TECHNICAL SPECIFICATION FOR EARTHWORK (EXCAVATION & FILLING)

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TECHNICAL SPECIFICATION
FOR
EARTHWORK
(EXCAVATION & FILLING)

Client
HINDUSTAN PETROLEUM CORPORATION LTD.
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1 Scope

1.1 This specification deals with earth work in excavation and filling in all kinds of soil including murrum, hard murrum, soft rock (without blasting), hard rock (without blasting), hard rock (with blasting) filling excavated earth in plinths, sand filling in plinth & filling for general foundations.

2 Applicable Codes

Following Indian Standards including all Amendment and Revisions form the part of this Specification Alternative equivalent National Specifications to suit the country in which the works are being executed, may be used but only with the written approval of the Engineer.

   IS: 1200 (PART 1) : 1992  Methods of Measurement of Building and Civil Engineering Works - Earthwork
   IS: 2720 : 1983  Methods of Test for Soils
   PART 2: 1983  Determination of Water Content.
   PART 7: 1980  Determination of Water Content - Dry Density relation using light compaction
   PART 8: 1983  Determination of Water Content - Dry Density relation using heavy compaction
   PART 29: 1975  Determination of Dry Density of Soils in place by the Core Cutters Method

3 Classification of Soil

All materials to be excavated shall be classified into one of the classes listed below. The engineer’s decision regarding classification of excavated material is binding on the contractors.

3.1 Soft/Loose/Hard/Dense Soil and Mud

Generally any soil which yields to the application of pick and shovel or to phawra, rake or other ordinary digging equipment such as vegetable or organic soil, turf, gravel, sand, silt, loam, clay, peat, cobble stone, mud etc. It shall include embedded rock boulders of size less than 1 metre in any dimension & not more than 200 mm in any of the other two dimensions.

3.2 Soft/Disintegrated/Weathered Rock (Not Requiring Blasting)

Rock or boulder which may be quarried or split with crowbar. This will also include murrum laterite and hard conglomerate. For this type of soil the core sample recovery is less than or equal to 0.50. This shall also include rock boulder not bigger than 1 metre in any dimension & not more than 500 mm in anyone of other 2 dimension.
3.3 **Hard Rock (Requiring Blasting)**

The type of strata which cannot be excavated with pick-axes, crowbars etc. Any rock or boulder for the excavation of which blasting is required. For this type of soil the core sample recovery is more than 0.50.

3.4 **Hard Rock (Requiring Controlled Blasting)**

Due to any reason if general blasting is prohibited, for rock excavation, controlled blasting shall be used, with approval of the MMCI/HPCL Engineer-in-Charge. The core sample recover is more than 0.5.

3.5 **Hard Rock (Blasting Prohibited)**

Hard rock requiring blasting as described under Cl. No. 3.3 above, but where blasting is prohibited for any reason(s), breaking up of rock shall be done by chiselling, wedging or by using Hydraulic Splitter and chemical substances mixed in an appropriate proportion. The core sample recovery is more than 0.5

4 **Backfilling Material**

4.1 Backfilling material shall be as approved by the MMCI/HPCL Engineer-in-Charge.

4.2 Backfilling of excavation in trenches, foundations and elsewhere shall consist of one of the following materials as shown on drawing, or directed by the MMCI/HPCL Engineer-in-Charge.

   i) Soil
   ii) Selected earth from heaps or brought from borrow areas.

   In case (i) or (ii) are not available, the MMCI/HPCL Engineer-in-Charge may approve use of any of the following:

   ii) Stone/gravel
   iv) Sand
   v) CNS material.

4.3 The material shall be free from rubbish, roots, hard lumps and any other foreign organic material. The compaction of filling shall be carried out as specified in drawings or as directed by engineer in charge.

4.4 All operations for structural fill & backfill which will support footings & slabs shall be conducted in the dry with suitable on-site taken from excavated stock piles designated for such use.

5 **Preparation of Area**

5.1 Prior to the commencement of earthwork operations, areas to be excavated, or on which embankment is to be placed, shall be cleared, grubled and scalped as required. Earthwork shall not start until an area has been prepared which is suitable to allow efficient and uninterrupted progress.

5.2 CONTRACTOR shall carry out the survey of the site before excavation and set properly all lines and establish levels.
5.3 Before excavation work begins the contractor shall check all underground utilities such as electrical cables, pipelines, tanks etc.

5.4 The CONTRACTOR shall not remove any tree without the prior permission of the MMCI/HPCL Engineer-in-charge. Adjacent tree/shrubs subject to possible damage shall be properly marked and/or protected during construction.

5.5 The CONTRACTOR shall provide and maintain barricades, guard rails, fences and other protective devices necessary for prevention of injury to persons/property around all work areas and at other locations where such potential hazard exists.

5.6 The CONTRACTOR shall preserve all Bench marks, Boundary and reference pillars.

6 Weather Limitations

6.1 During the periods when weather conditions are such or have previously been such, as to preclude satisfactory execution of the work, earthwork operations shall be suspended or shall be limited to those activities which can be successfully executed under prevailing conditions. For this purpose excavation can be carried out in such area or depth where concrete will be poured immediately after the excavation has been completed. The CONTRACTOR may if he wishes cover the bottom of excavation with suitable material to keep off the frost/rain from affecting the exposed earth surface. The material for this purpose shall be furnished by the CONTRACTOR and removed by him immediately before pouring concrete at his cost.

7 Preservation of Property, Antiques and Relics

7.1 Excavating operation shall be conducted in such a manner that all properties, facilities, utilities and improvements on or near the project site, which are to remain in place, are not damaged.

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

7.3 Where circumstances require so the contractor shall furnish and install sheet-piling, cribbing, bulkheads, shores, bracing or other means as may be necessary to adequately support materials carrying such items or to support the items themselves and shall maintain such supports until they are no longer needed, at which time they shall be removed and disposed of.

8 Drainage

8.1 The CONTRACTOR shall take suitable precautions to prevent ingress of water into the excavated areas during construction. CONTRACTOR shall ensure positive drainage at all time or all areas affected by the work.

8.2 Areas to be fixed or to have the placement of dikes shall be drained of all surface water and such ground water as may impair the construction of embankment or areas fill. The area may be drained by well points and/or temporary ditches, sumps and pumps. Pumping and bailing from the interior of any foundation enclosure shall be done in such a manner as to prevent the possibility of movement of water through or alongside any concrete being placed. Excavations shall be as dry as possible prior to and during placing concrete.
All water pumped or bailed out during de-watering of pits and trenches shall be disposed off suitably through properly laid channels or pipes by the CONTRACTOR at his own cost. Disposal of water shall be carried out in such way that no inconvenience or nuisance is caused to the work in progress in the area or to the other agencies working in the area or cause damage to property and structures nearby.

9 **Setting Out**

9.1 The Contractor shall be responsible for the true and proper setting out of the work in relation to original points, lines and levels of reference and for the correctness of the levels, dimensions and alignment of all parts of the work. If at any time during progress of the work any error appears or arises in the position of level, dimension, or alignment of part of the work, the Contractor at his own expense shall rectify such errors to the satisfaction of the MMCI/HPCL Engineer-in-Charge. The checking of any line or level by the MMCI/HPCL Engineer-in-Charge shall not in any way relieve the Contractor of his responsibilities.

9.2 The Contractor shall lay out, and construct one or more permanent bench marks in some central place before the start of the work, from which all important levels for the excavations will be set.

The contractor shall provide all material & labour for establishing permanent benchmark at his own cost. These permanent bench marks shall consist of masonry pillars with top neatly plastered and levelled as per the directions of the MMCI/HPCL Engineer-in-Charge. These permanent benchmarks shall be properly founded to ensure no settlements. Bench marks shall be well connected with triangular grid system or any other bench mark approved by the MMCI/HPCL Engineer-in-Charge.

10 **Earthwork In Excavation**

10.1 Excavation shall be carried out in any material met on the site to the lines, levels and contours shown on the detailed drawings and the Contractor shall remove all excavated materials to spoil heaps on site or transport for use in filling on the site or stack them for reuse as directed:

10.2 Excavated material shall not be deposited within 1.5m from the top edge of the excavation.

10.3 The sides of the excavation may be cut sloping, or shored and strutted to hold the face of earth as per site requirements and as directed by the Engineer-in-Charge.

10.4 Foundation pits/trenches shall not be excavated to the full depth unless construction is imminent. The last fifteen (15) cm depth of the excavation shall not be done until concreting work is imminent. The full depth may at the discretion of the MMCI/HPCL Engineer-in-Charge be excavated and the bed covered with a fifty (50) mm (minimum) thick (or as indicated on drawing) layer of lean concrete 1:4:8 mix (1 cement: 4 coarse sand: 8 crushed stone aggregate) or as specified in schedule of rates/shown on drawing, after watering if required, and consolidating the bed.

10.5 If the bottom of any excavation has been left exposed by the Contractor and in the opinion of the MMCI/HPCL Engineer-in-Charge, that has become badly affected by the atmosphere or by water, then the Contractor shall remove such portions of the deteriorated material as the MMCI/HPCL Engineer-in-Charge may direct and shall make good with lean concrete 1:4:8 mix (1 Cement: 4 Coarse Sand: 8 Crushed Stone Aggregate). All expenses for such additional concrete and excavation shall be borne by the Contractor.
10.6 Where excavation is made in excess of the depth required, the Contractor shall, at his own expense, fill up to required level with lean concrete 1:4:8 mix (1 Cement : 4 Coarse Sand : 8 Crushed Stone aggregates) or as decided by MMCI/HPCL Engineer-in-Charge.

10.7 The Contractor shall provide suitable drainage arrangement to prevent surface water from any source entering the foundation pits at his own cost.

10.8 The Contractor shall make all arrangements for dewatering during excavation and subsequent works, the accumulated water from any source (including subsoil water) in the excavated pits/trenches and keeping the excavated pits/trenches dry for subsequent works.

10.9 The Contractor shall make necessary arrangements for lighting, fencing and other suitable measures for protection against risk of accidents due to open excavation.

10.10 Where the excavation is to be carried out below the foundation level of an adjacent structure, the precaution to be taken such as under pinning, shoring and strutting etc. shall be determined by the Engineer-in-Charge. No excavation shall be done unless such precautionary measures are carried out as per directions of the MMCI/HPCL Engineer-in-Charge. The payment for such precautionary measures shall, however, be made separately.

10.11 Loose or soft bed ground encountered in excavation at the required depth shall on the Engineers-in-Charge’s instructions be excavated to a firm bed and difference made up to the required level with lean concrete 1:4:8 mix (1 Cement : 4 Coarse Sand : 8 Crushed Stone Aggregates).

10.12 In those cases where during excavation, side slips occur for reasons not attributable to the Contractor (e.g. side slips which take place on their own but not due to surcharge of earth kept near the edge of excavation and cracking of excavation top strata due to clay drying out leading to collapse of excavation sides), the MMCI/HPCL Engineer-in-Charge shall admit payment at his discretion.

10.13 Any obstacle encountered during excavation shall be reported immediately to the MMCI/HPCL Engineer-in-Charge and shall be dealt with as instructed by him. Removal of buried pipes or cables shall not be done without prior permission of the MMCI/HPCL Engineer-in-Charge and the Contractor shall provide all measures to protect the same. Cost of such protective measures is deemed to be included in the rates for various items of excavation.

10.14 The Contractor shall not undertake any concreting in foundation until the excavation pit/trench is approved by the MMCI/HPCL Engineer-in-Charge.

10.15 The specification for earthwork shall also apply to excavation in rock in general.

10.16 Payment

10.16.1 Payment for earthwork in excavation shall be made on cubic meter (m3) basis on the measurement of volume of pit / trench of excavation with working space as per relevant Indian Standard (IS:1200) and slopes / stepping as permitted by the MMCI/HPCL Engineer-in-charge. The rate shall include cost of all the operations of blasting with explosives & accessories, making of all arrangements for dewatering the accumulated water from any source in the excavated pit or trench, removal and disposal of surplus excavated soil within a lead of 100m from construction areas. The rate shall also include setting out and line out work required for the excavation.
10.16.2 The following works shall not be measured separately and allowance for the same shall be deemed to have been made in the description of main item:

a) Setting out works, profiles, etc.

b) Site clearance, such as cleaning grass and vegetation;

c) Unauthorized battering or benching of excavation;

d) Forming (or leaving) ‘dead men’ or ‘tell-tales’ in borrow pits and their removal after measurements;

e) Forming (or leaving) steps in sides of deep excavation and their removal after measurements;

f) Excavation for insertion of planking and strutting;

g) Unless otherwise specified, removing slips or falls in excavations;

h) Baling out or pumping of water in excavation from rains;

i) Baling out or pumping of water in excavation from sub-soil water, and

j) Slinging or supporting pipes, electric cables, etc, met during excavation.

10.16.3 Special pumping other than what is included in 10.16.2 (h and i) and well point dewatering where resorted to, shall each be measured separately, unless otherwise stated, in kilolitres of water against separate specific provision(s) made for the purpose.

10.16.4 The Contractor shall intimate to the MMCI/HPCL Engineer-in-Charge as soon as different classification of soils are met with. The measurements of various soil classifications then shall be worked out by either of the following alternatives in the order of their decreasing importance.

a) Joint levels shall be taken as to the levels of different soil classifications and volume worked out on the basis of levels only.

b) Where levels of different strata cannot be clearly marked and defined the Contractor shall stack different soils of various classifications separately for measurement purpose and then dispose it off.

c) If the quantum of work involved in (b) above is extensively large & time consuming, then the total area may be divided into various zones and reasonable representative samples as in (b) above may be taken and quantities of soils of various classifications finalized for the entire zone based on the representative.

If soil of any classification other than that specified in the Schedule of Rates is met with during excavation, the decision of the MMCI/HPCL Engineer-in-Charge as to the classification of soil, levels of the strata of different classifications and their location shall be binding.

In above case, the total quantity of excavation shall be computed from the measurement of the pit / trench excavated. The hard rock and soft rock shall be measured separately from the relevant stacks and each shall be reduced by fifty percent of voids, and paid under the relevant items. The balance, that is the total quantity of excavation minus the reduced (for voids) quantity of excavation for rocks shall be paid as soft / hard soil as per the direction of the MMCI/HPCL Engineer-in-Charge (However, the maximum payment shall be limited to the volume of the excavated pit / trench as approved by Engineer-in-Charge).
11 **Excavation of Rock**

11.1 Should rock be encountered above contract levels, it shall be immediately brought to the notice of the MMCI/HPCL Engineer-in-charge. When directed the rock surfaces shall be uncovered and CONTRACTOR shall submit a survey report indicated the levels of rock surface on a 3.0 M grid.

11.2 Blasting for rock excavation shall be carried out by persons skilled in such work and only with prior approval of MMCI/HPCL Engineer-in-charge. It shall be performed in strict accordance with the requirements of Explosives Rules 1940, Indian Explosive act 1844 and other local and Governmental laws. The CONTRACTOR shall remain totally responsible for any accident arising out of blasting operations or driving storage and transport of blasting materials.

11.3 Excavations in rock shall be cut as close as practical to the lines required for the installation of the full thickness of floors, footings and trenches or a indicated on the construction drawings.

11.4 **Blasting**

11.4.1 **Storing and Transport**

Explosives shall be stored in clean, dry, well ventilated magazines to be built for the purpose by the CONTRACTOR at his own cost. Fuses and detonators shall be stored in separate magazines, detonators and explosives shall be transported separately to the blasting site.

11.4.2 **Preparation of Blasting**

Explosives shall be kept dry and away from the direct rays of the sun, naked lights, steam pipes or heated metal etc. Only the quantity of explosives required for a particular amount of firing to be done shall be brought to the site of work. All surplus explosive left after filling the holes shall be removed at least 600 m from the firing point.

A wooden stemming rod shall be used to push the cartridge into the shot-hole. Metal rod or rammer shall not be permitted on the site of the work. The charge shall be pressed firmly into the place and not rammed or pounded.

The explosive shall be fired by means of an electric detonator placed inside a cartridge and connected to the firing cable.

Due precautions shall be taken to keep the firing circuit insulated from the ground, bare wires, rails, pipes or any other path of stray currents and to keep the lead wires short circuited until ready to fire.

11.4.3 **Drilling Rock for Blasting**

The holes for charging explosives shall be drilled with pneumatic drills, the drilling pattern being so planned that rock pieces after blasting shall be suitable for handling without any secondary blasting. The rock pieces so blasted shall be neatly stacked at allotted places.

11.4.4 **Blasting Operations**

Before any blasting is carried out it shall be ensured that all workmen, vehicles and equipment on the site are cleared from an area of 300 meters radius from the firing point at least 15
minutes before the firing time by sounding a warning siren. The area shall be encircled by red flags.

All operations shall be carried out by competent and experienced licensed supervisors. The firing shall be conducted by a supervisor and the number of shorts fired at one time shall not exceed the permissible limits. In case of misfires, the unexploded charged shall be carefully located after half an hour and shall be exploded by drilling a fresh hole along side of the misfired hole (but not nearer than 600 mm from it) and by exploding a new charge. The workmen shall not return to the site of firing until at least half an hour after firing.

11.4.5 Controlled Blasting

When blasting is conducted in the neighbourhood of roads, structures, building or any place which requires controlled blasting, only shallow shot holes shall be drilled. The holes shall be filled with a light charge on explosive and the blast controlled by placing steel plates loaded with gunny bags filled with sand or earth over the hole and covering them with wire net fixed to the ground, so as to ensure that the blasted material do not scatter.

In such cases short delay detonators shall be used for blasting purpose.

In areas where blasting is not permissible due to close proximity of sensitive structures/installations, excavation by chiselling shall be carried out by the CONTRACTOR.

Blasting shall be carried out only with prior approval of MMCI/HPCL Engineer-in-charge. CONTRACTOR shall strictly adhere to the provisions of the Explosives Rules 1940, Indian Explosives Act 1844 and other local and governmental laws and shall remain totally responsible for any accident out of blasting operations or during storage and transport or blasting materials.

12 Shoring and Strutting

12.1 The CONTRACTOR shall provide timbering, sheet piling, bracing, anchoring and other supports as may be necessary to protect the excavated slopes, adjacent paving, structures, utilities and to prevent personnel injuries and property damage.

12.2 Braced sheet piling shall be provided where deemed necessary. Shoring shall be installed so as not to interfere with the proper placement and compaction of back fill.

12.3 Shoring of excavation shall be removed only when excavation is safe from cave-in and as back filling progresses.

13 Back Filling around Foundations and In Plinth

13.1 Back filling around completed foundations, structures, trenches and in plinth shall be done to the lines and levels shown on the drawings including any trimming of the surfaces, as may be necessary. This shall be done with selected and approved earth from excavation or otherwise with materials described under clause 4.2 as directed by the MMCI/HPCL Engineer-in-Charge. Where sufficient suitable material is not available from the excavation, the MMCI/HPCL Engineer-in-Charge may direct to import suitable earth from other sources. The filling shall be done in layers of thickness not exceeding 15 cm with watering, rolling and ramming by manual methods/mechanical compactors to grade and level as shown on drawings to obtain 90% laboratory maximum dry density.
13.2 The Contractor shall not commence filling in and around any work until it has been permitted by the Engineer-in-Charge.

13.3 Backfilling around liquid retaining structures and pipes shall be done only after approval of the Engineer-in-Charge is obtained.

13.4 Payment
Payment for backfilling with earth shall be based on volume in cubic meters (m³) of consolidated fill. This volume shall be derived from the difference between the volume of excavation and the structure or trenches as the case may be. The rate shall include cost of extracting suitable approved earth from available excavated soil from spoil heaps within a lead of 100m, placing, watering, rolling, ramming, compacting in layers, trimming and dressing finished surface and disposal of surplus material up to a lead of 100 m.

However, backfilling done with material other than earth shall be paid separately under relevant items.

14 Quality Control of Fill
Prior to carrying out filling the Contractor shall carry out sufficient laboratory moisture-density tests to evaluate compaction. From these tests, the maximum dry density and optimum moisture content for the approved fill material shall be determined. The laboratory tests shall be in accordance with Indian Standards IS:2720 - Parts 2, 7 and 8.

When earth filling is being carried out field tests shall be carried out at various stages to ensure that adequate compaction is being achieved. The field tests shall be in accordance with IS:2720, Part 28 and 29.

The compacted surface shall be carried out to the dimensions and levels as indicated on the drawing within a tolerance of ± 25 mm.

14.1 Frequency of Field Density Tests
To ensure adequate quality control on compaction of earth fill, the following minimum number of field density tests shall be performed.

1. One test for every 500 cubic metres of fill material placed for fill construction in site grading.
2. One test for every 250 cubic metres of fill material placed for fill construction in plinth filling.

15 Transportation of Surplus Earth / Soil
15.1 Surplus earth and soil from excavation shall be removed from construction area to the area demarcated by the MMCI/HPCL Engineer-in-Charge.

16 Clean - Up
16.1 At the conclusion of all fill and backfill operations, the CONTRACTOR shall clear away from the job site as well as from private and public roads, ditches and surrounding areas, all rubbish and construction materials and all CONTRACTOR’S tools, equipment and other properly, before the work is finally accepted.