

**SECTION - I
EARTH - WORK**

1.0 GENERAL

1.1 Standards

Work shall be carried out to Indian Standards and Code of Practices. In absence, International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/conflict noticed shall be directed to the PM for his direction / approval. However as a general rule more stringent specification shall take precedence.

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| (1) | IS 1498 | Classification and identification of soils for general engineering purpose |
| (2) | IS 2720 | Method of test of soil |
| (3) | IS 3764 | Safety code for excavation work |
| (4) | IS 4081 | Safety code for blasting and related drilling operation |
| (5) | IS 6313 Part 1 | Code of practice for anti-termite measures in buildings : constructional measures |
| | Part 2 | Code of practice for anti-termite measures in buildings : Pre constructional chemical treatment measures |
| (6) | | Explosive Rules 1940 |

2.0 SITE CLEARANCE

- 2.1 Prior to the start of any activity of earthwork, the area under construction shall be cleared of shrubs, vegetation, grass, brushwood, trees and saplings of girth upto 30 cm measured at a height of 1 metre above ground level. All rubbish must be removed and stacked at a distance of 50 m outside the periphery of the area under clearance or location as decided by the PM.
- 2.2 The rate of such clearance is to be included in the rate of other earth-work items and no separate rate shall be paid.

3.0 SETTING OUT

- 3.1 The contractor shall prepare detailed setting out drawings based on the layout of Architectural drawings and those shall be submitted to the PM prior to commencement of work. Benchmarks and Reference Lines shall be established, by the contractor with approval of the PM.
- 3.2 The contractor shall do the setting out with the use of theodolite and like instruments at site, based on details given to him. He shall erect timber profiles, masonry pillars, burjis, etc. for his use. All markings on these shall be painted with red colour and they shall be maintained for the entire duration of the project. Setting out shall be approved by the PM before the commencement of any work.

3.3 The rate for the earth-work items shall include expenses for all such work including labour, material and equipment/instruments, etc. No additional payment shall be eligible on this account.

4.0 EXCAVATION IN SOILS

4.1 Excavation over area

Excavation exceeding 1 m in width as well as 10 sq m in plan and 30 cm in depth shall be considered as excavation over area.

4.2 Surface dressing

Trimming of natural ground, excavated surfaces, and filled up areas to remove vegetation and/or small inequalities not exceeding 15 cm in depth shall be described as surface dressing.

4.3 Rough excavation

Excavation not requiring dressing of sides and bottom and reduction to exact levels, such as winning earth from borrow pits, hill side cuttings, etc. shall be described as rough excavation.

4.4 Surface excavation

Excavation exceeding 1 m in width as well as 10 sq m on plan but not exceeding 30 cm in depth shall be considered as surface excavation.

4.5 Trenches for pipes/cables

It shall be detailed with nominal dia of pipe/cable. Required bottom width, allowance for concrete foundation for laying pipes, working area, grip required for socketed pipe, return fill, ramming and removal of surplus soil shall be part of this item unless otherwise specified. It shall generally be measured in cubic metres unless specified specifically as running meter in the BOQ.

4.6 Post holes

Independent post holes (or similar holes) each not exceeding 0.5 cu m shall generally be enumerated. Rate shall include return fill, ramming and removal of surplus soil. However this shall be in cubic meters as part of excavation items.

4.7 General

4.7.1 The excavated earth shall be thrown or disposed-off beyond 50 m periphery of the building. Earth suitable for backfilling shall be stacked separately.

Subsequent disposal of the surplus and unsuitable material shall be as per the respective items. Foundations, trenches shall be dug out to the exact dimensions as shown in the drawings or as directed by the PM.

4.7.2 In firm soil, the sides of the trench shall be kept vertical upto a depth of 2 m. If the trench is to be deeper, it shall be in the form of steps of 50 cm, at every 2 m depth. This shall be suitably increased or decreased as per site conditions and type of soil met with. This shall be to the approval of the PM. Sloping of sides also may be adopted.

4.7.3 The bed of trenches shall be firmly consolidated and leveled by watering and ramming of the soft soil. Defective spots shall be dug out and filled with concrete of the same mix as of PCC or as directed by the PM. Cost of digging

and filling with concrete shall be paid extra if excavation and PCC is measured separately.

If excavation is done to a depth greater than that required, excess depth shall be back filled with the same mix as of PCC or as directed. Cost of such concrete shall be to the contractor's account.

- 4.7.4 Excavated trenches shall have to be approved by the PM prior to laying of PCC or any other Permanent Work.
- 4.7.5 Excavation for drains shall be carried out with extra care to cut the sides and bottom exactly to the required shape, slope and gradient. Filling for excess deeper excavation shall be done at the contractor's cost in consultation with the PM.
- 4.7.6 Excavated materials shall not be placed within 1 m of the edge of the trench or half the depth of the trench, whichever is more.
- 4.7.7 Excavations for column footings shall be carried to depths indicated in the drawings. Safe bearing capacity at such depth shall be verified to comply design requirements. If ordered by the PM, appropriate tests shall be carried out by the contractor.
- 4.8 Protection
- 4.8.1 Fencing and/or other suitable measures for protection against risk of accidents due to open excavation shall be provided by the contractor at his cost.
- 4.8.2 Where excavation is to be carried out below the foundation level of an adjacent structure, and to avoid underpinning, precautions such as shoring and strutting, etc. must be taken. No excavation should start till such measures are taken to the satisfaction of the PM. Payments for such work shall not be made separately unless specified otherwise.

5.0 EXCAVATION IN SOFT ROCK

- 5.1 This shall be carried out by crowbars, pickaxes or pneumatic drills or any other suitable means. Blasting may be permitted if the contractor so desires, but no extra money shall be paid for blasting.
- 5.2 Other general details same as clause 4.7 and its sub clauses.

6.0 EXCAVATION IN HARD ROCK

- 6.1 General
- 6.1.1 On meeting hard rock that requires blasting, the contractor shall inform the PM. On approval in writing, blasting operation shall start if the contractor feels it necessary and so desires.
- 6.1.2 The contractor shall obtain the necessary license from the District Authorities for undertaking blasting work and explosive storing as per Explosives Rules 1940, and as updated. Explosives shall only be procured from an authorized dealer. He shall be responsible for the safe custody and proper accounting of explosives. The PM shall have access to the store.
- 6.1.3 The contractor shall be responsible for any accident to those working on the site, to the public or to property due to blasting operations.
- 6.2 Precautions

- 6.2.1 Safety measures to be adhered to shall be as detailed in IS 4081, Safety Code of Blasting (as amended from time to time, and to related drilling operations). Also digest No.37 of C.R.R.I and I.R.C.A. Road tariff No.18 shall be adhered to.
- 6.2.2 Blasting operation shall be carried out under the supervision of a responsible authorized agent of the contractor. Timings shall be as approved by the PM in writing. Lunch break will be preferred. The authorized agent of the contractor should be well conversant with the rules and regulations of blasting operations. Further the contractor shall employ licensed blasters for actual operation.
- 6.2.3 All proper precautions for safety shall be taken. All persons shall be moved away to a distance not less than 200 m. All entries shall be sealed, and red flags displayed at prominent places.
- 6.2.4 Blasting shall be done only with gunpowder. Dynamite, gelignite, or any other high explosive shall be used only with written permission of the PM.
- 6.2.5 The number of charges to be fired and the actual number of shots heard shall be counted and the contractor's agent shall satisfy himself by examining that all charges have exploded. Only then shall workmen be allowed to start work. Unexploded charges shall be flooded with water, a new hole drilled and exploded again.
- 6.2.6 The PM shall be informed about all misfires, their causes and the remedial steps taken.

7.0 CLASSIFICATION

- 7.1 All soils comprising any of the following:
- (a) Vegetable or organic soil, turf, sand, silt, loam, clay, mud, peat, black cotton soil, soft shale or loose murrum.
 - (b) Any mixture of soils in (a).
 - (c) Mud concrete below ground level.
 - (d) Generally, any material which yields to the ordinary application of a pickaxe and shovel or to phawra, rake or other ordinary digging implement and not affording resistance to digging greater than mentioned in (a) to (c).
 - (e) Stiff heavy clay, hard shale, or compacted murrum requiring close application of a grafting tool or pick or both and shovel.
 - (f) Gravel and cobblestone (cobblestone are a rock fragment), usually rounded, having maximum dia in one direction of 75-300 mm.
- 7.2 Soft rock comprising any of the following
- (a) Soling of roads, paths, etc. and hard core.
 - (b) Macadam surfaces of any description (water bound, grouted, tarmac, etc.)
 - (c) Lime concrete, stone masonry, in lime mortar and brick work in lime or cement mortar, below ground level.
 - (d) Soft conglomerate, where the stones may be detached from the matrix with picks, crow bars, wedges, etc.

- (e) Limestone, sandstone, laterite, hard conglomerate or other soft or disintegrated rock which may be quarried or split with a crowbar.
- (f) Unreinforced cement concrete which may be broken up with crowbars or pickaxes and stone masonry in cement mortar, below ground level.
- (g) Boulders not requiring blasting, rock fragments usually rounded by weathering, disintegration and exfoliation or abrasion by water or ice, having maximum dia length in any direction of 500 mm, found loose, embedded, etc.
- (h) Other varieties of rock which would normally be removed with pick, crowbars, wedges and hammer with only a little difficulty.

7.3 Hard rock comprising any of the following

- (a) Any rock or cement concrete in excavation for which the use of mechanical equipment or blasting is required.
- (b) Reinforced cement concrete.
- (c) Boulders bigger than 1/2 cubic meter requiring blasting.
- (d) Hard rock as in (a) to (c) requiring blasting but prohibited from doing so for any reason and excavation has to be carried out by chiseling, wedging or any other agreed method.

8.0 DEWATERING

Bailing or pumping out of water that may have accumulated due to rains, subsoil seepage, tidal waves, or any other means shall be carried on continuously and the area shall be kept dry for the following operations:

- (a) Measurements
- (b) Concreting or masonry work
- (c) Shuttering and reinforcement
- (d) Backfilling
- (e) Line out
- (f) Any other reason deemed fit by the PM

9.0 PLANKING AND STRUTTING

In case of deep trenches where the soil is soft and not capable of being retained without the help of support, planking and strutting as required shall be carried out. It shall be the responsibility of the contractor to take steps to prevent slide/collapse. Method of planking/strutting will be largely influenced by the type of soil encountered and as approved by the PM.

10.0 DISPOSAL OF SURPLUS EARTH

10.1 Surplus earth shall be used to the maximum extent in the compound. Earth useful for filling shall be separately stacked as directed by the PM from time to time. Approved quality earth shall be used in the filling. It shall be consolidated as detailed and approved by the PM.

10.2 Rate for excavation shall include sorting out of useful materials.

- 10.3 All surplus and unusable earth shall be disposed-off outside the campus but at a location approved by local authority and conforming to their specification. The contractor shall quote his rate for disposing off or carting away the items considering requirements and standards of the local authority with whose permission surplus and unusable earth shall have to be disposed-off.

11.0 FILLING

- 11.1 Filling shall be done where required with approved quality of earth. It may be from excavation and, where possible, cutting and filling shall be done simultaneously to avoid double handling.

- 11.2 Filling shall be done in layers not exceeding 15 cm in depth. Earth used shall be free from roots, grass and rubbish and all lumps and clods exceeding 8 cm in any direction shall be broken down. Each layer shall be watered with optimum moisture content to achieve 95% Procter density. Consolidation shall be done by mechanical roller of minimum 12 tons weight. The roller shall pass a minimum of 10 runs evenly to achieve dense consolidation. All undulation made up and final layer re-rolled.

Measurement shall be for compacted volume in Cubic Meter.

- 11.3 Rubble soling

Good quality 150 mm to 230 mm thick rubble soling shall be carried out depending upon the grade of soil. Rubble used shall be at least 100 mm for 150 mm thick soling and 150 mm for 230 mm thick soling. Stone shall be hand packed as close as possible and bedded firmly with the broadest face downwards and the greatest length across, voids filled with chips and small stones. These shall be hammered down to achieve packing and the complete filling of interstices. To achieve the desired levels and slopes, pegs at suitable intervals (about 12 m) shall be fixed.

Soling shall be watered and again packed with sand or murrum to fill interstices created by watering. Then it shall be rolled with 10 ton roller or vibratory compactor. Filling sand or murrum, watering and rolling shall continue till full compactness is achieved to satisfaction of the Architect.

Measurement shall be in Square Meter.

12.0 MEASUREMENT & RATES

- 12.1 The measurement shall be generally conforming to IS: 1200, Part-I unless otherwise specified. Measurement for excavation of foundations and footing shall be as required for the exact width, length and depth as shown of figured on the drawings or as may be directed by the PM. If taken out to a greater width, length, or depth than shown or required, the extra work occasioned thereby shall be done at the Contractor's expenses.

The dimensions of the trenches and pits shall be measured correct to the nearest cm. and cubical contents worked out in cubic meters, correct to two places of decimal.

Measurements of filling excavated earth or sand in plinth or under floors: depth of consolidated earth fillings shall be measured for the purpose of payments. The dimensions of the fillings shall be measured correct to the

nearest cm. and cubical contents worked out in cubic meters correct to the two places of decimal.

Rate for earth work shall include the following:

- a) Excavation and disposing of all excavated materials as specified.
- b) Setting out works, profiles etc.
- c) Site clearance such as cleaning of rank vegetation, shrubs, brushwood.
- d) Forming (or leaving) "dead man" or "tell tales" and their removals after measurement
- e) Bailing out water in excavation from rains, sub-soil water, any water coming inside the place of work irrespective of its source if not specified separately.
- f) Doing shoring / planking / strutting etc. as required to support excavation sides with required supporting arrangements.
- g) Temporarily supporting of existing services of pipes, water mains, cables etc. met within the course of excavation if not specified separately. Care shall be taken not to disturb electric and communication cables. Removal of such cables, if necessary, shall be arranged by the PM.
- h) Forming (or leaving) steps in sides of deep trenches and their removal.
- i) Removing slips or falls in excavation.
- j) Fencing and/or other suitable measures for protection against risk of accidents as approved by the PM.
- k) Excavation for insertion of planking and strutting where required, and
- l) Backfilling the trenches foundations (sides of footings) with selected excavated materials.
- m) Stacking of any executed materials which are not to be disposed-off as per instructions of the PM.
- n) Carting away all surplus excavated material outside the plot area including loading, transportation, unloading etc. complete. (Volume will be measured on compacted basis, on the basis of approved excavation quantities and filling quantities. Allowance for voids shall be included in quoted rates only.) Contractor should locate suitable area for dumping the material at his own cost.

13.0 ANTI-TERMITE TREATMENT

13.1 Indian Standards

Indian Standards to be followed are

- 1) IS 4015 (Part-I & II) - Guide for handling cases of pesticide poisoning.
- 2) IS 6313 (Part-I) - Code of practice for Anti- termite measures in buildings constructional measures

- 3) IS 6313 (Part - II) - Code of practice for anti-termite measures in Building (pre-constructional chemical treatment)
- 4) IS 8944 - Specification for Chloropyrifos Emulsified concentrates.

13.2 Materials

One of the following chemicals in water emulsion shall be used

13.2.1 For mound treatment

	Chemical	Relevant Indian Standard	Concentration By Volume
a.	Cholopyrifos emulsifiable concentrate	IS : 8944	1.0%
b.	Lindane	IS : 632	1.0%

13.2.2 For soil treatment

	Chemical	Relevant Indian Standard	Concentration By Volume
a.	Cholopyrifos emulsifiable concentrate	IS : 8944	1.0%
b.	Heptachlor emulsifiable concentrate	IS : 6436	0.5%
c.	Chlordane emulsifiable concentrate	IS : 2682	1.0%

13.3.0 Workmanship

13.3.1 Conditions of formation

Barrier shall be complete and continuous under the whole of the structure to be protected. All foundation shall be fully surrounded by and in close contact with the barrier of treated soil. Each part of the area treated shall receive the prescribed dosage of chemical.

13.3.2 Time of application

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

13.3.3 Disturbance

Once formed, treated soil barriers shall not be disturbed. If, by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barriers- system.

13.4.0 Termite mound treatment

If termite mounds are found within the plinth area, these shall be destroyed by pouring into the mounds at several places, after breaking open the earthen structure, and making holes with crow- bars, at the rate of approximately 4 litres of emulsion per cubic meter of mound.

13.5.0 Soil Treatment

13.5.1 Treatment of column pits foundation, trenches and basement excavations:

The bottom surface and the sides (upto a height of 300 mm above concrete foundation level) of the excavations made for column pits, wall trenches and basements shall be treated with the chemical at the rate of 5 litres per sq m. of surface area. After the column foundation and retaining walls of the basement come up, the back fill in immediate contact with the foundation structure shall be treated at the rate of 15 litres per sq m. of the vertical surface of the sub-structure for each side. If water is used for ramming the earth fill the chemical treatment shall be carried out after ramming operation is done by rodding the earth at 150 mm centers close to wall surface and spraying the chemical with the above dose. As earth is filled in layers the treatment shall be carried out in similar stages. The chemical emulsion shall be directed towards the concrete or masonry surfaces of the columns and walls so that earth in contact with these surfaces is well treated with the chemicals. In the case of RCC framed structure with columns and plinth beams and RCC basements, the treatment shall start at the depth of 500 mm below ground level. From this depth the backfill around the columns beams and RCC basement wall shall be treated at the rate of 15 liters per sq m. of vertical surface. The other details of treatment shall be as described below:

13.5.2 Treatment to top surface of plinth filling:

- a) After the earth filling is completed in the plinth area and before the rubble packing or subgrade is laid, the entire surface of the filled earth shall be treated with the chemical emulsion at the rate of 5 litres per sq m. Light rodding may be carried out in the soil surface to facilitate absorption saturation of the soil with chemical emulsion.
- b) For buildings where construction has advanced already for facility of construction, the treatment could also be done effectively, over the base concrete (lean mix) under the floor taking care that the emulsion, at the rate of 5 litres per sq m. soak fully into the concrete.
- c) The above application effectively prevents entry of termites through the floor structure.

13.5.3 Treatment of soil along external perimeter:

Finally, the earth around the external perimeter of the building upto a depth of 30 cm shall be treated at the rate of 5.0 litres per running meter of the external wall. To facilitate this treatment solid MS rods should be driven into the soil as close possible to the plinth wall at intervals of 15 cm, and upto a depth of 30 cm, and the rods moved backwards and forwards in a direction parallel to the wall to break up the earth so that the emulsion mixes intimately with the soil.

13.5.4 Treatment of soil surrounding pipes, wastes and conduits:

When pipes, wastes, and conduits enter the soil inside the area of the foundation, the soil surrounding the points of entry shall be loosened around each such pipe, waste or conduits for a distance of 15 cm, and upto a depth of 7.5 cm before the treatment is commenced. When they enter the soil external to the foundations, they shall be similarly treated unless they stand clear of the walls of the building by about 7.5 cm for a distance over 30 cm.

13.5.5 Treatment for expansion joints

Expansion joints at ground floor level are one of the biggest hazards for termite infestation. The soil beneath these joints should receive special attention when the treatment under para 13.5.4 is carried out. This treatment should be supplemented by treating through the expansion joint after the sub-grade has been laid at the rate of 2 litres per linear meter.

13.6.0 Spraying Equipment

A pressure pump shall be used to carry out spraying operations to facilitate uniform spraying and penetration of chemical into the earth. The chemicals, concentration and dosage for horizontal and vertical surfaces are based on the IS code of practice for Anti- termite measures in Buildings. IS 6313 (Part-II).

13.7.0 Safety

Work shall be carried out as per safety measures instructions of manufacturer of approved pesticide & direction of Architect. Also IS 4015 part I and II shall be followed.

13.8.0 Measurement

Measurement for payment in case of preconstruction treatment as detailed above shall be for actual carpet area covered by building at ground level in plan in sqm.

13.9.0 Free Service Guarantee

The contractor shall note that termite proofing work, is subject to a free service guarantee from the date of completion of the treatment. The contractor shall give an undertaking in writing to the effect that during the guarantee period any infestation of subterranean termites will be eradicated, and necessary treatment carried out to prevent re-infestation, free of cost to the employer. The guarantee shall allow a minimum period of -10 (ten) years for pre-constructional treatment.

Tenderers must ensure that the work will be done through the professional Pest Control operator. They should be members of National Pest Control Association of USA, or Indian Pest Control Association or any other recognised professional body. They should furnish a list of Termite Control jobs carried out by them successfully for Government Department, Statutory bodies or large private organisations to prove that they are capable of handling anti termite work.

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