

**Part 1 General****1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials, applications, installation and verification for excavating, trenching and backfilling.
- .2 Related Sections:
  - .1 Section 01 33 00 - Submittal Procedures.
  - .2 Section 01 35 29.06 - Health and Safety Requirements.
  - .3 Section 01 35 43 - Environmental Procedures.
  - .4 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .5 Section 02 41 13 - Selective Site Demolition.
  - .6 Section 33 41 00 - Storm Utility Drainage Piping.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117- 03, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136- 01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422-63 2002, Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D698- 00a1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
  - .5 ASTM D1557- 02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2,700 kN-m/m<sup>3</sup>).
  - .6 ASTM D4318- 00, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1- 88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2- M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000- 03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001- 03, Cementitious Materials for Use in Concrete.
  - .2 CAN/CSA-A23.1/A23.2- 00(August 2001), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .4 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

- .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

### 1.3 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
- .1 Rock : any solid material in excess of 1.00 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment . Frozen material not classified as rock.
- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil:
- .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters (1 inch) in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
- .1 Weak, chemically unstable, and compressible materials.
- .2 Frost susceptible materials:
- .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136 : Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
- .2 Table:
- | Sieve Designation | % Passing |
|-------------------|-----------|
| 2.00 mm           | 100       |
| 0.10 mm           | 45 - 100  |
| 0.02 mm           | 10 - 80   |
| 0.005 mm          | 0 - 45    |
- .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

**1.4 SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Preconstruction Submittals:
  - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
  - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field, clearance record from utility authority, or location plan of relocated and abandoned services, as required.
- .3 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.
  - .3 Submit 70 kg samples of type of fill specified including representative samples of excavated material.
  - .4 Ship samples prepaid to Departmental Representative, in tightly closed containers to prevent contamination and exposure to elements.

**1.5 QUALITY ASSURANCE**

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Where Departmental Representative is employee of Contractor, submit proof that Work by Departmental Representative is included in Contractor's insurance coverage.
- .3 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .5 Keep design and supporting data on site.
- .6 Engage services of qualified professional Engineer who is registered or licensed in Province of Ontario, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.
- .7 Do not use soil material until written report of soil test results are approved by Departmental Representative.
- .8 Health and Safety Requirements:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements .

**1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Storage and Protection:
  - .1 Protect existing features in accordance with applicable local regulations.
  - .2 Existing buried utilities and structures:
    - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

- .2 Prior to beginning excavation Work, notify applicable Departmental Representative and authorities having jurisdiction to establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
- .3 Confirm locations of buried utilities by careful soil hydrovac methods.
- .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
- .5 Record location of maintained, re-routed and abandoned underground lines.
- .6 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
  - .3 Where required for excavation, cut roots or branches as directed by Departmental Representative.
- .2 Construction/Demolition Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal .
  - .2 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  - .3 Place materials defined as hazardous or toxic in designated containers.
  - .4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
  - .5 Ensure emptied containers are sealed and stored safely.
  - .6 Divert excess materials from landfill to local recycling facility for reuse as directed by Departmental Representative.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:
  - .1 Crushed, pit run or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 and CAN/CGSB-8.2.

.3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representation for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Unshrinkable fill: proportioned and mixed to provide:
- .1 Maximum compressive strength of 0.4 MPa at 28 days.
  - .2 Maximum Portland cement content of 25 kg/m<sup>3</sup> : to CSA-A3001, Type 10 .
  - .3 Minimum strength of 0.07 MPa at 24 h.
  - .4 Concrete aggregates: to CAN/CSA-A23.1.
  - .5 Portland cement: Type 10 .
  - .6 Slump: 160 to 200 mm.
- .4 Shearmat: honeycomb type bio-degradable cardboard 100 mm thick, treated to provide sufficient structural support for poured concrete until concrete cured.

## Part 3 Execution

### 3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.
- .3 Daylight identified services and utilities by hydrovac and/or hand excavation to confirm existing infrastructure elevations within all working limits prior to any major excavation operations. Immediately report any potential conflicts to the Departmental Representative

**3.2 STOCKPILING**

- .1 Stockpile fill materials in areas designated by Departmental Representative. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

**3.3 COFFERDAMS, SHORING, BRACING AND UNDERPINNING**

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Health and Safety Act for the Province of Ontario.
- .2 Construct temporary Works to depths, heights and locations as indicated or approved by Departmental Representative.
- .3 During backfill operation:
  - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
  - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
  - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
- .4 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .5 Upon completion of substructure construction:
  - .1 Remove cofferdams, shoring and bracing.
  - .2 Remove excess materials from site as directed by Departmental Representative.

**3.4 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Departmental Representative approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in a manner not detrimental to public and private property, or portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

**3.5 EXCAVATION**

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations.
- .2 Excavate to lines, grades, elevations and dimensions as indicated or as directed by Departmental Representative.
- .3 Remove all obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition .
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.
- .5 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .6 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .7 Restrict vehicle operations directly adjacent to open trenches.
- .8 Dispose of surplus and unsuitable excavated material in approved location off site.
- .9 Do not obstruct flow of surface drainage or natural watercourses.
- .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .11 Notify Departmental Representative when bottom of excavation is reached.
- .12 Obtain Departmental Representative approval of completed excavation.
- .13 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .14 Correct unauthorized over-excavation as follows:
  - .1 Fill under bearing surfaces and footings with fill compacted to not less than 100 % of corrected Standard Proctor maximum dry density.
  - .2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
- .15 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
  - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

**3.6 FILL TYPES AND COMPACTION**

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698 .
  - .1 Exterior side of perimeter walls: use Type 3 fills to subgrade level. Compact to 95 % of corrected maximum dry density.
  - .2 Within building area: use Type 2 to underside of base course for floor slabs. Compact to 100 % of corrected maximum dry density.

- .3 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill topped with shearmat filler as indicated to underside of slab. Compact base course to 100 %.
- .4 Retaining walls: use Type 2 fill to subgrade level on high side for minimum 500 mm from wall and compact to 95 %. For remaining portion, use Type 3 fill compacted to 95 %.
- .5 Place unshrinkable fill in areas as indicated.

### **3.7 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services.
- .2 Place bedding and surround material in unfrozen condition.

### **3.8 BACKFILLING**

- .1 Do not proceed with backfilling operations until completion of following:
  - .1 Departmental Representative has inspected and approved installations.
  - .2 Departmental Representative has inspected and approved of construction below finish grade.
  - .3 Inspection, testing, approval, and recording location of underground utilities.
  - .4 Removal of concrete formwork.
  - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations.
  - .1 Place bedding and surround material as specified elsewhere.
  - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading.
  - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
    - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative:
    - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
- .6 Place unshrinkable fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.



**3.9 RESTORATION**

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal , trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as indicated or as directed by Departmental Representative.
- .3 Reinstall lawns to elevation which existed before excavation.
- .4 Reinstall pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstall areas affected by Work as directed by Departmental Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**