitable dimensions for the
48 species. Typical sizes are:

49 small shrubs: 75x125 mm (3"x5"), medium shrubs 100x150 mm (4" x 6"), large
50 shrubs: 200 x 250mm (8" x 10")

1 **Ground covers:**

2 Age: at least 6 months

3 Height: 200 to 300 mm

4 Canopy: Each sapling should have healthy (free of pest and diseases) foliage
5 with at least 6-8 leaves, evenly balanced to allow equal growth in all directions.

6 Bag size: 75x125 mm (3"x5") or larger

7 Roots: Plants shall have fully developed roots and leaves. Rooted cuttings will
8 not be accepted. Rooted shoots of certain spreading ground cover plants shall be
9 used only where specified, planted as 'sprigs' as opposed to established plants in
10 soil. Plants shall be rooted shoots and shall have at least one shoot and evidence
11 of vigorous root growth. Recent cuttings with no root development shall not be
12 acceptable.

13 **Bamboos:**

14 Age: at least 1 year

15 Height: Dwarf varieties: 300 to 600 mm regular varieties: 900-1200mm

16 Canopy: Each saplings should have healthy (free of pest and diseases) foliage
17 with atleast 10-12 leaves

18 Bag size: dwarf varieties: 75x125 mm (3"x5"), regular: : 200 x 250mm (8" x
19 10")

20 **Grasses:**

21 Age: at least 1 year

22 Height: 200 to 300 mm (if in bags), otherwise, live and healthy loose rhizomes,
23 suckers, stolons, etc.

24 Canopy: If in bags, each saplings should have healthy (free of pest and diseases)
25 foliage with 3-4 leaves. If in loose form, live and healthy

26 Bag size: 75x125 mm (3"x5") or larger

27 **Creepers & Climbers:**

28 Age: at least 1 year

29 Height: 450 to 600 mm

30 Canopy: If in bags, each saplings should have healthy (free of pest and diseases)
31 foliage with 3-4 leaves. Plants shall have at least two leader shoots up to the
32 recommended height and a vigorous root system.

33 Bag size: 75x125 mm (3"x5") or larger

2.42.1

Complete maintenance of the entire garden features having as per yard stick in the garden area i.e. lawn trees, shrubs, hedge, flower beds, foliage, creepers etc. including hoeing, weeding, pruning, replacement of plants, gap filling, watering, mowing of lawn, grass cutting by lawn mover and brush cutter, removal of garden waste, applying insecticide, pesticide & fertilizers (whenever required) top dressing of lawn with good earth and manure and maintenance of other garden related works as directed by office-in-charge (Cost of Good Earth, Manure, Fertilizer, Insecticide, Pesticide, lawn mover and brush cutter with fuel will be provided by the Department & other T & P material/articles shall be provided by the contractor.)

Prestigious works / H.M. house & officers entitled to free accommodation. (as per yard stick 1Mali = 1.00Acre)

2.44

Complete maintenance of trees (out side garden features), jobs like making of basin at regular intervals i/c watering, weeding, pruning & application of fertilizer etc, (excluding the cost of material which shall be supplied by the department) and as per direction of officer in charge. trees for 250/no (upto 4 & upto 3 year slow and fast growing group)

General Maintenance

All protective fencing must be maintained and kept in good condition and in position until the end of the maintenance period.

Contractor must appoint 1 mali for each 1 acre area or part thereof for daily maintenance, and maintain a register of daily attendance as well as work done on site.

Contractor must also appoint a horticultural supervisor with minimum 10 years of experience who will visit site on a daily basis.

Contractor must also maintain an equipment and materials register along with issue dates and quantities.

All plant beds are to be kept in a weed free condition with a weeding operation once a month. All weeds, stones and rubbish collected from this operation shall be removed from the site by the Contractor. Herbicides may not be used on this site unless a specific application in writing is made by the Contractor with full back up data on the performance of the chemicals and the particular need for the chemicals use. Approval will in all cases be subject to the EIC's decision.

After weeding, at least once per month the soil surface is to be lightly broken up between plants using a pronged fork upto a maximum depth of 100mm. Taking care not to disturb the root systems. After forking the soil loose, the mulch and loosened soil are to be raked to give an even re-distribution of the mulching materials

Maintenance of trees:

In addition to procedures mentioned in general maintenance, maintenance shall include, regular watering, weeding, mulching, soil working, supporting and pruning.

1 Firming up and adjusting of stakes/ties shall be carried out monthly to ensure
2 that the trees and shrubs are firmly held in the ground. If required stakes shall
3 be adjusted, tightened or loosened. If tree ties or ropes are rubbing the bark of
4 the trees, the ties are to be taken off and retied. Any damaged branches are to
5 be carefully pruned and the wounds sealed.

6 For manure and fertilizers, refer to section on fertilizers.

7 For irrigation, refer to section on irrigation aspects.

8 For regular pruning operations, refer to section on pruning.

9 Spreading of 25mm thick mulch materials such as sawdust, leaf litter, wood
10 chips, hay in the root zone is required to control weed growth and also reduce
11 evaporation losses.

12 Fortnightly checking against insect / pest / fungus attack is advisable. Presence
13 of such occurrences should be recorded and appropriate control measures
14 should be initiated immediately to check it in the early stages of development.

15 'Geru' pointing work shall be done two times per year on the trunk of the trees,
16 in March and October every year.

17 **Maintenance of shrubs:**

18 In addition to procedures mentioned in general maintenance, maintenance shall
19 include, regular watering, weeding, mulching, soil working, supporting and
20 pruning.

21 For manure and fertilizers, refer to section on fertilizers.

22 For irrigation, refer to section on irrigation aspects.

23 For regular pruning operations, refer to section on pruning.

24 Spreading of 25mm thick mulch materials such as sawdust, leaf litter, wood
25 chips, hay in the root zone is required to control weed growth and also reduce
26 evaporation losses.

27 Fortnightly checking against insect / pest / fungus attack is advisable. Presence
28 of such occurrences should be recorded and appropriate control measures
29 should be initiated immediately to check it in the early stages of development.

30 **Maintenance of ground covers/grasses:**

31 In addition to procedures mentioned in general maintenance, maintenance shall
32 include, regular watering, weeding, mulching, soil working, supporting, pruning
33 and thinning.

34 For manure and fertilizers, refer to section on fertilizers.

35 For irrigation, refer to section on irrigation aspects. In addition, one needs to
36 'train' plants under this category by giving sub-optimal water.

37 For regular pruning operations, refer to section on pruning.

1 Fortnightly checking against insect / pest / fungus attack is advisable. Presence
2 of such occurrences should be recorded and appropriate control measures
3 should be initiated immediately to check it in the early stages of development.

4 **Maintenance of bamboos:**

5 In addition to procedures mentioned in general maintenance, maintenance shall
6 include, regular watering, weeding, soil working, supporting, pruning and
7 thinning.

8 For manure and fertilizers, refer to section on fertilizers.

9 For irrigation, refer to section on irrigation aspects. In addition, one needs to
10 'train' plants under this category by giving sub-optimal water.

11 For regular pruning operations, refer to section on pruning.

12 Fortnightly checking against insect / pest / fungus attack is advisable. Presence
13 of such occurrences should be recorded and appropriate control measures
14 should be initiated immediately to check it in the early stages of
15 development. Normally, bamboos are free from such occurrences.

16 **Lawn**

17 In addition to procedures mentioned in general maintenance, the Contractor
18 shall mow all lawn areas using approved cutting equipment to maintain a close
19 sward to a height of not less than 20mm and not more than 30mm for all grass
20 types. Mowing shall be carried out generally weekly, except in dry weather and
21 grass shall not be allowed to flower between cuts. Weekly inspections are to be
22 made to ensure adequate planning of grass cuts to suit growth and weather
23 conditions. All clippings to be gathered up and removed.

24 As directed by EIC, the Contractor shall apply top dressing of not more than
25 15mm depth fine sand and granulated compost raked and spread evenly over
26 the lawn areas. The next topdressing shall be applied only after the grass has
27 grown through to a mowable height.

28 If depressions or bumps over 25mm deep or high in turf areas during the
29 maintenance period these are to be levelled out by lifting the turf and raising the
30 soil level with sand/compost mix or trimming to level grades, followed by
31 returfing.

32 Grass areas are to be kept free of weeds, annual grasses, fungus and insect
33 attack and free of stones or other debris throughout the maintenance period as
34 often as is required.

35 All chemicals used shall be to the approval of the EIC. Assessment of these
36 operations is to be prepared on the basis of the weekly maintenance inspection
37 chart.

38 If compaction or consolidation takes place or hard passing or baking of the soil
39 occurs, the soil areas are to be well watered first and lightly loosened by
40 mechanical means such as spiking, slitting or hollow tinning using equipment
41 approved by the EIC.

1 **Pruning**

2 All plants are to be reviewed monthly and pruned as and when required during
3 the maintenance Period to promote bushy growth and good flowering
4 characteristics. The Contractor must submit a pruning program clearly
5 mentioning types and details of pruning for each plant species for approval of
6 EIC. Contractor will prune only plants approved by EIC.

7 Plants shall be checked and all dead wood, broken, damaged or crossed
8 branches shall be cut back, depending on species. Pruning and removal of
9 branches is to be carried out using sharp clean implements to give a clean
10 sloping cut with one flat face. Ragged edges of bark or wood are to be trimmed
11 with a sharp knife.

12 Trees shall be pruned if dead, rotten or crossed branches are present or to
13 maintain a clear stem up to the specified height using the methods described
14 below. Tree pruning is to be reviewed monthly.

15 For all roadside trees and those specifically marked by EIC, removal of any side
16 branches in the first 1500 to 2100 mm region of the trunk is essential for the
17 straight growth of tree. This procedure is not to be carried out for other site level
18 plantation.

19 Many tree species will produce side suckers or root suckers in the root zone area,
20 these need to be removed upon notice.

21 For large shrubs (as specified in drawing and directed by EIC), removal of any
22 side branches in the first 900 to 1200 mm region of the trunk is required.

23 Many species will produce side suckers or root suckers in the root zone area,
24 these need to be removed upon notice.

25 Pruning for all other plants shall be carried out as follows:

- 26 ● Pruning is to be done with the cut just above and sloping away from an
27 outward facing health bud.
- 28 ● Removal of branches is to be done by cutting flush with the adjoining stem
29 and in such a way that no part of the stem is damaged or torn.
- 30 ● Ragged edges of bark are to be trimmed with a sharp knife.
- 31 ● Any cuts or wounds over 25mm diameter are to be painted with an approved
32 sealant after trimmed.
- 33 ● All pruning to be cleared up and removed from site after pruning.
- 34 ● All hedges, mat forming herbaceous plants and ground cover plants shall be
35 clipped with shears as often as necessary (at least monthly) to maintain a
36 tidy appearance. Tall hedges are to be cut to forms shown on the drawings.
37 fertilizer is to be applied to clipped areas around 1-2 weeks after clipping.
- 38 ● Selective pruning of flowering plants shall be done where special flowering
39 characteristics are required such as for Ixoras, Hibiscus, Allamanda where
40 flowering takes places on twig ends. Heavy clipping must not be used for
41 these species since this will remove future flower buds. Selective pruning
42 by clipping non flowering twigs and leaving flowering twigs is necessary for
43 these plants, and this operation must be done by experienced workers.

44 **Fertilizers**

45 The trees shall be manured once a year at the end of rainy season after making
46 bund around tree with F.Y.M. / cow dung manure (4.5 liters per tree) and N-P-K
47 12:32:16 or 10:26:26 (50 g/tree for the first year and 100 g/tree in subsequent

1 years).

2 Shrubs shall be manured once a year at the end of rainy season after making
3 bund around it and mixing with F.Y.M. (2.5 liters per square metre of shrub area)
4 and N-P-K 12:32:16 or 10:26:26 (30 g/sqm of shrub area for the first year and
5 60 g/sqm of shrub area in subsequent years).

6 Ground covers shall be manured once a year at the end of rainy season after
7 making bund around a larger group of plantation, say 10 sqm, and mixing with
8 F.Y.M. (18 liters per group) and N-P-K 12:32:16 or 10:26:26 (100 g/group for
9 the first year and 150 g/group in subsequent years).

10 Bamboos shall be manured once a year at the end of rainy season after making
11 bund around each clump and mixing with F.Y.M. (4.5 liters per group) and N-P-K
12 12:32:16 or 10:26:26 (50 g/group for the first year and 100 g/group in
13 subsequent years).

14 fertilizer of NPK value 10-15-15 or similar approved be spread at a rate of
15 40gm/sq m over all grass areas at monthly intervals, using approved spreading
16 equipment to give an overall even spread. Grass areas that have been fertilized
17 shall be watered if no rain falls within 24 hours.

18 The Contractor shall also provide for monthly fertilizer operations during the
19 Maintenance Period. An approved slow release fertilizer shall be applied to each
20 plant at the rate of 50gm per shrub and 200gm per tree, one month after
21 planting and thereafter monthly. After spreading the fertilizer around the base of
22 the plant the granules shall be lightly forked into the soil, and the plant well
23 watered. Herbaceous and ground cover areas shall receive 25mm of approved
24 soil conditioner, evenly spread and mixed with 50gm/m² of approved slow
25 release fertilizer, evenly spread over entire area and lightly forked into the soil to
26 break up the top layer, and the area well watered on a month by month basis.

27 The horticultural requirements of different plants or areas may involve
28 variations to those techniques (such as the use of organic liquid fertilizers for
29 sensitive plants) and variations in method will be authorized as required.

30 Heavy feeding plants such as Canna, Heliconia and Lantana shall be dressed
31 with a 25mm mulch of approved organic compost or similar approved compost
32 every 2 months, lightly forked in around the base of the plants.

33 Additional mulching layer, 25mm deep to be spread and forked in over all
34 planted areas at 3 monthly intervals.

35 The Contractor shall make regular weekly checks to ensure that the plant
36 material is insect and pest and fungus free. No pesticides may be used unless
37 approval from the EIC is given from the Contractor stating the chemical intended
38 for use; concentration, spraying programme and including full technical details
39 of the product.

40 **Irrigation aspects:**

41 Recycled water from STP / DEWATS only shall be used for the landscape.
42 Irrigation water pH should be in the range of 7.0 to 7.9 and electrical
43 conductivity below 1.0 dS/m. Contractor must check this at all sources at weekly
44 intervals using portable meters and bring any discrepancy to notice of EIC.
45 Water shall be supplied to the Contractor from agreed points on the site.

1 However, it will be only to necessary for the Contractor to supply his own means
2 of transport from the watering points to the plant beds. An inspection of
3 watering requirements is to be made by the Contractor at least two times a week
4 in dry weather.

5 Water shall be supplied using an approved hose or sprinkler or with an
6 automated irrigation system so as not to cause compaction or wash-outs of the
7 soil or loosening of plants. Flood irrigation is prohibited and spray heads must be
8 used for manual watering. The Contractor shall immediately make good any
9 such damage, soil erosion or outwash and plants loosened by erosion are to
10 replanted or if damaged, replaced. Care should be exercised that no pit is
11 waterlogged at any point of time.

12 The Contractor shall water all trees, palms, shrubs, ground cover, rooted shoots,
13 herbaceous plants and other planting areas to keep the ground moist all around
14 and to the full depth of the roots of the plants to a minimum depth of saturation
15 of:

16 100mm for lawn / groundcover / bulbous plants

17 300mm for shrubs / bamboos

18 750mm for trees

19 Irrigation should be carried out during early or late hours of the day to minimize
20 evaporation and conflict with functional requirements.

21 For site plantation, plants must be irrigated every alternate day in summer,
22 every 3rd day in winter and weekly in monsoon. Irrigation must be stopped in
23 case of rainfall on 3 consecutive days or more, for period of one week from last
24 rainy day.

25 All lawn areas are to be watered by means of sprinklers during dry weather as
26 often as is required to keep the grass green and the soil moist. The Contractor
27 shall provide hoses and sprinklers for use from water points provided by others.
28 Weekly inspections are to be made to determine the need for water and, in dry
29 weather watering must be done to moisten the soil to a depth of 100mm.

30 **Measurement**

31 The rate includes the cost of all equipment, labour, carting, loading & unloading,
32 removal of debris to local specified within the site, involved in all the operations
33 described above. Consumable materials like manure, fertilizer, additional soil,
34 insecticides, pesticides and water shall be provided by the institute.

2.44

Maintenance of Potted Plants at Nursery in Earthen pot including resetting/ displaying at Nursery, including watering weeding, hoeing, colouring, transplanting the damaged pots and disposal of generated garbage at specified place as per direction of officer-in-charge. (Good earth, manure, fertilizer, insecticide & pesticide shall be provided by the department) for earthen 3000 pots

Nursery establishment:

Nursery will be constructed at a location demarcated in drawings or directed by EIC. Nursery area should be relatively flat, with good accessibility and with no extreme condition (very hot, very cold, strong wind, dry or flooding etc.). Nursery should have good accessibility so that planting and nursery materials can be handled with ease. Once location for nursery is finalized, plantation of tall and fast growing tree species such as *Peltophorum* should be carried out to provide shade and protection from wind.

Structures required:

Contractor should arrange for own site office cum workshed in form of a port-a-cabin.

Fencing: Cattle proof fencing like cactus is must to prevent entry of cows, goats, and even rabbits around nursery.

Management of nursery:

Land preparation: The land of a nursery is prepared by ploughing and cross ploughing. All kinds of waste materials are to be removed and the land must be levelled properly.

Preparation of media: The most common media is a mixture of topsoil (50%), sand (30%) and compost (20%). The media-mix then are filled into containers, such as polytubes, pot trays, or most commonly polybags and arranged in nursery beds of 5 x 1 m.

Sowing and germination: Sowing and germination of seeds are normally conducted in plastic boxes (36 x 30 x 12 cm). The media that is commonly used for germination is sand, combination of sand and top-soil, and top-soil. Certain seeds are very sensitive to dumping-off; therefore, sterilization of seeds and media is very important. Soaking of seeds in 2 -2.5 g/l solution of fungicide (Dithane M-45) for 12 hr eliminates this problem. After sowing the seeds in germination boxes, the media is wetted with the dose of fungicide solution.

For fine seeds, the sowing beds need to be protected from direct rainwater and sunlight. Watering has also needed to be done very carefully to avoid disturbing the germinating seeds. By contrast, large seeds with high germination rate could be sown directly into poly bags.

Potting the seedling: Before planting of sapling in the pots, the pots should be filled up with proper potting mixture. Different types and sizes of earthen pots, plastic containers and poly bags are used for this purpose.

Transplanting of germinating seeds is started when the seedling has already two leaves. Seedlings are transplanted to containers when the cotyledon is still intact with the needles, and the needles have yet opened. Only good quality seedlings, germinating normally and healthy are transplanted to the container.

1 This is the first step of selection of good quality planting materials.
2 The transplanted seedlings are raised in the nursery beds under suitable shading
3 net for 1 to 2 months. Newly transplanted seedlings are sensitive to direct
4 sunlight with full light intensity; therefore, providing shade is necessary.

5 Manuring: Rooted cuttings, layers or grafted plants till they are transferred to
6 the permanent location, require fertilizers. Addition of fertilizers will give healthy
7 & vigorous plants with good root & shoot system. It is recommended that each
8 nursery bed of 10 X 10 m area should be given 300 gm of ammonium sulphate,
9 500 gm of Single super phosphate and 100 gm of Muriate of potash.

10 Irrigation: For potted plants hand watering is done and for beds low pressure
11 irrigation by hose pipe is usually given. Heavy irrigation should be avoided.
12 Watering is commonly conducted twice a day, i.e. at 6:00 to 9:00am and at
13 16:00 to 18:00pm. Watering is done by using sprinklers or manually. The size of
14 water droplets should be kept as fine as possible to avoid disturbance to
15 germinating seeds.

16 Plant protection measures: Adoption of plant protection measures, well in
17 advance and in a planned manner is necessary for the efficient raising of nursery
18 plants. The major disease of nursery stage plant is "damping off". There are
19 several techniques to overcome this disease, i.e. using fungicide, removing
20 infected seedlings, opening shading net, control watering, and replacing media.
21 The fungicides being used are Dithane, and Benlate, which is applied 5 days
22 after transplanting the seedlings to polybags and repeated every 5 days for 1
23 month.

24 Some of the seed treatments are: The infection within the seed is eliminated by
25 use of sodium hypo chloride solution. Dry seeds are placed in hot water having
26 a temperature of 48 to 55 degree centigrade for 10-30 minutes. Soil contains
27 harmful fungi, bacteria, nematodes and even weeds seeds, which affect the
28 growth and further development of plant. These can be eliminated by heat,
29 chemical treatment. For that soil is disinfected by heating to the temperature of
30 about 60 degree centigrade for 30 minutes. Chemicals like Bordeaux mixture,
31 Carbendazim, Redomil can be used. Tricoderma viridi, a bio-fungicide, can also
32 be used.

33 Hardening-off: Hardening-off is needed to train the seedlings to adapt to
34 adverse condition in the planting sites. This is conducted by cutting the
35 overgrown roots, reducing watering intensity, opening shading nets, and no
36 fertilizer application.

37 **Measurement**

38 The rate includes the cost of all equipment, labour, carting, loading & unloading,
39 removal of debris to local specified within the site, involved in all the operations
40 described above. Consumable materials like manure, fertilizer, additional soil,
41 insecticides, pesticides and water shall be provided by the institute.

1 **2.50**

2 **Providing & fixing of White River (Stone) Pebbles size of 2"" to 2.50"**
3 **dia in natural colour al site of work including loading, unloading,**
4 **carriage and all taxes paid etc.and as per direction of officer in charge.**

5 Pebbles shall be sourced from a natural river source. Pebbles shall conform to
6 the size specifications of 50-60mm diameter. Color should be natural white.

7 Pebbles must be clean of any dirt, dust, grime, etc and should not have any
8 damage or shear marks.

9 Site where pebbles are to be laid shall be cleared of all debris and obstructions,
10 cleaned and tamped to create a level and compacted ground.

11 Pebbles shall be laid in layers not more than 100mm thick and raked or lightly
12 compacted to get even spread and finish.

13 Measurements

14 Measurement shall be by weight of bags received at site in quintals. The rate
15 includes the cost of all equipment, labour, carting, loading & unloading, removal
16 of debris to local specified within the site, involved in all the operations described
17 above.

1 **Providing and fixing of Tuflex Garden fencing Hexagonal net/or**
2 **equivalent of green colour having contents (Weight grams/sqm. 510**
3 **(+/- 8%)) in width of 60 cm. with bamboo of 90 cm. length. The**
4 **bamboo should be painted with green colour paint of approved brand**
5 **and manufacture (two or more coats) and fixed 30cm below ground**
6 **level and 60cm above ground level at distance of 1.50 metres. The net**
7 **and bamboo should be binded with 2 mm. G.I. Wire at three places**
8 **properly as per direction of Engineer-in-charge.**

9 Material procured shall conform to manufacturer's specifications.

10 Bamboo stakes shall be driven 30cm into the ground without splitting at 1.50 m
11 spacing along the proposed fencing line. Stakes shall be straight and in one line
12 and alignment.

13 Bamboos shall be painted green to match color of garden fencing.

14 Garden fence shall be unrolled along the line of stakes, fixed to each stake after
15 straightening and tightening it with reference to previous stake. Fixing shall be
16 done with 2mm GI wire, bound at top, middle and bottom.

17 Measurements

18 Garden fencing installed shall be measured in square metres, accurate to the
19 nearest metre. The rate includes the cost of all equipment, labour, carting,
20 loading & unloading, removal of debris to local specified within the site, involved
21 in all the operations described above.

1 OTHER WORKS

2 **Steel work in built up tubular (round, square or rectangular hollow**
3 **tubes etc.) trusses etc., including cutting, hoisting, fixing in position**
4 **and applying a priming coat of approved steel primer, including welding**
5 **and bolted with special shaped washers etc. complete.**
6 **Hot finished welded type tubes**

7 All mild steel items shall have ISI mark and conforming to Indian Standards IS
8 8910. Mild Steel supplied shall be of minimum Fe570 grade. Tubes shall be clean
9 finished and reasonably free from scale. They shall be free from cracks, surface
10 flaws, laminations and other defects. The ends shall be cut clean and square
11 with axis of tube, unless otherwise specified. Wall thickness of tubes used for
12 construction exposed to weather shall be not less than 4 mm.

13 The component parts of the structure shall be assembled in such a manner that
14 they are neither twisted nor otherwise damaged and be so prepared that the
15 specified cambers, if any, are, maintained. The tubular steel work shall be
16 painted with one coat of approved steel primer after fabrication. All fabrication
17 and welding is to be done in an approved workshop. The joint details shall be
18 generally as per S.P-38 of B.I.S publication.

19 All material before being assembled shall be straightened, if necessary, unless
20 required to be of curvilinear form and shall be free from twist. Where welding is
21 adopted, it shall be as per IS 816.

22 Cutting shall be carried out via mechanical or heat powered tools. Maximum
23 permissible variation shall be 5 millimetres for all cuts. All cut areas shall be
24 ground to a smooth surface using mechanical grinder.

25 Bending of steel sections shall be undertaken to provide smooth and true curves.
26 Tightly curved and bent sections shall be free from all distortions and rippling.
27 All sharp edges shall be ground smooth.

28 The Contractor shall provide a sample of all fixings and fastenings to the EIC for
29 approval. These shall include but not be limited to beams, columns, hinges,
30 locks, nuts and bolts, nails and screws, cables, wire and tensioners.

31 Washers shall be specially shaped where necessary, or other means, used to
32 give the nuts and the heads of bolts a satisfactory bearing. In all cases, where
33 the full area of the bolts is to be developed, the threaded portion of the bolt shall
34 not be within the thickness of the parts bolted together and washers of
35 appropriate thickness shall be provided to allow the nuts to be completely
36 tightened.

37 When the end of a tube is not automatically sealed by virtue of its connection be
38 welding to another member the end shall be properly and completely sealed.
39 Before sealing, the inside of the tubes should be dry and free from loose scale.
40 In tubular construction the ends of tubes may be flattened or otherwise formed
41 to provide for welded. Riveted or bolted connections provide that the methods
42 adopted for such flattening do not injure the material. The change of sections
43 shall be gradual.

44 Tubular trusses shall be hoisted and erected in position carefully, without
45 damage to themselves, other structure, equipment and injury to workman.

1 The method of hoisting and erection proposed to be adopted shall be got
2 approved from the Engineer-in-charge. The contractor shall however be fully
3 responsible, for the work being carried out in a safe and proper manner without
4 unduly stressing the various members. Proper equipment such as derricks,
5 lifting tackles, winches, ropes etc. shall be used.

6 Galvanized iron PVC chain link fencing shall conform to IS 2721 (2003) with
7 uniform PVC coating. Sample shall be approved by Engineer-in-Charge &
8 installed as shown in drawings.

9 The work as fixed in place shall be measured in running metres correct to a
10 centimeter on their weights calculated on the basis of standard tables correct to
11 the nearest kilogram unless otherwise specified.

12 Weight of cleats, brackets, packing pieces bolts nuts, washers distance pieces
13 separators diaphragms gaskets (taking overall square dimensions) fish plates,
14 etc. shall be added to the weight of respective items unless otherwise specified.
15 No deduction shall be made for skew cuts.

16 For chain link fencing, the work shall be measured in square metres dimensions,
17 true to the nearest 0.1 square metre.

18 Measurements

19 Measurement shall be in kilogram of installed steel work. The rate includes the
20 cost of all materials, equipment, labour, carting, loading & unloading, removal of
21 debris to local specified within the site, involved in all the operations described
22 above, including application of one coat of approved steel primer, i.e. red oxide
23 zinc chrome primer conforming to IS 2074. The rate includes the cost of all
24 materials, equipment, labour, carting, loading & unloading, removal of debris to
25 local specified within the site, involved in all the operations described above.

1 **13.52.1**

2 **Finishing with Epoxy paint (two or more coats) at all locations prepared**
3 **and applied as per manufacturer's specifications including appropriate**
4 **priming coat, preparation of surface, etc. complete. On steel work**

5 Before beginning the process, all rust, rust scale, heavy chalk or deteriorated
6 coatings must be removed by a combination of solvent or detergent washing,
7 hand or power tool cleaning or abrasive blasting.

8 Priming coat shall be applied to dry surface as per manufacturer's specifications
9 and allowed to dry for atleast 24 hours.

10 Finish paint shall be applied in two separate coats using an air spray. Spray shall
11 be used perpendicular to the surface to be painted, and sprayed from a distance
12 of 15-20 cms from surface. Each coat of paint shall be allowed to dry as per
13 manufacturer's specifications.

14 Paint finish should have even thickness and colour, with no damaged or
15 unpainted areas.

16 Measurement shall be area of surface painted correct to one square centimetre.
17 The rates shall include the cost of all materials and labour involved in all the
18 operations described above including the cost of cleaning of RCC slab surface
19 and applying the cement slurry, but it shall not include the cost of base concrete.
20 The rate includes the cost of all materials, equipment, labour, carting, loading &
21 unloading, removal of debris to local specified within the site, involved in all the
22 operations described above.

23 **Supply & Fixing Agricultural Net (Agronet) Type-I (shade factor 50%)**
24 **manufactured as per IS 16008 : 2012 , having minimum weight 100**
25 **gsm, having green colour, UV resistant, including all materials required**
26 **for fixing in all respect as directed by Engineer-in-Charge**

27 Agronet shall be used to shade plants and nursery area. Agronet procured shall
28 be manufactured as per IS 16008:2012, with 50% shade factor and minimum
29 100 gsm weight. It shall be UV resistant and of green colour, shade as approved
30 by Engineer-in-Charge.

31 Agronet shall be installed on MS frame as per manufacturer's specifications with
32 suitable SS or MS hooks that do not tear the fabric. MS frame and hooks shall be
33 paid for separately.

34 Measurement shall be in area, accurate to a centimetre in each direction. The
35 rate includes the cost of all materials, equipment, labour, carting, loading &
36 unloading, removal of debris to local specified within the site, involved in all the
37 operations described above.

38 **Supply & spreading of graded moorum upto 300 mm for play areas, in**
39 **layers not exceeding 100mm thick and consolidating with 8 tonne roller,**
40 **complete including supply of all material, labour and equipment, upto**
41 **any lead and lift as directed by EIC**

42 Graded moorum shall be sourced from approved sources only. Sample shall be

1 approved by Engineer-in-Charge before supply of moorum.

2 Area on which moorum is to be applied shall be cleared of all vegetation, growth,
3 large and small stones, rubble, etc. Area shall then be level on flat area such that
4 there is no unevenness more than 100mm in any area.

5 Moorum shall be applied on this area in thickness of 100mm as shown in drawing,
6 and directed by Engineer-in-Charge. 8 tonne roller shall be used to compact the
7 moorum.

8 Measurement shall be in cubic metres volume, accurate to a centimetre in each
9 direction. The rate includes the cost of all materials, equipment, labour, carting,
10 loading & unloading, removal of debris to local specified within the site, involved
11 in all the operations described above.

12 **Dry stone pitching 22.5 cm thick including supply of stones and**
13 **preparing surface complete.**

14 ***Stones***

15 These shall be clean, hard stones, free from decay and weathering. They shall be
16 in block and hammer dressed on all sides.

17 The size of the pitching stones shall be approximately 22.5 cm. in depth and not
18 less than 15 cm. In any other direction.

19 ***Preparation of surface***

20 The sides and bottom of earth work to be pitched, shall be brought to the
21 required slope and gradient and shall be compacted to a firm and even surface.

22 ***Pitching***

23 Pitching shall be of 22.5 depth unless specified otherwise. Profiles shall be put
24 up by means of pegs and strings or by placing stones, at intervals of not more
25 than 15 cm. Stones shall then be laid closely in position in between the profile
26 and firmly embedded with joints staggered and with exposed faces true to line,
27 gradient and in uniform slope throughout. Cross bands of approximately 22.5
28 cm. width through bond stones equal to the full depth of pitching shall be
29 provided at an interval of approximately 3 metres centre to centre both
30 longitudinally and transversely.

31 The interstices between adjacent stones shall be filled in with stones of proper
32 size, well driven in with crow bars to ensure tight packing and complete filling of
33 all interstices. Such filling shall be carried on simultaneously with the placing in
34 position of the large stones and shall in no case be permitted to fall behind. Final
35 wedging shall be done with the largest sized chip practicable, each chip being
36 well driven home with a hammer so that no chip is possible of being picked up or
37 removed by hand.

38 ***Measurements***

39 The measurements shall be taken in square metres. The area of pitching for
40 drains shall be calculated by multiplying the perimeter (bed width plus side
41 slopes) by the length of the pitching. The length, width and side slope shall be
42 measured correct to a cm. The rate shall include the cost of the materials and
43 labour involved in all the operations described above, except pitching stone, if
44 specified, shall be paid for separately. The rate includes the cost of all materials,
45 equipment, labour, carting, loading & unloading, removal of debris to local
46 specified within the site, involved in all the operations described above.

1 **Geosynthetic Drainage with two filtering nonwoven geotextiles**
2 **having a "W" configuration as longitudinal parallel channels. Minimum**
3 **thickness to be 7.2mm, with two filtering UV stabilized polypropylene**
4 **nonwoven geotextile of minimum thickness of 0.75mm having pores of**
5 **150 micron and tensile strength of 8.0 kN/m and having plane flow**
6 **capacity of 2.1 L / (m.s) at hydraulic gradient of 1.0 & 20 kPa**
7 **pressure ,tensile strength of 18 kN/m , with mass per unit area of 740**
8 **gsm.**

9 Geosynthetic drainage membrane shall conform to BIS standards. It shall
10 conform to the following specifications:

11 ***Composite properties***

12 Tensile strength: 18kN/m

13 Elongation : 35%

14 CBR puncture resistance: 3300N

15 In plane water flow: 2.1 lt / ms @ hydraulic gradient 1.0 & 20kPa pressure

16 Thickness: 7.5mm

17 ***Polypropylene Geotextile filter properties***

18 UV stabilized

19 Thickness: 0.75mm

20 Pore size: 150 microns

21 Tensile strength: 8.0 kN/m

22 Permeability: 50 lt / sqm-sec

23 ***Installation***

24 The geotextile should be laid such that the roll is opened along the slope if
25 applicable.

26 The composite must be kept flat – no lumps or undulations - to prevent ponding.

27 All joints need to be precisely executed.

28 Base on which geotextile is to be laid must have an adequate slope

29 Sufficient outlets must be provided at frequent intervals.

30 Where cutting is required, a sharp cutter must be used such that the different
31 layers are not peeled off

32 Where geotextile has to be joined to another part, 100mm of overlap must be
33 maintained. Overlap must be fixed with a tape at intermittent intervals

34 Exposed edges of the composites can be finished by peeling back the geotextile
35 filter by (say) 75mm,trimming back the exposed core and folding this flap
36 around the edge of the composite.

37 Alternatively, wrap any spare geotextile lengths around exposed edges.

38 Once unwrapped, the products should be completely covered with fill within 14
39 days to avoid exposure to UV radiation.

40 While filling on top of the geotextile, care must be taken to ensure that large
41 stones are not allowed to damage the surface of the geotextile filter(s).

42 ***Measurement***

43 Geotextile shall be measured as installed, accurate to the nearest metre in each
44 dimension. Rate shall be in square metres. The rate includes the cost of all
45 materials, equipment, labour, carting, loading & unloading, removal of debris to
46 local specified within the site, involved in all the operations described above.

1 **Geosynthetic Drainage Composite having thermobonding a draining**
2 **core - HDPE geonet comprises of two sets of parallel overlaid ribs**
3 **integrally connected to have a rhomboidal shape with a polyethylene**
4 **film and a nonwoven geotextile having mass per unit area 130 g/m²**
5 **and tensile strength of 8.0 kN/m having in plane flow capacity of 0.7 L**
6 **/ (m.s) at hydraulic gradient of 1.0 & 20 kPa pressure and tensile**
7 **strength of 13.5 kN/m , with mass per unit area of 830 gsm,**

8 Geosynthetic drainage membrane shall conform to BIS standards. It shall
9 conform to the following specifications:

10 ***Composite properties***

11 Tensile strength: 13.5kN/m

12 Elongation : 25%

13 CBR puncture resistance: 2200N

14 In plane water flow: 0.7 lt / ms @ hydraulic gradient 1.0 & 20kPa pressure

15 Thickness: 5.0mm

16 Mass: 830 gm / sqm

17 ***Geotextile filter properties***

18 Mass: 130 gm / sqm

19 Pore size: 75 micrometres

20 Permeability: 50 lt / sqm-sec

21 ***Installation***

22 The geotextile should be laid such that the roll is opened along the slope if
23 applicable.

24 The composite must be kept flat – no lumps or undulations - to prevent ponding.

25 All joints need to be precisely executed.

26 Base on which geotextile is to be laid must have an adequate slope

27 Sufficient outlets must be provided at frequent intervals.

28 Where cutting is required, a sharp cutter must be used such that the different
29 layers are not peeled off

30 Where geotextile has to be joined to another part, 100mm of overlap must be
31 maintained. Overlap must be fixed at lower end with a pressure sensitive

32 waterproof tape. Top filter geotextile can be taped at intermittent intervals

33 Exposed edges of the composites can be finished by peeling back the geotextile
34 filter by (say) 75mm,trimming back the exposed core and folding this flap
35 around the edge of the composite.

36 Alternatively, wrap any spare geotextile lengths around exposed edges.

37 Once unwrapped, the products should be completely covered with fill within 14
38 days to avoid exposure to UV radiation.

39 While filling on top of the geotextile, care must be taken to ensure that large
40 stones are not allowed to damage the surface of the geotextile filter(s).

41 ***Measurement***

42 Geotextile shall be measured as installed, accurate to the nearest metre in each
43 dimension. Rate shall be in square metres. The rate includes the cost of all
44 materials, equipment, labour, carting, loading & unloading, removal of debris to
45 local specified within the site, involved in all the operations described above.

1 **Extra for covering top of membrane with Geotextile, 120 gsm non**
2 **woven, 100% polyester of thickness 1 to 1.25 mm bonded to the**
3 **membrane with intermittent touch by heating the membrane by Butane**
4 **Torch as per manufactures recommendation.**

5 If the water proofing treatment of flat roof has been done with APP modified five
6 layered membrane and the roof is accessible, a separation layer on top of
7 membrane should be laid before any protected treatment is done. Brick tiles in
8 cement mortar or 25 mm thick cement concrete 1:2:4 shall be laid as final layer.

9 Geotextile 120 gm. Non woven 100% polyester of thickness 1.0 to 1.25 mm
10 manufactured by a company of repute shall be used.

11 Geotextile of the specified thickness is bonded to the water proofing membrane
12 with intermittent touch by heating the membrane by Butane torch as per
13 manufacturing recommendations.

14 Measurements: Length and breadth shall be measured correct to two places of
15 decimal, measurement shall be taken over the entire exposed area of roofing.
16 The rate includes the cost of all materials, equipment, labour, carting, loading &
17 unloading, removal of debris to local specified within the site, involved in all the
18 operations described above.

1 **Random rubble masonry with hard stone in foundation and plinth**
 2 **including leveling up with cement concrete 1:6:12 (1 cement: 6 coarse**
 3 **sand: 12 graded stone aggregate 20 mm nominal size) up to plinth level**
 4 **with:**
 5 **Cement mortar 1:6 (1 cement: 6 coarse sand)**

6 **7.5**
 7 **Extra for random rubble masonry with hard stone curved on plan for a**
 8 **mean radius not exceeding 6 m.**

9 **1.0 Material**

10 **1.1 Stone**

11 The stone shall be of the type specified such as granite, trap, limestone, sand
 12 stone, quartzite, etc. and shall be obtained from the quarries, approved
 13 by the Engineer-in-Charge. Stone shall be hard, sound, durable and
 14 free from weathering decay and defects like cavities, cracks, flaws,
 15 sand holes, injurious veins, patches of loose or soft materials and other similar
 16 defects that may adversely affect its strength and appearance. As far
 17 as possible stones shall be of uniform colour, quality or texture.
 18 Generally stone shall not contain crypt crystalline silica or chart, mica and
 19 other deleterious materials like iron-oxide organic impurities etc.

20 Stones with round surface shall not be used.

21 The compressive strength of common types of stones shall be as per Table 5.1
 22 and the percentage of water absorption shall generally not exceed 5%
 23 for stones other than specified in Table 5.1. For laterite this percentage is
 24 12%.

25 **TABLE 5.1**

<i>Type of stone</i>	<i>Maximum Water Absorption</i>	<i>Minimum Compressive</i>
Granite	0	1000
Basalt	0	400
Lime stone (Slab & Tiles)	0	200
Sand stone (Slab & Tiles)	2	300
Marble	0	500
Quartzite	0	800
Laterite (Block)	1	35

26 **Note 1:** Test for compressive strength shall be carried out as laid down
 27 in IS 1121 (Part I).

28 **Note 2:** Test for water absorption shall be carried out as laid down in IS
 29 1124.

30 **1.2 Size of Stones**

31 Normally stones used should be small enough to be lifted and placed by
 32 hand. Unless otherwise indicated, the length of stones for stone masonry shall
 33 not exceed three times the height and the breadth on base shall not be greater
 34 than three-fourth of the thickness of wall, or not less than 150 mm. The
 35 height of stone for rubble masonry may be upto 300 mm.

1 The selection and grading of stones for rubble masonry is largely done at
2 site and the smaller stones are used in the hearting of wall.

3 **1.3** Random Rubble Masonry shall be uncoursed or brought to courses as
4 specified (Fig. 5.8 and 5.9). Uncoursed random rubble masonry shall be
5 constructed with stones of sizes as referred to in para 5.0 and shapes picked
6 up random from the stones brought from the approved quarry. Stones having
7 sharp corners or round surfaces shall, however, not be used.

8 **1.4** Random rubble masonry brought to the course is similar to uncoursed
9 random rubble masonry except that the courses are roughly levelled at
10 intervals varying from 300 mm to 900 mm in height according to the size
11 of stones used.

12 **1.5** 13 **Dressing**

14 Each stone shall be hammer dressed on the face, the sides and the beds.
15 Hammer dressing shall enable the stones to be laid close to neighbouring
16 stones such that the bushing in the face shall not project more than 40 mm
17 on the exposed face.

18 (i) **Face stone:** At least 25% stones shall be headers
19 tailing into the work at least 2/3rd the thickness of wall in
20 super structure masonry. Such stones shall not be less than 200 sq.
21 cm in cross sections.

22 (ii) **Hearting Stones:** The hearting or interior filling of a wall face shall
23 consist of rubble stones not less than 150 mm in any direction,
24 carefully laid, hammered down with a wooden mallet into position
25 and solidly bedded in mortar. The hearting should be laid nearly
26 level with facing and backing.

27 (iii) **Quoin Stone:** Quoin stone shall be less than 0.03 cum in volume.

28 (iv) **Jamb stones:** The jambs shall not be made with stones specified
29 for quoins except that the stones which were required to be provided
30 at 1 metre centre to centre on both the exposed faces shall here be
31 provided only on the jamb and the length shall be equal to the thickness
32 of the wall

33 for wall upto 60 cm and a line of headers shall be provided for walls
34 thicker than 60 cm as specified for bond.

35 **1.5 (A) Courses**

36 The masonry shall be carried out in regular courses of height not exceeding
37 50 cm and masonry on any day will not be raised more than 60 cm in height
38 when using mortars having compressive strength less than 20 kg./sq. cm at
39 28 days and 100 cm when using mortars exceeding this strength.

40 **1.5 (B) Thickness of Joints**

41 The joint thickness shall not exceed 30 mm at any point on the face. Chips
42 of the stone and spalls shall be wedged into seating bed of face stones to

1 avoid excessive bed thickness. No pinning shall be allowed to avoid excessive
2 joint thickness.

3 **1.6 Mortar**

4 The mortar used for joining shall be as specified.

5 **1.7 Laying**

6 Stone shall be laid on their natural bed and shall be solidly bedded full in
7 mortar with close joints, chips of stone spalls be wedged into the work
8 wherever necessary. No dry work or hollow spaces shall be allowed and every
9 stone whether large or small shall be carefully selected to fit snugly the
10 interstices between the large stones. Masonry shall be built breaking joints in
11 all the three directions. Bond stone and headers shall be properly laid into the
12 work and shall be marked by the contractor with white lead paint. The bond
13 stones shall be provided as specified in para 1.8.

14 The masonry work in wall shall be carried up true to plumb or to specified
15 batter.

16 Random rubble masonry shall be brought to the level courses at plinth,
17 window sills, lintel and roof levels. Levelling shall be done with concrete
18 comprising of one part of the mortar as used for masonry and two parts of
19 graded stone aggregate of 20 mm nominal size.

20 The masonry in structure shall be carried uniformly. Where the masonry of one
21 part is to be delayed, the work shall be raked back at an angle not steeper than
22 45°.

23 **1.7 (A) Raking out joints**

24 All the joints on the faces to be pointed or plastered shall be raked out with
25 racking tool to a depth of 20mm while the mortar is still green.

26 **1.8 Bond Stones**

27 Though bond stones shall be provided in walls upto 600 mm thickness, a set
28 of two or more bond stones overlapping each other by at least 150 mm shall
29 be provided in a line from face to back. In case of highly absorbent types of
30 stones (porous lime stone and sand stone etc.) the bond stone shall extend
31 about two-third into the wall, as through stones in such walls
32 a set of two or more bond stones overlapping each other by at least
33 150 mm shall be provided. Each bond stone or a set of bond stones shall be
34 provided for every 0.5 m² of the wall surface and shall be provided at 1.5 m
35 to 1.8 m apart clear in every course.

36 In case of highly absorbent types of stones (porous lime stone and sand
37 stone etc.) single piece bond stones may give rise to dampness. For all
38 thicknesses of such walls a set of two or more bond stones overlapping each
39 other by at least 15 cm shall be provided. Length of each such bond stone shall
40 not be less than two-third of the thickness of the wall.

41 Where bond stones of suitable lengths are not available pre-cast cement
42 concrete block of 1:3:6 mix
43 (1 cement : 3 coarse sand: 6 graded stone aggregate 20 mm nominal size) of
44 cross section not less than
45 225 square centimeters and length

1 equal to the thickness.

2 At least one bond stone or a set of bond stones shall be provided at 1.5 m
3 to 1.8 m apart clear in every course. (Bond stones shall be marked suitably
4 with paint as directed by the Engineer-in-Charge).

5 **1.9 Quoin and Jamb Stones**

6 The quoin and jamb stones shall be of selected stones neatly dressed with
7 hammer or chisel to form the required angle. Quoin stones shall not be less
8 than 0.01 cum in volume. Height of quoins and jamb stones shall not be less
9 than 15 cm. Quoins shall be laid header and stretcher alternatively.

10 **1.10 Joints**

11 Stones shall be so laid that all joints are fully packed with mortar and chips.
12 Face joints shall not be more than 20 mm thick.

13 The joints shall be struck flush and finished at the time of laying when
14 plastering or pointing is not to be done. For the surfaces to be plastered or
15 pointed, the joints shall be raked to a minimum depth of 20 mm when the
16 mortar is still green.

17 **1.11 Scaffolding**

18 Single scaffolding having one set of vertical support shall be allowed. The
19 supports shall be sound and strong, tied together by horizontal pieces, over
20 which the scaffolding planks shall be fixed. The inner end of the horizontal
21 scaffolding member may rest in a hole provided in the masonry.
22 Such holes, however, shall not be allowed in pillars under one metre in width
23 or near the skew back of arches. The holes left in masonry work for supporting
24 scaffolding shall be filled and made good with cement concrete
25 1 : 3 : 6 (1 cement : 3 coarse sand : 6 stone aggregate
26 20 mm nominal size).

27 **1.12 Curing**

28 Masonry work in cement or composite mortar shall be kept
29 constantly moist on all faces for a minimum period of seven days. In
30 case of masonry with fat lime mortar curing shall commence two days after
31 laying of masonry and shall continue for at least seven days thereafter.

32 **1.13 Protection**

33 Green work shall be protected from rain by suitable covering.
34 The work shall also be suitably protected from damage, mortar dropping
35 and rain during construction.

36 **1.14 Measurements**

37 **1.14.1** The length, height and thickness shall be measured correct to a cm.
38 The thickness of wall shall be measured at joints excluding the bushing. Only
39 specified dimensions shall be allowed; anything extra shall be ignored. The
40 quantity shall be calculated in cubic metre nearest to two places of decimal.

41 **1.14.2** The work under the following categories shall be
42 measured separately. (i) From foundation to plinth
43 level (level one) :

44 (a) work in or under water and
45 or liquid mud, (b) work in or
46 under foul positions.

- 1 (i) Above plinth level and upto floor five level.
- 2 (ii) Above floor five level to every floor/floors or part thereof.
- 3 (iii) Stone masonry in parapet shall be measured together with the
- 4 corresponding item in the wall of the storey next below.

5 **1.14.3** No deduction shall be made nor extra payment
6 made for the following :

- 7 (i) Ends of dissimilar materials (that is joists, beams, lintels, posts,
8 girders, rafters purlins, trusses, corbels, steps etc.) upto 0.1 sqm in
9 section.
- 10 (ii) Openings each upto 0.1 sqm in area. In calculating the area of
11 openings, any separate lintels or sills shall be included alongwith the
12 size of opening but the end portions of the lintels shall be excluded and
13 the extra width of rebated reveals, if any, shall also be excluded.
- 14 (iii) Wall plates and bed plates, and bearing of chajjas and the like, where
15 the thickness does not
16 exceed 10 cm and the bearing does not extend over the full thickness of
17 the wall.
18 **Note:** The bearing of floor and roof shall be deducted from wall
19 masonry.
- 20 (iv) Drain holes and recesses for cement concrete blocks to embed hold
21 fasts for doors, windows etc.
- 22 (v) Building in masonry, iron fixture, pipes upto 300 mm dia, hold fasts of
23 doors and windows etc.
- 24 (vi) Forming chases in masonry each upto section of 350 sq cm.

25 Masonry (excluding fixing brick work) in chimney breasts with smoke or air
26 flues not exceeding 20 sq dm (0.20 sq m) in sectional area shall be measured
27 as solid and no extra payment shall be made for par getting and coring such
28 flues. Where flues exceed 20 sq dm (0.20 sq m) sectional area, deduction
29 shall be made for the same and par getting and coring flues shall be measured
30 in running metres stating size of flues and paid for separately. Aperture for fire
31 place shall not be deducted and no extra payment made for splaying of jambs
32 and throating.

33 **1.14.5** Apertures for fire places shall not be deducted and extra labour
34 shall not be measured for splaying of jambs, throating and making arch to
35 support the opening.

36 **1.14.6 Square or Rectangular Pillars:** These shall be measured as walls,
37 but extra payment shall be allowed for stone work in square or rectangular
38 pillars over the rate for stone work in walls. Rectangular pillar shall mean a
39 detached masonry support rectangular in section, such that its
40 breadth does not exceed two and a half times the thickness.

41 **1.14.7 Circular Pillars (Columns):** These shall be measured as
42 per actual dimensions, but extra payment shall be allowed for stone work
43 in circular pillars over the rate for stone work in walls. The diameter as well
44 as length shall be measured correct to a cm.

45 **1.14.8** Tapered walls shall be measured net, as per actual dimensions and
46 paid for as other walls.

1 **1.14.9 Curved Masonry:** Stone masonry curved on plan to a mean radius
2 exceeding 6 metres shall be measured and included with general stone work.
3 Stone work circular on plan to a mean radius not exceeding 6 metres
4 shall be measured separately and shall include all cuttings
5 and waste and templates. It shall be measured as the mean length of the
6 wall.

7 **1. 15 Rate**

8 The rate shall include the cost of materials and labour required for all the
9 operations described above and shall include the following :

- 10 (a) Raking out joints for plastering or pointing done as a separate item, or
11 finishing flush as the work proceeds.
12 (b) Preparing tops and sides of existing walls for raising and extending.
13 (c) Rough cutting and waste for forming gables cores, skew backs or
14 spandrels of arches, splays at eaves and all rough cutting in the body of
15 walling unless otherwise specified.
16 (d) Bond stones or cement concrete bond blocks.
17 (e) Leading and making holes for pipes etc.
18 (f) Bedding and pointing wall plates, lintels, sills etc. in or on walls,
19 bedding roof tiles and corrugated sheets in or on walls.
20 (g) Building in ends of joists, beams, lintels etc.

1 **LIST OF MANDATORY TESTS**

Material	Clause	Test	Field/ Laboratory	Test procedure	Min. qty of Material for Carrying out test	Frequenc y of Testing	
1	2	3	4	5	6	7	
Stone aggregate	2.1.2.2	(a) Percentage of soft or deleterious material	Field or Laboratory-Test as required	IS 2386-Part II	As required by Engineer-in-charge	For all quantities	
	2.1.2.3	Particle size	Field/ Lab	Appendix 'A'	45 cum	For every 45 cum or part thereof for RCC Work only. For rest of items as decided by Engineer-in-charge	
	2.1.2.5	(a)	Estimation of organic impurities	Field/ Lab	IS 2386-Part II	10 cum	For every 40 cum or part thereof
		(b)	Surface moisture	Field/ Lab	IS 2386	10 cum	-do-
		(c)	Determination of 10% fine value	Field/ Lab	IS 2386	10 cum	-do-
		(d)	Specific gravity	Field/ Lab	IS 2386	10 cum	-do-
		(e)	Bulk density	Field/ Lab	IS 2386	10 cum	-do-
		(f)	Aggregate crushing strength	Field/ Lab	IS 2386	10 cum	-do-
(g)	Aggregate impact value	Field/ Lab	IS 2386	10 cum	-do-		
Concrete	2.2.2	Slump test	Field	Appendix 'D'	10 cum	15 cum or part thereof	

1

LIST OF BUREAU OF INDIAN STANDARDS CODES

S.	I. S. No.	Subjec
1.	IS 383	Specification for coarse and fine aggregate from natural sources for concrete.
2.	IS 456	Plain and reinforced concrete - Code of practice
3.	IS 516	Method of test for strength of concrete
4.	IS 1199	Method of sampling and analysis of concrete
5.	IS 1200 (Part II)	Method of measurement of building and civil engineering work (concrete work)
6.	IS 1322	Specification for bitumen felt for water proofing and damp
7.	IS 1791	General requirements for batch type concrete mixers
8.	IS 2386	Method of test for aggregates for concrete
		(a) Part I - Particle size and shape
		(b) Part II - Estimation of deleterious materials and
		(c) Part III - Specific gravity, density, voids absorption and
		(d) Part IV - Mechanical properties.
		(e) Part V - Soundness
9.	IS 2505	General requirements for concrete vibrators - immersion type.
10.	IS 2506	General requirements for concrete vibrators - screed board concrete vibrators
11.	IS 2645	Specification for integral water proofing compounds for cement mortar and concrete
12.	IS 3068	Specification for broken brick (burnt clay) coarse aggregate for use in concrete.
13.	IS 3812	Specification for fly-ash for use as pozzolana and admixture in cement mortar and concrete.
14.	IS 4656	Specification for form vibrators for concrete.
15.	IS 7861 (Part-I)	Code of practice for extreme weather concreting (Part-I) recommended practice for hot weather concreting.
16.	IS 7861 (Part-II)	Code of practice for extreme weather concreting (Part-II) recommended.
17.	IS 9103	Specification for concrete admixtures

1 **4.1.8**
2 **Providing and laying in position cement concrete of specified grade**
3 **excluding the cost of centering and shuttering - All work up to plinth**
4 **level:**
5 **1:4:8 (1 cement: 4 fine sand: 8 graded stone aggregate 40mm nominal**
6 **size)**

7 **1. MATERIAL**

8 Water, cement, fine aggregate or sand, surkhi, and fly ash shall be as
9 specified in Chapter of Mortar.

10 **1.1 Coarse Aggregate**

11 **1.1.1 General:** Aggregate most of which is retained on 4.75 mm IS Sieve
12 and contains only as much fine material as is permitted in IS 383 for
13 various sizes and grading is known as coarse aggregate. Coarse
14 aggregate shall be specified as stone aggregate, gravel or brick
15 aggregate and it shall be obtained from approved/ authorized sources.

16 (a) *Stone Aggregate:* It shall consist of naturally occurring (uncrushed,
17 crushed or broken) stones. It shall be hard, strong, dense, durable and
18 clean. It shall be free from veins, adherent coating, and injurious
19 amounts of disintegrated pieces, alkali, vegetable matter and other
20 deleterious substances. It shall be roughly cubical in shape. Flaky
21 and elongated pieces shall be avoided. It shall conform to IS 383 unless
22 otherwise specified.

23 (b) *Gravel:* It shall consist of naturally occurring (uncrushed, crushed or
24 broken) river bed shingle or pit gravel. It shall be sound, hard and clean.
25 It shall be free from flat particles of shale or similar laminated material,
26 powdered clay, silt, loam, adherent coating, alkali, vegetable
27 matter and other deleterious substances. Pit gravel shall be washed if
28 it contains soil materials adhering to it. These shall conform to IS 383
29 unless otherwise specified.

30 (c) *Brick Aggregate:* Brick aggregate shall be obtained by breaking well
31 burnt or over burnt dense brick/ brick bats. They shall be homogeneous
32 in texture, roughly cubical in shape and clean. They shall be free
33 from unburnt clay particles. Soluble salt, silt, adherent
34 coating of soil, vegetable matter and other deleterious substances.
35 Such aggregate should not contain more than one percent of sulphates
36 and should not absorb more than 10% of their own mass of water, when
37 used in cement concrete. It shall conform to IS 306 unless otherwise
38 specified.

39 (d) Light weight aggregate such as sintered fly ash
40 aggregate may also be used provided the
41 Engineer-in-Charge is satisfied with the data on the proportion of
42 concrete made with them.

43 **1.1.2 Deleterious Material:** Coarse aggregate shall not contain
44 any deleterious material, such as pyrites, coal, lignite, mica, shale or
45 similar laminated material, clay, alkali, soft fragments, sea shells and organic
46 impurities in such quantity as to affect the strength or
47 durability of the concrete. Coarse aggregate to be used for reinforced

1 cement concrete. Coarse aggregate to be used for reinforced cement
 2 concrete shall not contain any material liable to attack the steel reinforcement.
 3 Aggregates which are chemically reactive with alkalis of cement shall not be
 4 used. The maximum quantity of deleterious material shall not be more than
 5 five percent of the weight of coarse aggregate when determined in accordance
 6 with IS 2386.

7 **1.1.3 Size and Grading**

- 8 (i) *Stone aggregate and gravel*: It shall be either graded or single sized
 9 as specified. Nominal size and grading shall be as under:-
 10 (a) Nominal sizes of graded stone aggregate or gravel shall be
 11 40, 20, 16, or 12.5 mm as
 12 Specified. For any one of the nominal sizes, the proportion of other
 13 sizes as determined by the method prescribed in Appendix 'A' of Chapter
 14 4 shall be in accordance with Table 2.1.

15 **TABLE 2.1**
 16 **Graded Stone Aggregate or Gravel**

IS Sieve Designatio	Percentage passing (by weight) for nominal			
	40 mm	20 mm	16 mm	12.5 mm
80 mm	100	-	-	-
63 mm	-	-	-	-
40 mm	95 to 100	100	-	-
20 mm	30 to 70	95 to 100	100	100
16 mm	-	-	90 to 100	-
12.5 mm	-	-	-	90 to 100
10 mm	10 to 35	25 to 55	30 to 70	40 to 85
4.75 mm	0 to 5	0 to 10	0 to 10	0 to 10

- 17 (b) Nominal sizes of single sized stone aggregate or gravel shall be 63,
 18 40, 20, 16, 12.5 or 10 mm as specified. For any one of the nominal size,
 19 the proportion of other sizes as determined by the method prescribed in
 20 Appendix 'A' of Chapter Concrete work shall be in accordance with Table
 21 2.2.

22 **TABLE 2.2**
 23 **Single Sized (Ungraded)**
 24 **Stone Aggregate or Gravel**

IS Sieve Designati	Percentage passing (by weight) for nominal					
	63 mm	40 mm	20 mm	16 mm	12.5	10 mm
80 mm	100	-	-	-	-	-
63 mm	85-100	100	-	-	-	-
40 mm	0-30	85-100	100	-	-	-
20 mm	0- 5	0-20	85-100	100	-	-
16 mm	-	-	-	85-100	100	-
12.5 mm	-	-	-	-	85-100	100
10 mm	0-5	0-5	0-20	0-30	0-45	85-100
4.75 mm	-	-	0-5	0-5	0-10	0-20
2.36 mm	-	-	-	-	-	0-5

1 (c) When stone aggregate or gravel brought to site is single sized
 2 (ungraded), it shall be mixed with single sized aggregate of different
 3 sizes in the proportion to be determined by field tests to obtain graded
 4 aggregate of specified nominal size. For the required nominal size, the
 5 proportion of other sizes in mixed aggregate as
 6 determined by method prescribed in Appendix 'A' of Chapter 4
 7 shall be in accordance with Table 2.1. Recommended proportions by
 8 volume for mixing of different sizes of single size (ungraded)
 9 aggregate to obtain the required nominal size of graded aggregate are
 10 given in Table 2.3.

11 **TABLE 2.3**
 12 **Single Sized (Ungraded)**
 13 **Stone Aggregate or Gravel**

Cement concrete	Nominal size of graded aggregate	Parts of single size aggregate of				
		50 mm	40 mm	20 mm	12.5 mm	10 mm
(1	(2	(3	(4	(5	(6	(7
1:6:12	63	9	-	3	-	-
1:6:12	40	-	9	3	-	-
1:5:10	63	7.5	-	2.5	-	-

(1	(2	(3	(4	(5	(6	(7
1:5:10	40	-	7.5	2.5	-	-
1:4:8	63	6	-	2	-	-
1:4:8	40	-	6	2	-	-
1:3:6	63	4.5	-	1.5	-	-
1:3:6	40	-	4.5	1.5	-	-
1:3:6	20	-	-	4.5	-	1.5
1:2:4	40	-	2.5	1	-	1.5
1:2:4	20	-	-	3	-	1
1:2:4	12.5	-	-	-	3	1
1: 1 ¹ / ₂ :3	20	0	0	2	-	1

14 **Note:**

15 (i) The proportions indicated in Table 2.3 above are by
 16 volume when considered necessary, these proportions may be
 17 varied marginally by Engineer-in-Charge after making sieve analysis of
 18 aggregate brought to site for obtaining required graded aggregate. No
 19 adjustments in rate shall be made for any variation in the proportions
 20 so ordered by the Engineer-in-Charge. If single size coarse
 21 aggregate are not premixed at site to obtain the graded
 22 coarse aggregate required for the mix, the volume of single
 23 size aggregates required for the mix shall be suitably increased to
 24 account for reduction in total volume at the site of mixing.

25 (ii) *Brick Aggregate:* Nominal size of brick aggregate shall be 40 mm and
 26 its grading shall be as specified in Table 2.4 when tested for sieve
 27 analysis for the method prescribed in Appendix 'A' of Chapter 2.0.

1 **TABLE 2.4**
2 **Brick Aggregate**

<i>IS Sieve Designation</i>	<i>Percentage passing (by</i>
75 mm	100
37.5 mm	95-100
20.0 mm	45-100
4.75 mm	0.50

3 **1.1.4 Stacking:** Aggregate shall be stacked on a hard, dry and level patch
4 of ground. When stack piling, the aggregate shall not form pyramids resulting
5 in segregation of different sized materials. It shall be stacked separately
6 according to nominal size of coarse aggregates. Stacking shall be done in
7 regular stacks, of height not exceeding 100 cm.

8 **1.1.5 Testing:** Coarse aggregate shall be tested for the followings (as per IS
9 2386)

- 10 (a) Determination of particle size and shape (Appendix 'A' of Concrete
11 work)
12 (b) Estimation of organic impurities (as per IS 2386 - Part II)
13 (c) Surface moisture (Appendix 'B' of Concrete work)
14 (D) Determination of 10% fine value (Appendix 'C' of Concrete work)

15 **1.1.6 Measurements:** The aggregates shall be measured in
16 stacks and paid for after making a deduction of 7.5% of the gross
17 measurements of stacks in respect of aggregates of nominal size 40 mm and
18 above. No deduction from the gross measurements of the stacks
19 is to be made in respect of aggregate of nominal size below 40 mm.

20 **1.2 Chemical Admixtures**

21 When required, admixtures of approved quality shall be mixed
22 with concrete, as specified. The admixtures shall conform to IS 9103
23 and as specified in - R.C.C work.

24 **1.2.1** Admixtures may be any one of the following classes for use in concrete:-

- 25 (a) Water Reducing Admixtures
26 (b) Retarding Admixtures
27 (c) Accelerating Admixtures.
28 (d) Water Reducing and Retarding Admixtures.
29 (e) Water Reducing and Accelerating Admixtures.
30 (f) Permeability reducing (water proofing) Admixtures.

31 **1.2.2 Liquid Admixtures:** Admixtures introduced into the concrete as liquids
32 generally fall into the following categories.

- 33 (a) Air Entraining.
34 (b) Water Reducing.
35 (c) Water Reducing Retarders.
36 (d) Retarders.
37 (e) Water Reducing Accelerators.
38 (f) Accelerators.

39 **1.2.3** Dosage of these admixtures may vary according to

1 manufacturer's specification.

2 **1.2.4** Two or more admixtures may not be compatible in the same solution.
3 It is therefore mandatory that when two admixtures manufactured by the
4 same manufacturers is being used simultaneously, the manufacturer shall
5 certify their compatibility. In case the two or more admixtures
6 are produces by different manufacturers, then, before their use in
7 concrete, test shall be performed by the manufacturer to establish their
8 compatibility, all such test reports shall be furnished to the
9 Engineer-in-Charge for his approval before their use in concrete.

10 **1.2.5** Some admixture may be in the form of powder, particle or high
11 concentration liquids which may require mixing with water prior to dosing.
12 Under these conditions water in solution shall be considered as part of total
13 water content in the batch in order to maintain the water-cement ratio.

14 **1.2.6** Admixture manufacturer's recommendation shall be carefully followed
15 so as to ensure complete solution of the product or to prepare a standard
16 solution of uniform strength for easier use.

17 **1.2.7** Certain admixtures may contain significant amounts of finely divided
18 insoluble materials or active ingredients which may or may not be readily
19 soluble. It is essential for such admixtures that precautions be taken to
20 ensure that these constituents be kept in a state of uniform
21 suspension before actual batching. When relatively small amounts of
22 powdered admixtures are to be used directly, these shall be pre-blended with
23 cement.

24 **1.2.8** Admixtures are sold under various trade names and may be in the form
25 of liquids or powders. The proprietary name and the net quantity of content
26 shall be clearly indicated in each package or container of admixtures. The
27 admixtures shall be uniform within each batch and uniform between all
28 batches.

29 **1.2.9** No admixtures shall be accepted for use in concrete unless these are
30 tested in accordance with
31 IS 9103 and the test results are approved by the
32 Engineer-in-Charge.

1 **2. CEMENT CONCRETE**2 **2.1 Grades of Cement Concrete**

3 The concrete shall be in grade designated as under:

4 **TABLE 2.5**5 **Grades of Concrete**

<i>Group</i>	<i>Grade Designation</i>	<i>Specified characteristic compressive strength of 150 mm Cube at 28</i>
(1)	(2)	(3)
Ordinary Concrete	M10	10
	M15	15
	M20	20
Standard Concrete	M25	25
	M30	30
	M35	35
	M40	40
	M45	45
	M50	50
	M55	55
High Strength Concrete	M60	60
	M65	65
	M70	70
	M75	75
	M80	80

6 **Notes:**

- 7 1. In the designation of concrete mix M refers to the
8 mix and the number to the specified compressive strength of
9 150 mm size cube at 28 days, expressed in N/mm².
- 10 2. For concrete of compressive strength greater than M55, design
11 parameters given in the standard may not be applicable and
12 the values may be obtained from specialized literatures
13 and experimental results.

14 **2.1.1** The characteristic strength is defined as the strength of material below
15 which not more than 5 percent of the test results are expected to fall.

16 **TABLE 2.6**

17 **Minimum Cement Content, Maximum**
18 **Water-Cement Ratio and Minimum**
19 **Grade of Concrete for Different**
20 **Exposures with Normal Weight**
21 **Aggregates of 20 mm Nominal;**
22 **Maximum Size**

Sl. No	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content	Maximum Free Water Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content	Maximum Free Water-Cement	Minimum Grade of Concrete
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(i)	Mild	220	0.60	-	300	0.5	M20
(ii)	Moderate	240	0.60	M15	300	0.5	M25
(iii)	Severe	250	0.50	M20	320	0.4	M30
(iv)	Very Severe	260	0.45	M20	340	0.4	M35
(v)	Extreme	280	0.40	M25	360	0.4	M40

1 **Notes:**

- 2 1. Cement content prescribed in this Table is irrespective of the grades
3 of cement. The additions such as fly or ground granulated blast furnace
4 slag may be taken into account in the concrete composition with
5 respect to the cement content and water-cement ratio, if
6 the suitability is established and as long as the maximum amounts
7 taken into account do not exceed the limit of pozzolona and slag
8 specified in IS 1489 (Part 1) and IS 455 respectively.
- 9 2. Minimum grade for plain concrete under mild exposure condition is not
10 specified.
- 11 3. The above minimum cement content and maximum water cement
12 ratio apply only to 20 mm nominal maximum size aggregate. For other
13 sizes of aggregate, these should be changed as per Table 6 of IS 456.

14 The minimum grade of concrete for plain and reinforced concrete shall be as per
15 Table 2.6.

16 **2.1.2** Concrete of grades lower than those given in Table 2.6
17 may be used for lean concrete, foundation for masonry walls or
18 temporary reinforced concrete construction.

19 **2.2 Workability of Concrete**

20 **2.2.1** The concrete mix proportion chosen should be such that the concrete
21 is of adequate workability for the placing conditions of the concrete and can
22 properly be compacted with the means available. Suggested ranges of
23 workability of concrete measured in accordance with IS 1199 are given below:

Placing Conditions	Degree of Workability	Slump (mm)
(1	((

Blinding concrete: shallow sections: Pavements using pavers	Very low	See 2.2.2.2
Mass concrete: Lightly reinforced sections in slabs, beams, wall, columns, floors	Low	25-75
Hand placed pavements: canal lining; Strip footing	Medium	50-100
Heavily reinforced sections in slabs, beams,		
Slip form work: Pumped concrete	Medium	75-100
Trench fill	High	100-150
Tremie concrete	Very High	See 2.2.2.3

1 **Note:-** For most of the placing conditions, internal
2 vibrators (needle vibrators) are suitable. The diameter of the
3 needle shall be determined based on the density and spacing of
4 reinforcement bars and thickness of sections. For tremie concrete,
5 vibrators are not required to be used (see also 2.7)

6 **2.2.2** In the 'very low' category of workability where strict control is necessary,
7 for example, pavement quality concrete, measurement of workability
8 be determination of compacting factor will be more appropriate
9 than slump (see IS 1199) and a value of compacting factor of 0.75 to 0.80 is
10 suggested.

11 **2.2.3** In the 'very high' category of workability, measurement of workability by
12 determination of flow will be appropriate (see IS 9103).

13 **2.3 Concrete Mix Proportioning**

14 **2.3.1** The determination of the proportion of cement, aggregate
15 and water to attain the required strength shall be made as follows:

16 (a) *By designing the concrete mix:* such concrete shall be called 'Design
17 mix concrete', for details

18 Reference may be made to RCC work Chapter.

19 (b) *By adopting nominal concrete mix:* such concrete shall be called
20 'Nominal mix concrete'.

21 Design mix concrete is preferred to nominal mix. If design mix concrete
22 cannot be used for any reason on the work for grades of M20 or lower,
23 nominal mixes may be used with the permission of Engineer-in-Charge, which,
24 however, is likely to involve a higher cement content.

25 **2.3.2 Nominal Mix Concrete:** Nominal Mix Concrete may be used for
26 concrete of M20 or lower. The proportions of materials for nominal mix
27 concrete shall be in accordance with Table 2.7.

28 The cement content of the mix specified in Table 2.7 for any nominal mix shall
29 be proportionately increased if the quantity of water in the mix has to be

1 increased to overcome the difficulty of placement and compaction, so that the
2 water cement ratio as specified is not exceeded.

3 **TABLE 2.7**
4 **Proportions for Nominal Mix Concrete**

Grade of Concrete	Total Quantity of Dry Aggregates by Mass per 50 kg of cement, to be taken as the Sum of the Individual Masses of Fine and Coarse	Proportion of Fine Aggregate to Coarse Aggregate (by Mass)	Quantity of Water per 50 kg of Cement, max Ltr.
(1)	(2)	(3)	(4)
M5	800	Generally 1:2 but subject to an upper limit of 1: 1 ½ and a lower limit of 1:2 ½	60
M7.5	625		45
M10	480		34
M15	330		32
M20	250		30

5 **Note :** - The proportion of the fine to coarse
6 aggregate should be adjusted from upper limit
7 progressively as the grading of fine aggregate becomes finer and
8 the maximum size of coarse aggregate becomes larger. Graded coarse
9 aggregate shall be used.

10 **Note:** - Quantity of water required from durability point of view may be
11 less than the value given

12 Above.

13 **Example**

14 For an average grading of fine aggregate (that is, Zone II of Table 4 of IS
15 383), the proportions shall be 1:1 ½, 1:2 and 1:2 ½ for maximum size
16 of aggregates 10 mm, 20 mm and 40 mm respectively.

17 **2.2.4 Batching**

18 To avoid confusion and error in batching, consideration should
19 be given to using the smallest practical number of different concrete
20 mixed on any site or in any one plant. In batching concrete, the quantity of
21 both cement and aggregate shall be determined by mass; admixture, if solid,
22 by mass: liquid admixture may however be measured in volume or mass:
23 water shall be weighed or measured by volume in a calibrated tank (see also
24 IS 4925).

25 Ready-mixed concrete supplied by ready-mixed concrete plant shall be
26 preferred. For large and medium project sites the concrete shall be sourced
27 from ready-mixed concrete plants or from on site or off site batching and
28 mixing plants (see IS 4926).

29 **2.4.1** Except where it can be shown to the satisfaction of the
30 Engineer-in-Charge that supply of properly graded aggregate of
31 uniform quality can be maintained over a period of work, the grading

1 aggregate should be controlled by obtaining the coarse aggregate in different
 2 sizes and blending them in the right proportions when required, the
 3 different sizes being stocked in separate stock-piles. The material
 4 should be stock-piled for several hours preferably a day before use. The
 5 grading of coarse and fine aggregate should be checked as
 6 frequently as possible, the frequency for a given job being
 7 determined by the Engineer-in-Charge to ensure that the specified grading is
 8 maintained.

9 **2.4.2** The accuracy of the measuring equipment shall be within ± 2 percent
 10 of the quantity of cement being measured and within ± 3 percent
 11 of the quantity of aggregate, admixtures and water being
 12 measured.

13 **2.4.3** Proportion/Type and grading of aggregates shall be made by trial in
 14 such a way so as to obtain densest possible concrete. All ingredients of the
 15 concrete should be used by mass only.

16 **2.4.4** Volume batching may be allowed only where weigh-batching is
 17 not practicable and provided accurate used in concrete have earlier
 18 been established. Allowance for bilking shall be made in accordance
 19 with IS 2386 (Part 3). The mass volume relationship should be checked as
 20 frequently as necessary, the frequency for the given job being determined by
 21 Engineer-in-Charge to ensure that the specified grading is maintained.

22 **2.4.5** It is important to maintain the water cement ratio constant at its correct
 23 value. To this end, determination of moisture contents in both fine and
 24 coarse aggregates shall be made as frequently as possible, the frequency
 25 for a given job being determined by the Engineer-in-Charge
 26 according to weather conditions. The amount of the added water shall be
 27 adjusted to compensate for any observed variations in the moisture contents.
 28 For the determination of moisture content in the aggregates, IS 2386 (Part 3)
 29 may be referred to. To allow for the variation in mass for aggregate due to
 30 variations in their moisture content, suitable adjustments in the masses of
 31 aggregates shall be made. In the absence of exact data, only in the case of
 32 nominal mixes, the amount of surface water may be estimated from the
 33 values given in Table 2.8.

34 **TABLE 2.8**
 35 **Surface Water Carried by Aggregate**

Sl No.	Aggregate	Approximate Quantity of Surface Water	
		Percent by mass	l/m³
(i)	Very wet sand	7.5	120
(ii)	Moderately wet sand	5.0	80
(iii)	Moist sand	2.5	40
(iv)	Moist gravel or crushed rock	1.25-2.5	20-40

Pe

2.4.6 No substitutions in materials used on the work or alteration in the established proportions, except as permitted in 2.4.4 and 2.4.5 shall be made without additional tests to show that the quality and strength of concrete are satisfactory.

2.5 Mixing

Concrete shall be mixed in mechanical batch type concrete mixers conforming to IS 1791 having two blades and fitted with power loader (lifting hopper type). Half bag mixers and mixers without lifting

Hoppers shall not be used for mixing concrete. In exceptional circumstances, such as mechanical break

down of mixer, work in remote areas or power breakdown and when the quantity of concrete work is very small, hand mixing may be done with the specific prior permission of the Engineer-in-Charge in writing subject to adding 10% extra cement. When hand mixing is permitted, it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the concrete is uniform in color and consistency. Before mixing the brick aggregate shall be well soaked with water for a minimum period of two hours and stone aggregate or gravel shall be washed with water to remove, dirt, dust and other foreign materials. For guidance, the mixing time may be 1 1/2 to 2 minutes, for

Hydrophobic cement it may be taken

as 2 1/2 to 3 minutes.

2.5.1 Power Loader: Mixer will be fitted with a power loader complying with the following requirements.

- (a) The hopper shall be of adequate capacity to receive and discharge the maximum nominal batch of unmixed materials without spillage under normal operating conditions on a level site.

Note: In such a case the volume of the maximum nominal batch of mixed material is 50% Greater than the nominal mixed batch capacity.

- (b) The minimum inside width of the feeding edge of the hopper shall be as specified below in Table

2.9.

TABLE 2.9

Nominal size of mixer (T, NT or R). litre	Minimum inside width of hopper feeding edge
140	1.0
200	1.1
280	1.2
375	1.4
500	1.5
1000	2.0

T = Tilting;

NT = Non-tilting;

R = Reverse

- (c) The design of the loader shall be such that it allows the loading hopper to be elevated to such a height that the center line of the chute plate of the hopper when in discharge position, is at an angle of not less than

50° to the horizontal. A mechanical device to aid discharge of the contents as quickly as possible from the hopper to the drum may also be provided. Even when a mechanical device is provided, it is recommended that the angle of center line of the chute plate of the hopper when in discharge position, should be as larger as practicable, preferably not less than 40° to horizontal.

- (d) When the means of raising and lowering the loading hopper includes flexible wire ropes winding on to a drum or drums, the method of fastening the wire to rope to the drums shall be such as to avoid, as far as possible any tendency to cut the strands of the ropes and the fastening should preferably be positioned clear of the barrel of the drum for example, outside the drums flange. When the loading hopper is lowered to its normal loading position, these should be at least one and a half drums of rope on the drum.
- (e) Clutch brake and hydraulic control lever shall be designed so as to prevent displacement by liberation or by accidental contact with any person.
- (f) The clutch and brake control arrangements shall also be so designed that the operator can control the falling speed of the loader.
- (g) Safety device shall be provided to secure the hopper in raised position when not in use.

2.5.2 Mixing Efficiency: The mixer shall be tested under normal working conditions in accordance with the method specified in IS 4643 with a view to check its ability to mix the ingredients to obtain concrete having uniformity within the prescribed limits. The uniformity of mixed concrete shall be evaluated by finding the percentage variation in quantity (mass in water) of cement, fine aggregate and coarse aggregate in a freshly mixed batch of concrete.

The percentage variation between the quantities of cement, fine aggregate and coarse aggregates (as found by weighing in water) in the two halves of a batch and average of the two halves of the batch shall not be more than the following limits:

Cement	8%
Fine aggregate	6%
Coarse aggregate	5%

2.5.3 Machine Mixing: The mixer drum shall be flushed clean with water. Measured quantity of coarse aggregate shall be placed first in the hopper. This shall be followed with measured quantity of fine aggregate and then cement. In case fine aggregate is damp, half the required quantity of coarse aggregate shall be placed in the hopper, followed by fine aggregate and cement. Finally the balance quantity of coarse aggregate shall be fed in the hopper, & then the dry materials are slipped into the drum by raising the hopper. The dry material shall be mixed for at least four turns of the drum. While the drum is rotating, water shall be added gradually to achieve the water cement ratio as specified or as required by the

Engineer-in-Charge. After adding water, the mixing shall be continued until concrete of uniform color, uniformly distributed material and consistency is obtained. Mixing shall be done for at least two minutes after adding water. If there is segregation after unloading from the mixer, the concrete should be remixed.

The drum shall be emptied before recharging. When the mixer is closed down for the day or at any time exceeding 20 minutes, the drum shall be flushed cleaned with water.

2.5.4 Hand Mixing: When hand mixing has been specifically permitted in exceptional circumstances by the Engineer-in-Charge in writing, subject to adding 10% extra cement, it shall be carried out on a smooth, clean and water tight platform of suitable size. Measured quantity of sand shall be spread evenly on the platform and the cement shall be dumped on the sand and distributed evenly. Sand and cement shall be mixed intimately with spade until mixture is of even color throughout. Measured quantity of coarse aggregate shall be spread on top of cement sand mixture and mixing done by scowling and turning till the coarse aggregate gets evenly distributed the cement sand mixture. Three quarters of the total quantity of water required shall be added in a hollow made in the middle of the mixed pile and the material is turned towards the middle of pile with spade. The whole mixture is turned slowly over and again and the remaining quantity of water is added gradually. The mixing shall be continued until concrete of uniform color and consistency is obtained. The mixing platform shall be washed and cleaned at the end of the day.

2.5.5 Transportation and Handling : Concrete shall be transported from the mixer to the place of laying as rapidly as possible by methods which will prevent the segregation or loss of any of the ingredients and maintaining the required workability.

During hot or cold weather, concrete shall be transported in deep containers, other suitable methods to reduce the loss of water by evaporation in hot weather and heat loss in cold weather may also be adopted.

2.6 Placing

The concrete shall be deposited as nearly as practicable in its final position to avoid rehandling. It shall be laid gently (not thrown) and shall be thoroughly vibrated and compacted before setting commences and should not be subsequently disturbed. Method of placing shall be such as to preclude segregation. Care shall be taken to avoid displacement of reinforcement or movement of form work and damage due to rains. As a general guidance, the maximum free fall of concrete may be taken as 1.5 metre.

2.7 Compaction

Concrete shall be thoroughly compacted and fully worked around embedded fixtures and into corners of the form work. Compaction shall be done by mechanical vibrator of appropriate type till a dense concrete is obtained. The mechanical vibrators shall conform to IS 2505, IS 2506, IS 2514 and IS 4656. To prevent segregation, over vibration shall be avoided.

Compaction shall be completed before the initial setting starts. For the items where mechanical vibrators are not to be used, the contractor shall take permission of the Engineer-in-Charge in writing before the start of the work. After compaction the top surface shall be finished even and smooth with wooden trowel before the concrete begins to set.

2.8 Construction Joints

Concreting shall be carried out continuously upto construction joints. The position and arrangement of construction joints shall be as shown in the structural drawings or as directed by the Engineer-in-Charge. Number of such joints shall be kept minimum. Joints shall be kept as straight as possible. Construction joints should comply with IS 11817.

2.8.1 When the work has to be resumed on a surface which has hardened, such surface shall be roughened. It shall then be swept clean and thoroughly wetted. For vertical joints, neat cement slurry, of workable consistency by using 2 kgs of cement per sqm shall be applied on the surface before it is dry. For horizontal joints, the surface shall be covered with a layer of mortar about 10-15 mm thick composed of cement and sand in the same ratio as the cement and sand in concrete mix. This layer of cement slurry or mortar shall be freshly mixed and applied immediately before placing of the concrete.

2.8.2 Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of particles of coarse aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement slurry @ 2 kgs of cement per sqm. On this surface, a layer of concrete not exceeding 150 mm in thickness shall first be placed and shall be well rammed against old work particular attention being paid to corners and close spots; work, thereafter, shall proceed in the normal way.

2.9 Concreting under Special Conditions

2.9.1 *Work in Extreme Weather Conditions:* During hot and cold weather, the concreting shall be done as per the procedure set out in IS 7861 (Part-I)-1975 and IS 7861 (Part II)-1981 respectively. Concreting shall not be done when the temperature falls below 4.5°C. In cold weather, the concrete placed shall be protected against frost. During hot weather, it shall be ensured that the temperature of wet concrete does not exceed 38°C.

2.9.2 *Under Water Concreting:* Concrete shall not be deposited under water if it is practicable to de-water the area and place concrete in the regular manner. When it is necessary to deposit concrete under water, the methods, equipment, materials and proportions of the mix to be used shall be submitted to and approved by the Engineer-in-Charge before the work is started.

Under-water concrete should have a slump recommended in 2.2.2. The water-cement ratio shall not exceed 0.6 and may need to be smaller, depending on the grade of concrete or the type of chemical attack. For aggregates of 40 mm maximum particle size, the cement content shall be at

least 350 kg/m³ of concrete.

2.9.3 Concrete in Sea Water: Concrete in sea-water or exposed directly along the sea-coast shall be at least M20 Grade in the case of plain concrete and M30 in case of reinforced concrete. The use of slag or pozzolana cement is advantageous under such conditions.

- (i) Special attention shall be given to the design of the mix to obtain the densest possible concrete: slag, broken brick, soft lime stone, soft sandstone, or other porous or weak aggregates shall not be used.
- (ii) As far as possible, preference shall be given to precast members unreinforced, well-cured and hardened, without sharp corners, and having trowel-smooth finished surfaces free from crazing, cracks or other defect; plastering should be avoided.
- (iii) No construction joints shall be allowed within 600 mm below low water-level or within 60 mm of the upper and lower planes of wave action. Where unusually severe conditions or abrasion are anticipated, such parts of the work shall be protected by bituminous or silicon-fluoride coatings or stone facing bedded with bitumen.
- (iv) In reinforced concrete structures, care shall be taken to protect the reinforcement from exposure to saline atmosphere during storage, fabrication and use. It may be achieved by treating the surface of reinforcement with cement wash or by suitable methods.

2.10 Curing

Curing is the process of preventing loss of moisture from the concrete. The following methods shall be employed for effecting curing.

2.10.1 Moist Curing: Exposed surfaces of concrete shall be kept continuously in a damp or wet condition by ponding or by covering with a layer of sacking, canvas, Hessian or similar materials and kept constantly wet for at least 7 days from the date of placing concrete in case of ordinary Portland cement and at least 10 days where mineral admixtures or blended cements are used. The period of curing shall not be less than 10 days for concrete exposed to dry and hot weather conditions. In the case of concrete where mineral admixtures or blended cements are used, it is recommended that above minimum periods may be extended to 14 days.

2.10.2 Membrane Curing : Approved curing compounds may be used in lieu of moist curing with the permission of the Engineer-in-Charge. Such compound shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set. Impermeable membrane such as polythene sheet covering the concrete surface may also be used to provide effective barrier against the evaporation.

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

2.10.4 Over the foundation concrete, the masonry work may be started after 48 hours of its compaction but the curing of exposed surfaces of cement concrete shall be continued along with the

masonry work for at least 7 days. And where cement concrete is used as base concrete for flooring, the flooring may be commenced before the curing period of base concrete is over but the curing of base concrete shall be continued along with top layer of flooring for a minimum period of 7 days.

2.11 Testing of Concrete

Testing of concrete shall be done as described in chapter of R.C.C.

2.12 Form Work

Form work shall be as specified in R.C.C. chapter and shall be paid for separately unless otherwise specified.

2.13 Finishes

Plastering and special finishes other than those, obtained through form work shall be specified and paid for separately unless otherwise specified.

2.14 Durability of Concrete

A durable concrete is one that performs satisfactorily in the working environment during its anticipated exposure conditions during service. The materials and mix proportions shall be such as to maintain its integrity and, if applicable, to protect reinforcement from corrosion.

The factors influencing durability include:

- (a) The environment;
- (b) The cover to embedded steel;
- (c) The type and quality of constituent materials;
- (d) The cement content and water/ cement ratio of the concrete;
- (e) Workmanship, to obtain full compaction and efficient curing; and
- (f) The shape and size of the member.

2.14.1 Requirements for Durability

2.14.1.1 General Environment: The general environment to which the concrete will be exposed during its working life is classified into five levels of severity, that is, mild, moderate, severe, very severe and extreme as described in Table 2.9.

**TABLE 2.9
Environmental Exposure Conditions**

Sl. No	Environment	Exposure
(1)	(2)	(3)
(i)	Mild	Concrete surfaces protected against weather or aggressive conditions, except those situated in
(ii)	Moderate	Concrete surfaces sheltered from severe rain or freezing whilst wet Concrete exposed to condensation and rain Concrete continuously under water Concrete in contact or buried under non-aggressive
(iii)	Severe	Concrete surfaces exposed to severe rain, alternate wetting and drying or occasional freezing whilst wet or severe condensation. Concrete completely immersed in sea water. Concrete exposed to coastal environment.

(1)	(2)	(3)
(iv)	Very severe	Concrete surface exposed to sea water spray, corrosive fumes or severe freezing conditions whilst wet. Concrete in contact with or buried under aggressive sub-soil/ ground water.
(v)	Extreme	Surface of members in tidal zone. Members in direct contact with liquid/ solid

Note: For the purpose of determining exposure conditions, all places within a distance of 10 kms. of coastal line, sea front would be treated as coastal area.

2.14.1.2 Freezing and Thawing : Where freezing and thawing actions under wet conditions exist, enhanced durability can be obtained by the use of suitable air entraining admixtures. When concrete lower than grade M50 is used under these conditions, the mean total air content by volume of the fresh concrete at the time of delivery into the construction should be:

Nominal	Maximum	Size	Entrained Air Percentage
	20		5 ± 1
	40		4 ± 1

2.14.1.3 Exposure to Sulphate Attack : For the very high sulphate concentration in Class 5 conditions given in Table 2.11, some form of lining such as polyethylene or polychloroprene sheet; or surface coating based on asphalt, chlorinated rubber, epoxy; or polyurethane materials should also be used to prevent access by the sulphate solution.

2.14.1.4 Chlorides in Concrete: The total amount of chlorides content (as Cl) in the concrete at the time of placing shall be as under:

SI. No.	Type of Use of Concrete	Maximum Total Acid Soluble Chloride Content expressed as %
(1)	(2)	(3)
(i)	Concrete containing metal and steam cured at elevated temperature	0
(ii)	Reinforced concrete or plain concrete containing embedded metal	0
(iii)	Concrete not containing embedded metal or any material requiring protection from	3

2.14.1.5 Sulphates in Concrete : The total water-soluble sulphate content of the concrete mix, expressed as SO₃ should not exceed 4 per cent by mass of the cement in the mix. The sulphate content should be calculated as the total from the various constituents of the mix. The 4 per cent limit does not apply to concrete made with supersulphate cement

TABLE 2.11
Requirements for Concrete
Exposed to Sulphate Attack

Sl No.	Class	Concentration of sulphates, Expressed as SO₃ Concrete.			Type of Cement	Dense, Fully compacted made with 20 mm nominal maximum size	
		In Soil		In Ground Water (g/l)		Minimum Cement Content 3 kg/m	Maximum Free Water - Cement Ratio
		Total SO₃ (%)	SO₃ in 2:1 (Water: Soil Extract) (g/l)				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(i)	1	Traces (<0.2)	Less than 1.0	Less than 0.3	Ordinary Portland cement or Portland slag cement or	280	0.55
(ii)	2	0.2 to 0.5	1.0 to 1.9	0.3 to 1.2	Ordinary Portland cement or Portland slag cement or	330	0.50
					Supersulphated cement or sulphate	310	0.50
(iii)	3	0.5 to 1.0	1.9 to 3.1	1.2 to 2.5	Supersulphated cement or sulphate	330	0.50
					Portland Pozzolana cement or Portland slag	350	0.45

IIMU				Plantation Tender			
(iv)	4	1.0 to 2.0	3.1 to 5.0	2.5 to 5.0	Supersulphated or sulphate resisting Portland cement	370	0.45
(v)	5	More than 2.0	More than 5.0	More than 5.0	Sulphate resisting Portland cement	400	0.40

Notes

- Cement content given in this Table is irrespective of grades of cement.
- Use of supersulphated cement is generally restricted where the prevailing temperature is above 40°C.
- Supersulphated cement gives an acceptable life provided that the concrete is dense and prepared with a water-cement ratio of 0.4 or less, in mineral acids, down to pH 3.5.
- The cement contents given in col. 7 of this Table are the minimum recommended. For SO₃ Contents near the upper limit of any class, cement contents above these minimum are advised.
- For severe conditions, such as thin sections under hydrostatic pressure on one side only and sections partly immersed, considerations should be given to a further reduction of water-cement ratio.
- Portland slag cement conforming to IS 455 with slag content more than 50 per cent exhibits better sulphate resisting properties.
- Where chloride is encountered along with sulphates in soil or ground water, ordinary Portland cement with C₃A content from 5 to 8 per cent shall be desirable to be used in concrete, instead of sulphate resisting cement. Alternatively, Portland slag cement conforming to IS 455 having more than 50 per cent slag or a blend of ordinary Portland cement and slag may be used provided sufficient information is available on performance of such blended cements in these conditions.

2.15 Measurements

2.15.1 Dimensions of length, breadth and thickness shall be measured correct to nearest cm. except for the thickness of slab and partition which shall be measured to nearest 5 mm. Areas shall be worked out to nearest 0.01 sqm and the cubic contents of consolidated concrete shall be worked out to nearest

0.01 Cum. Any work done in excess over the specified dimension or sections shown in the drawing shall be ignored.

2.15.2 Concrete work executed in the following conditions shall be measured separately:

- Work in or under water
- Work in liquid mud

(c) Work in or under foul positions

2.15.3 *Cast-in-situ concrete* and or precast concrete work shall be measured in stages described in the item of work, such as:

- (a) At or near the ground level
- (b) Upto specified floor level
- (c) Between two specified floor levels
- (d) Upto specified height above or depth below plinth level/ defined datum level.
- (e) Between tow specified heights or depths with reference to plinth/defined datum level.

2.15.4 No deduction shall be made for the following:

- (a) Ends of dissimilar materials for example beams, posts, girders, rafters, purlins, trusses, corbels and steps upto 500 sq cm in cross sections.
- (b) Opening upto 0.1 sq metre (1000 sq.cm)
- (c) Volume occupied by pipes, conduits, sheathing etc. not exceeding 100 sq. cm each in cross sectional areas.
- (d) Small voids such as shaded portions in Figure A to J below when these do not exceed 40 sq cm each in cross section.

Note: In calculating area of opening, the thickness of any separate lintel or sill shall be included in the height. Nothing extra shall be payable for forming such openings or voids.

Area of Fig. A to G shall be = $L \times B$

Area of Fig. H & J shall be = $L \times \{\text{Average of } B \text{ and } B'\}$

DETERMINATION OF PARTICLE SIZE

The apparatus, sample size and test procedure shall be same as specified in sub-head 'MORTARS'. In order that the sieves shall not be overloaded, care must be taken to ensure that the maximum Sieve loads shown in Table A-2.1 (below) are not exceeded at the completion of sieving.

TABLE A-2.1

I.S. Designation	Sieve	Maximum weight for	
		45 cm dia sieve	30 cm dia sieve
45 mm		10	4.5
40 mm		8	3.5
31.5 mm or 22.1 mm		6	2.5
20 mm		4	2.0
16 mm or 12.5 mm		3	1.5
10 mm		2	1.0
5.6 mm		1.5	0.75
4.75 mm		1.0	0.50
3.35 mm		-	0.30

The sample weight taken will thus normally require several operations on each sieve. Each sieve should be taken separately over a clean tray or receiver until no more than a trace passes, but in any case for not less than two minutes. Materials should not be forced through the apertures but hand placing is permitted. A light brush should be used with fine sieves. The cumulative weight passing each sieve should be calculated as percentage of the total sample weight to the nearest whole number.

APPENDIX B

TEST FOR SURFACE MOISTURE

Take a sample of wet aggregate and weigh it (A). Then place it in a frying pan and gently apply heat, meanwhile stirring with a glass rod until the surface moisture disappears. This is apparent when the aggregate loses its shining wet appearance and becomes dull, or when it just attains a free funning condition. The saturated surface dry material is then weighed (B). Continue the heating thereafter until the moisture is evaporated and weigh the dry sample (C). The surface moisture is then calculated as follows:

$$\text{Surface moisture} = 100 \times \frac{A-B}{C}$$

It is expressed as a percentage of dry aggregate.

APPENDIX C

DETERMINATION OF TEN PER CENT FINE VALUE

Apparatus: The apparatus for the standard test shall consist of the following:

- (a) A 15 cm diameter open-ended steel cylinder, with plunger and base-plate, as shown in Fig. in the end of this appendix. The surfaces in contact with the aggregate shall be machined and case hardened or otherwise treated so as to have a diamond (VH) pyramid hardness number of not less than 650 VH.
- (b) A straight metal stamping rod of circular cross-section 16 mm in diameter and 45 to 60 cm long, rounded at one end.
- (c) A balance of capacity 3 Kg, readable and accurate to one gram.
- (d) I.S. Sieve of sizes 12.5, 10 and 2.36 mm.
- (e) A compression testing machine capable of applying a load of 50 tonnes and which can be operated to give a uniform rate of loading so that the maximum load in any test is reached in 10 minutes. This load may vary from 0.5 to 50 tonnes.
- (f) For measuring the sample, a cylindrical metal measure of sufficient rigidity to retain its form under rough usage and of the following internal dimensions:

Diameter	11.5 cm
Height	18.0 cm

- (g) Means of measuring the reduction in the distance between the plates of the testing machine to the nearest one millimeter during the test (for example, dial gauge).

Test Sample: Material for the test shall consist of aggregate passing a 12.5 mm I.S. Sieve and retained on a 10 mm I.S. Sieve. The aggregate shall be tested in a surface dry condition. If dries by heating the period of drying shall not exceed four hours, the temperature shall be 100°C to 110°C and the aggregate shall be cooled to room temperature before testing.

The quantity of aggregate shall be such that the depth of material in the cylinder, after tamping as described below, shall be 10 cm.

The weight of material comprising the test sample shall be determined (weight A) and the same weight of sample shall be taken for the repeat test.

Note: About 6.5 kg of natural aggregate is required to provide the two test samples. Less of light weight aggregate is required.

The measuring cylinder is filled in three layers of approximately equal depth with aggregate passing a 12.5 mm I.S. Sieve and retained on 10 mm I.S. Sieve. Each layer is subjected to 25 strokes from the tamping rod (16 mm dia and 45 to 60 cm long) rounded to one end, care being taken in case of weak materials not to break the particles. The surface of the aggregate shall be carefully levelled and the plunger inserted so that it rests horizontally on this surface.

Test Procedure: The apparatus, with the test sample and plunger in position, shall then be placed in the compression testing machine. The load

shall be applied at a uniform rate so as to cause a total penetration of a plunger in 10 minutes of about: 15.0 mm for rounded or partially rounded aggregates

(for example uncrushed gravel) 20 mm for nominal crushed aggregate & 24 mm for honey combed aggregate (for example expanded shales and slags). These figures may be varied according to the extent of the rounding or honey combing.

After reaching the required maximum penetration, the load shall be released and the whole of the material removed from the cylinder and sieved on a 2.36 mm I.S. Sieve. The fines passing the sieve shall be weighed, and this weight expressed as a percentage of the weight of the test sample. Normally, this percentage will fall within the range 7.5 to 12.5, but if it does not, a further test shall be made at a load adjusted appropriately, to bring the percentage fines within the range of 7.5 to 12.5.

A repeat test shall be made at the load that gives as percentage fines within the range 7.5 to 12.5. Calculations: The mean percentage fines from the two tests at this load shall be used in the following Formula to calculate the load required to give 10 percentage fines.

Load required for 10 percent fines = $14 \times X Y + 4$

Where X = Load in tonnes and Y = mean percentage fines from two test at X tonnes load.

Reporting of Results: The load required to produce 10 percent fines shall be reported to the nearest whole number for loads of 10 tonnes or more, the nearest 0.5 tonne for loads of less than 10 tonnes.

The value expressed to the nearest 0.5 tonne should be as follows:

- (a) For normal concrete, not less than 5 tonnes.
- (b) For wearing surfaces, not less than 10 tonnes.
- (c) For granolithic concrete, not less than 15 tonnes.

SLUMP TEST

Apparatus: Mould shall consist of a metal frustum of cone having the following internal dimensions: Bottom

diameter.....20 cm

Top diameter.....10 cm

Height.....30 cm

The mould shall be of a metal other than brass and Aluminium of at least 1.6 mm (or 16 BG) thickness. The top and bottom shall be open and at right angles to the axis of the cone. The mould shall have a smooth internal surface. It shall be provided with suitable foot pieces and handles to facilitate lifting it from the moulded concrete test specimen in a vertical direction as required by the test. A mould provided with a suitable guide attachment may be used.

Tamping rod shall be of steel or other suitable material 16 mm in diameter 60 mm long and rounded at one end.

Procedure: The internal surface of the mould shall be thoroughly cleaned and free from superfluous moisture and any set concrete before commencing the test. The mould shall be placed on a smooth horizontal, rigid and non-absorbent surface viz. levelled metal plate. The operator shall hold the mould firmly in place while it is being filled with test specimen of concrete. The mould shall be filled in four layers, each approximately one quarter of height of mould. Each layer shall be stamped with twenty five strikes of the rounded end of the tamping rod. The strokes shall be distributed in a uniform manner over the cross section of the mould and for the second and subsequent layers shall penetrate into the under-lying layer. The bottom layer shall be tamped throughout its depth. After the top layer has been rodded, the concrete shall be struck off level with trowel or the tamping rod, so that the mould is exactly filled. Any mortar which shall leak out between the mould and the base plate shall be cleaned away. The mould shall be removed from the concrete immediately after filling by raising it slowly and carefully in a vertical direction. The moulded concrete shall then be allowed to subside and the slump shall be measured immediately by determining the difference between the height of the mould and that of the highest point of specimen.

The above operations shall be carried out at a place free from vibration or shock, and within a period of two minutes after sampling.

Result: The slump shall be recorded in terms of millimeters of subsidence of the specimen during the test. Any slump specimen which collapses or shears off laterally give incorrect result. If this occurs, the test shall be repeated with another sample.

The slump test shall not be used for very dry mixes as the results obtained are not accurate.

2.2 "Demolishing cement concrete manually/ by mechanical means including disposal of material within 50 metres lead as per direction of Engineer - in - charge."

2.2.1 Nominal concrete 1:4:8 or leaner mix (i/c equivalent design mix)

List of Bureau of Indian Standards Codes Shall be followed.

<i>Sl.</i>	<i>IS No.</i>	<i>Subject</i>
1.	IS 1200 (Pt - XVIII)	Method of Measurements of Building and Civil Engineering Works
2.	IS 4130	Demolition of Buildings–Code of Safety

Precautions

All materials obtained from dismantling or demolition shall be the property of the Government unless otherwise specified and shall be kept in safe custody until they are handed over to the Engineer- in-Charge/ authorized EIC.

The demolition shall always be well planned before hand and shall generally be done in reverse order of the one in which the structure was constructed. The operations shall be got approved from the Engineer-in-Charge before starting the work.

Due care shall be taken to maintain the safety measures prescribed in IS 4130.

Necessary propping, shoring and or under pinning shall be provided to ensure the safety of the adjoining work or property before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining work or property. Wherever specified, temporary enclosures or partitions and necessary scaffolding with suitable double scaffolding and proper cloth covering shall also be provided, as directed by the Engineer-in-Charge.

Necessary precautions shall be taken to keep noise and dust nuisance to the minimum. All work needs to be done under the direction of Engineer-in-Charge. Helmets, goggle, safety belts etc. should be used whenever required and as directed by the Engineer-in-Charge.

The demolition work shall be proceeded with in such a way that it causes the least damage and nuisance to the adjoining building and the

public.

Dismantling shall be done in a systematic manner. All materials which are likely to be damaged by dropping from a height or by demolishing roofs, masonry etc. shall be carefully removed first. Chisels and cutters may be used carefully as directed. The dismantled articles shall be removed manually or otherwise, lowered to the ground (and not thrown) and then properly stacked as directed by the Engineer-in-Charge.

Where existing fixing is done by nails, screws, bolts, rivets, etc., dismantling shall be done by taking out the fixing with proper tools and not by tearing or ripping off.

Any serviceable material, obtained during dismantling or demolition, shall be separated out and stacked properly as directed by the Engineer-in-Charge within a lead of 50 metres. All unserviceable materials, rubbish etc. shall be disposed off as directed by the Engineer-in-Charge.

The contractor shall maintain/disconnect existing services, whether temporary or permanent, where required by the Engineer-in-Charge.

No demolition work should be carried out at night especially when the building or structure to be demolished is in an inhabited area.

Screens shall be placed where necessary to prevent injuries due to falling pieces.

Water may be used to reduce dust while tearing down plaster from brick work.

Safety belts shall be used by labourers while working at higher level to prevent falling from the structure.

First-aid equipment shall be got available at all demolition works of any magnitude.

MEASUREMENTS

All work shall be measured net in the decimal system, as fixed in its place, subject to the following limits, unless otherwise stated hereinafter.

(a) Dimensions shall be measured correct to a cm.

(b) Areas shall be worked out in sqm correct to two places of decimal.

(c) Cubical contents shall be worked out to the nearest 0.01 cum.

Parts of work required to be dismantled and those required to be demolished shall be measured separately.

Measurements of all work except hidden work shall be taken before demolition or dismantling and no allowance for increase in bulk shall be allowed.

Specifications for deduction for voids, openings etc. shall be on the same

basis as that adopted for new construction of the work.

Work executed in the following conditions shall be measured separately.

- (a) Work in or under water and/or liquid mud
- (b) Work in or under foul position.

RATES

The rate shall include the cost of all labour involved and tools used in demolishing and dismantling including scaffolding. The rate shall also include the charges for separating out and stacking the serviceable material properly and disposing off unserviceable material within a distance of 50 metres.

The rate shall also include for temporary shoring for the safety of portions not required to be pulled down, or of adjoining property, and providing temporary enclosures or partitions, where considered necessary.

Dry stone pitching 22.5 cm thick including supply of stones and preparing surface complete.

75 mm thick back filling for pitching including supplying of required materials and consolidation etc. complete with Hard Moorum

Stones

These shall be clean, hard stones, free from decay and weathering. They shall be in block and hammer dressed on all sides.

The size of the pitching stones shall be approximately 22.5 cm. in depth and not less than 15 cm. In any other direction.

Preparation of surface

The sides and bottom of earth work to be pitched, shall be brought to the required slope and gradient and shall be compacted to a firm and even surface.

Pitching

Pitching shall be of 22.5 depth unless specified otherwise. Profiles shall be put up by means of pegs and strings or by placing stones, at intervals of not more than 15 cm. Stones shall then be laid closely in position in between the profile and firmly embedded with joints staggered and with exposed faces true to line, gradient and in uniform slope throughout. Cross bands of approximately 22.5 cm. width through bond stones equal to the full depth of pitching shall be provided at an interval of approximately 3 metres centre to centre both longitudinally and transversely.

The interstices between adjacent stones shall be filled in with stones of proper size, well driven in with crow bars to ensure tight packing and complete filling of all interstices. Such filling shall be carried on simultaneously with the placing in position of the large stones and shall in no case be permitted to fall behind. Final wedging shall be done with the largest sized chip practicable, each chip being well driven home with a hammer so that no chip is possible of being picked up or removed by hand.

Measurements

The measurements shall be taken in sqm. The area of pitching for drains shall be calculated by multiplying the perimeter (bed width plus side slopes) by the length of the pitching. The length, width and side slope shall be measured correct to a cm. The rate shall include the cost of the materials and labour involved in all the operations described above, except pitching stone, if specified, shall be paid for separately. The rate includes the cost of all materials, equipment, labour, carting, loading & unloading, removal of debris to local specified within the site, involved in all the operations described above.