

Chapter 03: CONCRETE STRUCTURES

1- Earthworks and backfills

1.1 Site Preparation

- A. Prior to commencing any excavation work, the Contractor shall establish a horizontal and vertical survey, record existing ground elevations and stake the location of trenches to be excavated.
- B. The Contractor shall prepare the site for construction by clearing, removing and disposing of all items not indicated on the Drawings to remain or so defined by the Engineer.
- C. The Contractor shall obtain relevant excavation and road cutting permits as required to commencing work.

i) Existing Subsurface Structures and Utilities

For all works required to deal with existing subsurfaces and utilities refer to General Section of these Specifications.

ii) Clearing, Grubbing and Grading

- A. The Contractor shall perform the clearing and grubbing (if any), of top soil consisting mainly of loose soil, vegetable and organic matters, drift sand, unsuitable soil and rubbish by scarifying the areas to be excavated and sidewalks to a minimum depth of 300 mm from the natural ground level. All materials resulting from the above operations shall be removed from the site, loaded and transported and off loaded, spread and leveled to approved dumps as directed by the Engineer.
- B. The Contractor shall include for grading the route to provide access for his equipment and personnel, executing all cuttings to remove the high point of rises in terrain and in all respects prepare the route for pipe laying operations, all in accordance with the requirements of good pipeline construction practice.

1.2 Setting-Out

The Contractor shall stake-out the work as shown on the Drawings and secure the Engineer's approval of his stake-out before proceeding with construction. If, in the opinion of the Engineer, modification of the line or grade is advisable before or after stake-out, the Engineer will issue detailed instructions in writing to the Contractor for such modification and the Contractor shall revise the stake-out for further approval in accordance with the relevant Clause of the Conditions of Contract.

1.3 Excavation

- A. The Contractor shall perform all excavation true to lines, widths and depths shown on the Drawings or to such further lines, depths or dimensions as may be directed by the Engineer.
- B. Excavation work will be done in all kinds of soils.

i) Road along the line.

A. Wherever necessary the Contractor shall prepare a road along the line at such distance from the line that the traffic on the road will in no way interfere with pipe laying work. The Contractor shall also prepare access roads from the highway or other public roads to the said access road.

B. The road along the line and the access roads shall permit the normal movement of trucks and other vehicles and all equipment and plant required for the execution of the works.

C. The employer's employees shall at times have the use of the roads prepared by the Contractor, free of charge.

D. The Contractor shall maintain the road along the line and the access roads in a good and serviceable condition and shall make all repairs that may be necessary during the whole period of construction.

ii) Excavation to reduce levels.

A. Wherever shown on the drawings, the Contractor shall reduce the ground level on the trench site, prior to commencement of trench excavation. Before starting excavation for reducing of levels the Contractor shall move the marking of the alignment to such a distance that the marks will not be destroyed and will not interfere with the execution of the work.

B. Excavation for reducing levels shall be done to the lines and levels shown on the drawings. Where the depth of excavation is not so shown it shall be done to a line parallel to the trench bottom in the section concerned.

iii) Storing of Suitable Excavated Material

During excavation, materials suitable for backfill and fill will be stockpiled on site at sufficient distance from the sides of the excavation to avoid over-loading and prevent cave-ins.

iv) Disposal of Unsuitable and Surplus Excavated Material

Upon the order of the Engineer, all unsuitable and surplus materials shall be immediately removed, loaded and transported off Site area by the Contractor to approved dumps at the Contractors expense, and he shall abide by the relevant local regulations.

v) Unauthorized Excavation

If the bottom of any excavation is taken out beyond the limits indicated or prescribed, the resulting void shall be backfilled by well graded material at the Contractor's expense with thoroughly compacted to an acceptable proctor as directed by the Engineer, if the excavations are for a structure or a manhole, then the void should be filled by class C15 concrete.

1.4 Removal, Restoration and Maintenance of Surface

i) Removal of Pavement

The Contractor shall remove pavement and road surfaces as a part of the trench excavation, and the volume removed shall depend upon the width of trench specified for the installation of the pipe and the width and length of the pavement area required to be removed for the installation of valves, fittings, valve chambers, thrust blocks, manholes, or other structures. The width of pavement removed along the normal trench for the installation of the pipe shall not exceed the top width of the trench specified by more than 200 mm on each side of the trench. The widths and lengths of the area of pavement removed for the installation of valves, fittings, valve chambers, thrust blocks, manholes, or other structures shall not exceed the maximum linear dimensions of such structures by more than 300 mm on each side. Wherever, in the opinion of the Engineer, existing conditions make it necessary or advisable to remove additional pavement, the Contractor shall remove it as directed by the Engineer but shall receive no extra compensation therefore. The Contractor shall use such methods, either drilling or chipping, as will assure the breaking of the pavement along straight lines. The cut must be sharp and approximately vertical. The Engineer's representative may require that the pavement be cut with asphalt cut machine without extra compensation to the Contractor.

ii) Restoration of Damaged Surfaces and Property

If any pavement, trees, shrubbery, fences, poles, or other property and surface structures have been damaged, removed, or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the contract documents, state laws, municipal ordinances, or the specific direction of the Engineer or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired at the expense of the Contractor. If the Employer specifies that the replacements or repairs shall be made by the Contractor, he shall replace or repair and restore the structures to a condition equal to that before the work began and to the approval of the Engineer and shall furnish all incidental labour and materials.

2. Backfills

2.1 Material Used in Backfill

i) General

A. Backfill and fill material shall be suitable excavated material, natural or processed mineral soils obtained from off-site sources, or graded crushed stones or gravel.

B. Backfill and fill material shall be free from all organic material, trash, snow, ice, frozen soil, or other objectionable material which can't be properly compacted. Soft, wet, plastic soils which may be expensive, clay soils having a natural in-place water content in excess of 30 percent, soil containing more than 5 percent (by weight) fibrous organic material, and soil having a plasticity index greater than 30 shall be considered unsuitable for use as backfill and fill material.

C. Backfill and fill material shall have a maximum of one percent expansion when testing is performed on a sample remolded to 95 percent of maximum dry density at a two percent below optimum moisture content under a 490 kg/m² surcharge.

ii) Common Backfill Material

A. Common Backfill or fill material shall not contain Granite blocks, broken concrete, masonry rubble, asphalt pavement, or any material larger than 150 mm in any dimension provided that this material is not more than 25 percent of the backfill or fill material.

B. Common Fill shall have physical properties, as approved by the engineer, such that it can be readily spread and compacted.

iii) Selected Backfill Material

Selected Backfill and Fill material shall conform to the requirements of common Backfill except that the material shall not contain any materials larger than 50 mm in its largest dimension provided that this material is not more than 20 percent of the Backfill or fill material. iv) Structural Fill Structural Fill shall be gravel, sandy gravel, or gravelly sand. Material shall have a plasticity index of less than 15 and shall conform to the gradation limits shown in table 2.1 below : Table 2.1 Sieve Size Percent Finer By Weight 150 mm 100 No. 4 20 - 70 No. 40 5 - 35 No. 200 0 - 7 v) Crushed Stones Crushed stones shall be sound durable stone, angular in shape, and free of foreign material, structural defects and chemical decay. Crushed stones shall be of a maximum dimension of 50 mm and a minimum of 12 mm measured in any direction.

2.2 Quality Assurance Laboratory Testing

A. At least seven days prior to the placement of any Backfill or Fill material, the contractor shall deliver a representative sample of the proposed material weighing at least 22 Kg to an approved soils testing laboratory to perform:

i- Grain size analyses of the samples to determine their suitability for use as Backfill or Fill material in accordance to the material requirements

ii- The appropriate Proctor analysis to determine the maximum dry densities required for compaction testing as specified in the contract documents.

B. The test results and determinations of suitability shall be delivered to the engineer no later than three days prior to the placement of Backfill or Fill materials.

2.3 Replacement of Pavements and Structures by the Contractor

A. Unless otherwise shown on the Drawings or mentioned in the bill of quantities, the Contractor shall restore all pavements, sidewalls, sidewalks, curbs, gutters, shrubbery, fences, poles, sod, or other property and surface structures removed or disturbed as a part of the work to a condition equal to that before the work began, and shall furnish all incidental Labour and materials. No permanent pavement shall be restored unless and until, in the opinion of the Engineer, the condition of the backfill is such as to properly support the pavement and not before written approval from the Engineer to commence such works.

B. Where pipelines pass underneath asphalted roads and parallel to the axis of the road, the final 250 mm of the trench backfill shall be furnished as follows:

1. 200 mm (after compaction) shall be done by using approved base course material, placed, wetted and compacted to not less than 95 % of the modified Proctor density.
2. Spraying 2 kg of prime coat (MCO) per each square meter over the compacted base course, and applying a layer of asphalt mix in a thickness not less than 50 mm after compaction.

2.4 Measurement and Payment

- A. All Excavated material of whatever type shall be measured as “unclassified” which shall be deemed to include all materials encountered of any nature, including silts, clays, sand, gravel and granular materials and fractured, jointed and solid rock, and unsuitable material.
- B. Trench Excavation shall be measured, as classified in the Bill of Quantities, and trimmed to required line, grade and cross section, including depositing excavated material along the side of trench if directed or hauling away and wasting, stockpiling or depositing on or in the vicinity of the works completed and accepted.
- C. Measurement of Backfilling of trenches included in Excavation and Backfilling price.
- D. Soft Backfilling from the bottom of the trench to at least 200 mm above the crown of the pipe, with fine aggregate fill as specified.
- E. Final Backfilling for the remainder of the trench above the zone around the pipe with selected fill material as specified. Reinstatement of roads and paved surface shall be measured in linear meter. The work will include removal, restoration and maintenance of surfaces and property, preparation of road foundation and replacement of hard core, asphalted layer as indicated in the specification and the Bill of Quantities.