
Division 31 / Earthwork

PART 1 - GENERAL**1.1 REFERENCES**

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C117-13, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63 (2007)e1, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557-12, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318-10e1, 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).
 - .1 CAN/CSA-A3000-03 (R2005), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete

1.2 DEFINITIONS

- .1 Excavation Classes: Two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: Solid material which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. 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 Top soil: Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
- .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 Unsuitable Materials:
 - .1 Compressive and weak fill materials under the excavated areas.
 - .2 Frost susceptible materials under the excavated areas.
 - .3 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 Standards: Sieve sizes to CAN/CGSB-8.1.

- .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.

- .7 Unshrinkable Fill: Very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.3 DOCUMENTS TO BE SUBMITTED FOR APPROBATION/INFORMATION

- .1 Submit required documents.
- .2 Quality Control:
 - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
 - .2 Submit for review by Departmental Representative proposed dewatering and heave prevention methods as described in PART 3 of this Section.
 - .3 Submit to Departmental Representative written notice at least seven (7) days prior to excavation work, to ensure cross sections are taken.
 - .4 Submit to Departmental Representative written notice when bottom of excavation is reached.
- .3 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, location plan of relocated and abandoned services, as required.

1.4 QUALITY ASSURANCE

- .1 Submit design and supporting data at least two (2) weeks prior to beginning Work.
- .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Quebec and/or Canada.
- .3 Keep a copy of design and supporting data on the Work site.
- .4 Hire a qualified professional engineer registered or licensed in Province of Quebec and/or Canada, to be in charge of the conception and the inspection of the cofferdams and bracings, during the Work.
- .5 Do not use soil material until written report of soil test results is approved by Departmental Representative.

.6 Health and Safety Requirements.

- .1 Do construction occupational health and safety.

1.5 PROTECTION OF EXISTING STRUCTURES

- .1 Protect existing structures in accordance with local regulations.

.2 Underground structures and utility systems.

- .1 Before commencing Work verify and establish location of buried services on and adjacent to site.
- .2 Details indicated on the drawings regarding the dimensions, location and depth at which underground structures and utilities are buried are only provided for general information purposes and are not necessarily accurate or complete.
- .3 Before starting to dig trenches, notify the Departmental Representative and/or the authorities of the public utility companies involved and determine the location and condition of the underground structures and systems. Clearly identify the locations to prevent any service interruptions while the Work is being performed.
- .4 Confirm the location of the underground systems by carefully performing trial excavations.
- .5 Maintain in operation and protect against any damage all water, sewage, gas, electricity and telephone lines as well as other systems or structures that might be in the areas to be excavated.
- .6 Before moving or disturbing a structure or a public utility system in any way, obtain appropriate directives from the Departmental Representative.
- .7 Obtain appropriate directives from Departmental Representative before removal or detour of existing systems at the excavation site. Assume the costs for this Work.
- .8 Take note of the location of the underground lines that have been retained, diverted or abandoned.
- .9 Confirm the location of excavations recently performed near Work area.

.3 Existing buildings and structures on the property.

- .1 In the presence of the Departmental Representative, check the condition of the buildings, trees and other plants, lawns, fences, service poles, cables, railroad tracks, road surfaces, survey markers and elevation indicators that need to stay in place and which may be damaged during the Work.

- .2 Protect existing buildings and structures on the property likely to sustain damage, against all such damage while the Work is being performed. In the event of damage, immediately restore the affected components to their original state, to the Departmental Representative's satisfaction.
- .3 If roots or branches need to be cut to complete the excavation work, only perform this work after obtaining the Departmental Representative's approval.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Type 1 Fill: Crushed stone 20-0:

Clean, hard, durable crushed stone or gravel free of shale, clay and friable, organic or deleterious material; the sizing of the material shall remain within the range indicated below, when tested in accordance with the ASTM C136-06 and ASTM C117-04 Standards, and the sizing curve plotted on a semi-logarithmic graph shall be continuous and progressive. The fill shall be certified DB 0-20 fill.

ASTM Sizing: % Throughs

31.5	mm	100
20	mm	90-100
14	mm	68-93
5	mm	35-60
1.25	mm	19-38
315	µm	9-17
80	µm	2-7

.2 Type 2 Fill: Granular Class A Soils:

Compactable soils, essentially comprising granular, hard, durable, non-plastic material, such as MG-112 sand, gravel or crushed stone. These soils shall be free of shale, clay, and friable, organic or deleterious material, and of contaminated material. These soils shall not be frost prone. These soils shall not contain rubble greater than 100 mm in diameter.

.3 Type 3 Fill: Regular Class B Soil:

All compactable, unfrozen material may be used except organic soils. The soil components must be minerals, free from stones greater than 150 mm in diameter, clinker, ashes, waste, pieces of sod or other harmful material.

.4 Drainage Fill:

Crushed stone 19 mm in diameter, clean, hard, and durable, containing no dust or foreign material, organic or plant material, or flat or elongated fragments.

.5 Stone Dust:

Screened stone: hard, clean, durable, free of shale, clay and friable, organic or deleterious material; in compliance with the following sizing (ASTM C136-06 and ASTM C117-04):

ASTM Sizing; % Through

10	mm	100
5	mm	75-100
160	µm	4-25
80	µm	0-10

.6 Dimensionally Stabilized Fill Materials:

.1 0.4 MPa maximum compression strength at 28 days;

.2 maximum Portland cement content of 25 kg/m³, comprising 40% fly ash as cement replacement: in accordance with the CAN/CSA-A3000, Type GU Standard;

.3 0.07 MPa minimum strength at 24 hours;

.4 Concrete aggregate: In accordance with the CAN/CSA-A23.1/A23.2-04 Standard;

.5 Portland cement: Type GU;

.6 Slump: 160 mm.

.7 Geotextile Membrane: Texel No. 7609 type or approved equivalent.

.8 Before using, have the Departmental Representative approve all fill materials. After receiving approval, always purchase the same materials from the same sources.

.9 Before resorting to using borrowed material, the Contractor may use excavated material if it meets the requirements of this section of the specifications and is approved by the Departmental Representative. In-situ soils shall not be used as type 2 fill. They may be considered as type 3 fill if they meet the requirements for this type of fill.

.10 Provide supplementary fill material suitable for the Work, from an outside supplier.

- .11 **Bedding and surround materials for pipes and underground structures:** The bedding and surround of underground structures or the anti-contamination layer are produced using MG-20b calibre granular materials complying with the Quebec Department of Transport's 2101 and 2103 Standards shown in the tables appearing in the "Granular Materials" article, and whose petrographic number is 300 max. with M_gSO_4 (NQ2560-450) durability of 35 % max.

ASTM Sizing; % Throughs

31.5	mm	100
20	mm	90-100
14	mm	68-93
5	mm	35-60
1.25	mm	19-38
315	μm	9-17
80	μm	5-11

PART 3 - EXECUTION

3.1 PREPARATORY WORK

- .1 At the start of the Work, clear away all obstacles, snow and ice from the surfaces of the excavation and backfill area to the extent indicated and/or required to perform Work.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative's approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.3 STRIPPING OF TOP SOIL

- .1 Once the bushes, weeds and sod have been removed from the site, start excavating the top soil in the areas required for completion of the Work.
- .2 Excavate the top soil down to the subsoil. Do not mix the top soil with material from the subsoil.
- .3 Pile the top soil in the areas designated by the Departmental Representative for later use in landscaping operations. Do not pile the earth higher than 2 m.
- .4 Remove the unused top soil from the site.

3.4 PILING

- .1 Pile the backfill material in the areas designated by the Departmental Representative and store the aggregate material to prevent any segregation.
- .2 Protect the fill materials against any contamination.

3.5 COFFERDAMS, BRACING, CROSS BRIDGING, AND UNDERPINNING

- .1 Build temporary falsework as required.
- .2 Perform the following operations during backfilling:
 - .1 Unless otherwise indicated or directed by the Departmental Representative, remove the sheet piles and falsework from the excavation sites.
 - .2 Do not remove the cross bridging before the fill material has been piled to the height at which it stands.
 - .3 Gradually remove the sheet piles, keeping the compacted backfill at least 500 mm above the bottom of the sheet piles.
- .3 When the sheet piles need to remain in place, cut the tops of the sheet piles at the level indicated.
- .4 Perform the following operations once the infrastructure construction is completed.
 - .1 Remove the cofferdams, falsework and cross bridging.
 - .2 Remove the surplus material from the site.

3.6 EXCAVATION DEWATERING AND UPLIFT PREVENTION

- .1 Keep the excavations dry throughout Work.
- .2 If there is a risk of boiling or uplift, do not excavate below the water table. To prevent the conduits or the excavation floor from heaving, lower the water table, cut back the sheet piles or use other appropriate methods.
- .3 Protect open pits against flooding and damage that may result from surface runoff.
- .4 Evacuate the water in a manner that poses no risk to public or private properties, or to any part of the completed Work or Work in progress.
- .5 Provide and install flocculation tanks, settling tanks or other water treatment facilities to remove suspended solids or other undesirable material before discharging the water into a storm sewer, watercourse, or drainage basin.

3.7 EXCAVATION

- .1 Notify the Departmental Representative at least one week before starting the excavations and record the elevations of the natural land in his presence where necessary.
- .2 Perform the excavation work according to the indicated mapping, profiles, levels, cuts and dimensions.
- .3 The excavation work shall in no way alter the load-bearing capacity of adjacent foundations.
- .4 Do not move the earth under the canopy of trees or bushes that are to remain in place. If it is necessary to excavate between the roots, excavate by hand and cut the roots with a well-sharpened axe or saw.
- .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 any open trench at end of day's operation.
- .6 Excavation materials and piled materials shall be stored at an adequate distance from the trenches.
- .7 Limit Work performed with construction machinery in the immediate vicinity of unfilled trenches.
- .8 Dispose all excavation surpluses or unsuitable materials away from work site.
- .9 Avoid blocking surface runoff or natural watercourses.

- .10 Excavation bottoms shall be free of loose, soft or organic material.
- .11 If the soil at the bottom of the excavations appears to be unsuitable, notify the Departmental Representative.
- .12 Once the excavations are completed in an area, have them approved by the Departmental Representative.
- .13 Remove all unsuitable material, such as stone, rock fragments, and others, from the excavation site that might slides down into it.
- .14 Contour the excavations by hand, reinforce the walls and remove all loose material and debris from the excavations. If the material at the bottom of the excavation has been disturbed, compact it until it is at least as dense as the undisturbed soil. Clean cracks found in the rock and fill them with concrete grout or mortar to the Departmental Representative's satisfaction.
- .15 Install geotextiles.

3.8 FILL TYPES AND COMPACTION

- .1 Use types of fill as indicated or specified below or as mentioned on the plans. Compaction densities are percentages of maximum densities obtained from ASTM D698, and/or ASTM D1557.
 - .1 Place unshrinkable fill in areas as indicated.

3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

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

3.10 BACKFILLING

- .1 Perform compaction of backfilling materials with vibrating equipment.
- .2 Do not proceed with backfilling operations until Departmental Representative has inspected and approved the installations.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.

- .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .6 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.
- .7 Place unshrinkable fill in areas as indicated.
- .8 Consolidate and level unshrinkable fill with internal vibrators.

3.11 SITE RESTORATION

- .1 Once Work is completed, remove any surplus material and debris, re-grade the slopes and correct any defects.
- .2 Replace top soil as indicated.
- .3 Reinstall lawns to elevation which existed before excavation.
- .4 Restore the surfaces of roads affected during the Work to the condition and level that existed before the excavation began, ensuring that these structures are restored to their original thickness.
- .5 Clean and restore areas damaged during the Work, according to the Departmental Representative's directives.
- .6 During the first 24 hours, use temporary shoring to support the loads exerted by traffic on the dimensionally stabilized backfills.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

3.12 DISPOSAL OF WASTE MATERIALS

.1 General.

.1 The Contractor shall load, transport and dispose of all waste material off-site, at the location, which he shall select and which is suited to the disposal of said waste, in compliance with the directives of the MDDEP's Soil Protection and Contaminated Sites Rehabilitation Policy.

.2 Loading, transportation and disposal of waste are at the Contractor's expense.

.2 Dry Materials.

.1 All materials from 2nd class excavation such as crushed or shredded residue, which are non-petruscible and contain no hazardous waste such as scrap wood, rubble, waste plaster, and concrete, masonry and paving refuse, shall be transported and disposed of at a dry materials dump authorized by Quebec's Ministère de l'Environnement (Ministry of the Environment). The Contractor must provide the Departmental Representative with proof that the selected dumpsite meets the requirements of this article as well as receipts issued by the dumpsite upon reception of the material. The cost of sorting, handling, and disposing of these materials shall be assumed by the Contractor.

.3 Unusable Materials.

.1 All materials from 2nd class excavation and deemed unusable by the Departmental Representative, such as putrid matter, top soil, loam, etc., shall be transported to a suitable location chosen by the Contractor and approved by the Departmental Representative. Rotting materials from debris will also be loaded into closed truck boxes. The cost of sorting, handling and disposing of these materials shall be assumed by the Contractor.

.2 If deemed necessary by the Departmental Representative, the Contractor shall, for filling trenches, replace unusable materials with acceptable materials.

3.13 DISPOSAL OF EXCAVATION SURPLUS

.1 Excavation surplus refused by the Departmental Representative for the project's backfilling purposes can be disposed of at a site selected by the Contractor and approved by the Departmental Representative, and located at least 75 m (250 ft.) from a road's right-of-way or the shoreline of a water course. Materials must be placed so as not to be visible from a public road or obstruct the flow of water. Once disposal has been completed, the materials must be leveled to the satisfaction of the owner(s) of the land. The Contractor must obtain a letter of authorization from each of the owners of the land covered by these provisions. A copy of this agreement must be provided to the Departmental Representative before material is transported.

- .2 All Work covered by the preceding provisions shall be carried out in compliance with the directives and/or regulations of the MDDEP's *Soil Protection and Contaminated Sites Rehabilitation Policy*, which, in the event of contradiction, take priority over the preceding requirements.
- .3 All expenses related to any use whatsoever of the above-mentioned disposal and/or landfill site, including the obtention of any permit and/or authorization, as well as the loading, transportation and disposal, shall be at the Contractor's expense.
- .4 All sites for the storage and disposal of debris (excavation surplus excluding any refuse) considered within the framework of this contract must first be approved by the Departmental Representative no later than the first worksite meeting. None of these materials can be disposed of until this approval has been obtained.
- .5 Part of the debris is used by the Contractor to carry out Work covered by this contract. If excavation surplus is required by the Departmental Representative, the Contractor shall transport and spread this surplus material at his expenses, at designated locations within an overland radius of 8.0 km, as established by the Departmental Representative.
- .6 All excavation surplus and 1st and 2nd class debris not required by the Departmental Representative become the property of the Contractor.
- .7 The Contractor shall ensure that these materials are not disposed of in a flood zone and, prior to the start of Work, shall provide the Departmental Representative with a permit.
- .8 The Contractor is solely responsible for consequences resulting from the filling of one or more properties and possible claims or lawsuits from the property owners concerned, with regards to the leveling, the quality of debris materials, damages to trees, terraces, etc. The disposal of excavation surplus must not impede the natural drainage of the site.

END OF SECTION