

PART 1 - GENERAL**1.1 DESCRIPTION**

- .1 Excavation, trench digging and backfilling work include the supply of all the materials, supplies, services, labour, equipment, machinery and transport necessary for the complete execution of the work as indicated in the structural plans and in the current section. The work also includes, without being limited to:
 - .1 Detailed excavation for the footings and the pipes under the slabs.
 - .2 Backfilling of the foundations and of the pipes below the slabs.
 - .3 Excavation and backfill work for external features (landscaping).
 - .4 Installation of geotextile membranes and blind drains.
 - .5 Protection work of existing structures.
 - .6 Temporary support structures, ground-work and pumping work

1.2 RELATED SECTIONS

- .1 The specialized Contractor is responsible for obtaining a copy of all the sections of these specifications even if they do not appear to pertain to his speciality. If he does not, it shall be understood that he agrees to the clauses and requirements of all sections in these specifications. The specialized Contractor must consult the table of contents of these specifications to have knowledge of the complete list of the specifications sections.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-04, 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), Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557-07, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318-05, 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, Cementitious Materials Compendium.
 - .2 CAN/CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of test and Standard Practices for concrete.
- .4 National Research Council Canada (NRC) and the Régie du Bâtiment du Québec.
 - .1 Québec Construction Code – Chapter 1, Building and National Building Code of Canada 2010 (amended) as well as the user's guide – NBC 2010: Structural Commentaries (Part 4 of Division B)

1.4 DEFINITIONS

- .1 Type of excavation:
 - .1 Regular excavation:

Digging out of all excavation materials of any type whatsoever not considered to be rock, including erratic dense land, compact clay, frozen and partially cemented materials, and existing foundations and roads that can be removed with heavy construction equipment.
 - .2 Rock removal:

Igneous, sedimentary or metamorphic rock, which before being excavated was part of solid rock, and stones or rock fragments whose individual volume exceeds 1 m³.
- .2 Topsoil: all material suitable for plant growth which may be used as supplementary soil for landscaping or seeding.
- .3 Waste materials: surplus materials or excavated materials that cannot be used for this project.
- .4 Borrowed materials: materials from areas located outside the areas to be backfilled, required for backfilling or other parts of the work.
- .5 Unsuitable materials:
 - .1 Weak, compressible materials located beneath excavated areas.
 - .2 Frost-prone materials located beneath excavated areas.
 - .3 Frost-prone materials:

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- .1 Fine-grained soil with a plasticity index of less than 10, according to the ASTM D4318 test, and sizing that complies with the specified limits of the ASTM C136 and ASTM D422 tests. Sieve slot sizes shall comply with the CAN/CGSB-8.1 and CAN/CGSB-8.2 standard.

- .2 Table

Sieve Slot Sizes	% of Sieved Material
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45

- .3 Coarse-grained soil of which more than 20% by weight passes through a 0.075 mm sieve.
- .6 Dimensionally stabilized fill materials (concrete fill): very weak mix composed of Portland cement, concrete aggregate and water that will not compact once placed in utility service mains, and which can be excavated without prior preparation.

1.5 DOCUMENTS/SAMPLES TO BE SUBMITTED

- .1 At least four (4) weeks before beginning the work, advise the Departmental Representative regarding the proposed source of supply for the [backfill materials] [dimensionally stabilized fill materials] and allow him to access the source for sampling and approval purposes.
- .2 Submit to the Departmental Representative the results of the sizing tests performed on the proposed backfill materials.
- .3 Provide the Departmental Representative with a laboratory analysis attesting that the backfill aggregate does not contain pyrite and is certified DB (*dalle de béton* or concrete slab).
- .4 All documents shall be submitted in triplicate. A single (1) annotated copy shall be returned to the Contractor. The Contractor shall be responsible for making additional copies and distributing them.
- .5 Submit to the testing laboratory for analysis 25 kg samples of each of the specified types of backfill as well as representative samples of the excavated material. For earth containing coarse gravel or large pieces of crushed stone, submit 70 kg samples.

1.6 EXCAVATION SLOPES, BRACING, CROSS BRIDGING, SUPPORT STRUCTURES AND UNDERPINNING WORK

- .1 Prevent the excavation walls from collapsing or sloughing. Prevent the shifting or compacting of adjacent and excavation soil, as well as soil adjacent to existing buildings, facilities and services or adjacent to buildings, facilities and services under construction.

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- .2 During excavation work, construct the required slopes and/or provide and place all the falsework, cofferdams, bracing or other supports needed for proper excavation. The Contractor shall be entirely responsible for all this work.
- .3 If support structures are required on the Departmental Representative's drawings: design, provide and install walls at these locations. Also design, provide and install the other additional walls or bracing required according to the excavation method selected by the Contractor.
- .4 The specialized Contractor is entirely responsible for engineering and designing earth retaining structures. The structures shall be designed to withstand the pressure exerted by the soil, water, overloads caused by the foundations or buildings adjacent to the work, highway overloads and overloads exerted by the machinery needed to construct the basin. In addition, their design shall comply with the Quebec Construction Code - Chapter I, Building and National Building Code of Canada 2010 (amended), in particular parts 4 and 8, as well as the supplement to the National Building Code of Canada 2010.
- .5 All costs for the support structures and excavation required to locate utilities shall be included in the submission costs.
- .6 The Contractor is solely responsible for damage to persons or existing buildings, installations and services that may result from the absence or weakness of support structures or cofferdams, or due to the use of incorrect slope angles, whether this damage is the result of their incorrect installation, poor maintenance or removal.
- .7 Include the cost of all work required to protect the excavations in the submission price.
- .8 In cold weather, protect the slopes from frost so that backfilling operations can continue without interruption.
- .9 Retain the services of an Engineer who is a member in good standing of the Ordre des Ingénieurs du Québec to design and inspect the retaining walls, cofferdams, sheet piles, as well as the support, cross bridging and underpinning structures required for the work, or to determine the required slope angle for excavation walls to ensure their stability in compliance with the most recent version of the Canadian Code for Construction Safety, and local by-laws.
- .10 At least 2 weeks before the start of the work, submit the design documents and related technical data for verification. All documents shall be submitted in triplicate. A single (1) annotated copy shall be returned to the Contractor. The Contractor shall be responsible for making additional copies and distributing them.
- .11 Design documents and related technical data shall bear the seal and signature of an Engineer recognized in the Province of Quebec.
- .12 The Departmental Representative responsible for designing the falsework and slope angles shall provide proof that he has a professional liability insurance policy, unless this Engineer is employed by the Contractor. If so, the Contractor shall provide proof that his insurance policy covers his engineer's work.
- .13 The excavation area shall not exceed the property lines and/or permanent easements and/or construction easements.
- .14 Take into account the recommendations of the geotechnical study on the thrusts to consider when designing the planned support systems.

1.7 PROTECTION OF EXISTING STRUCTURES

- .1 Protect the excavation bottoms against any softening. If softening occurs, remove the softened soil and replace it with type 2 compacted fill.
- .2 Protect excavation bottoms against frost.
- .3 Take the necessary measures to eliminate the dust generated.
- .4 Adequately protect existing facilities, buildings and services, and existing equipment located on site to ensure they are not damaged during the work.
- .5 Never stack waste material in an area where it could hinder the work or property drainage.
- .6 Underground structures and utility systems
 - .1 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.
 - .2 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.
 - .3 Confirm the location of the underground systems by carefully performing trial excavations.
 - .4 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. Before moving or disturbing a structure or a public utility system in any way, obtain appropriate directives from the Departmental Representative.
 - .5 If required, provide the Departmental Representative and the public company with recommendations regarding the removal or detour of existing systems at the excavation site. Assume the costs for this work.
 - .6 Take note of the location of the underground lines that have been retained, diverted or abandoned.
 - .7 Confirm the location of excavations recently performed near the work area.
- .7 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.

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- .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.
- .8 Comply with municipal requirements and the Safety Code for the construction industry, S-2.1, r.6, Province of Quebec, regarding excavation and worker protection safety standards.
- .9 Adequately protect elevation indicators, alignment markers, survey markers and geodetic monuments located on the construction site.
- .10 Take all necessary measures to prevent any property damage and bodily injury.
- .11 Install protective barriers around all excavation sites.

1.8 CHOICE OF EXCAVATION METHODS

- .1 The Contractor is solely responsible for choosing the excavation methods to be applied. Submit these methods beforehand to the Departmental Representative for review and comments.

1.9 BLASTING OPERATIONS

- .1 No blasting shall be permitted during the work.

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 and ASTM C117 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	90-00
14	mm	68-93
5	mm	35-60
1.25	mm	19-38
315	µm	9-7
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 C136-83 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 to 200 mm.

.7 Anti-shear reinforcement:

Biodegradable corrugated cardboard, 100 mm thick, treated to support cast-in-place concrete adequately until it has hardened.

- .8 **Geotextile membrane:** Texel No. 7609 type or approved equivalent.
- .9 **Blind drain piping:** 150 mm diameter Big O type pipes.
- .10 Before using, have the Departmental Representative approve all fill materials. After receiving approval, always purchase the same materials from the same sources.
- .11 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.
- .12 Provide supplementary fill material suitable for the work, from an outside supplier.

PART 3 - PERFORMANCE

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 the work.
- .2 Using a saw, carefully cut the surfaces of the roads and sidewalks along the perimeter of the proposed excavation so the surfaces break cleanly and uniformly.
- .3 The Contractor shall construct a work surface made of granular material to enable heavy machinery to travel to the work site.

3.2 TOPSOIL

- .1 Once the bushes, weeds and sod have been removed from the site, start excavating the topsoil in the areas required for completion of the work.
- .2 Excavate the topsoil down to the subsoil. Do not mix the topsoil with material from the subsoil.
- .3 Pile the topsoil 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 topsoil from the site.
- .5 Do not move the topsoil when it is damp or in any manner whatsoever that might alter the soil structure.

3.3 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.

3.4 EXCAVATION DEWATERING AND UPLIFT PREVENTION

- .1 Keep the excavations dry throughout the work.
- .2 Submit to the Departmental Representative for [approval] [verification], the details of the proposed methods for dewatering the excavations or preventing uplift, such as the installation of dikes and filtration points, and sheet pile cut off.
- .3 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.
- .4 Protect open pits against flooding and damage that may result from surface runoff.
- .5 Evacuate the water in a manner that poses no risk to public or private properties, or to any part of the completed work or the work in progress.
- .6 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.
- .7 Take the required measures to prevent heaving and to ensure the bottoms of deep excavations remain stable. Have an Engineer who is a member in good standing of the Ordre des Ingénieurs du Québec design the pumping method and establish the anticipated flows and the number of pumps required to achieve this objective. Submit a drawing of the method along with calculations to the Departmental Representative for review and comments, before the work begins.
- .8 Maintain pumping operations throughout the entire construction process to ensure the stability of the structures and to prevent them from uplift.
- .9 The Contractor is solely responsible for controlling groundwater as well as ensuring the stability of the structures and preventing them from uplift during construction.
- .10 The following deep groundwater pumping principles shall apply:
 - .1 The water level in all excavated areas shall be kept 0.3 m lower than the top of the granular base of the structure's raft foundation for the entire duration of the work (see geotechnical study).
 - .2 Pumping equipment in the excavations shall be operational at all times, even in cold weather or during electrical power outages. Carry out emergency measures to get any defective equipment operating again immediately or repair or replace it without delay. Keep a complete replacement pumping system on site in case of breakdown.
- .11 Quickly remove all water, mud and debris that might penetrate or accumulate inside structures built under this contract.
- .12 All expenses incurred to comply with the above-mentioned drainage requirements shall be included in the submission price.

3.5 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 to enable the installation, construction, inspection and drainage of the required structures.
- .3 During the excavation work, remove concrete structures, masonry, parking lot and access surfaces, sidewalks, demolished foundations and rubble as well as any obstructions.
- .4 Excavate according to specific lines and levels to minimize the quantity of fill required.
- .5 The excavation work shall in no way alter the load-bearing capacity of adjacent foundations.
- .6 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.
- .7 Unless the Departmental Representative provides written authorization, it is forbidden to dig more than 30 metres of trench before installing components to be buried and the length of unfilled trench shall not exceed 15 metres at the end of a work day.
- .8 Excavation materials and piled materials shall be stored at an adequate distance from the trenches.
- .9 Limit work performed with construction machinery in the immediate vicinity of unfilled trenches.
- .10 Permanently dewater all construction site areas during the work, as required under Section 3.5 of these specifications.
- .11 Remove all unsuitable material, stone or rock fragments from the excavation site or material that might slide down into it.
- .12 Excavation bottoms shall be free of loose, soft or organic material.
- .13 If the soil at the bottom of the excavations appears to be unsuitable, notify the Departmental Representative and follow his directives.
- .14 Once the excavations are completed in an area, have them approved by the Departmental Representative.
- .15 When the excavation has gone too deep, backfill the unauthorized excavation with type 2 fill material, installing it as required under Section 3.9 – Backfilling.
- .16 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.

3.6 REMOVAL OF EXCAVATED MATERIALS

- .1 Retain reusable excavation material for backfilling at the site.

- .2 Transport off site deleterious debris, waste and surplus materials in compliance with all applicable laws.
- .3 When disposing off site of excavation materials, the contractor shall provide additional characterization tests requested on site at his own expense. The only tests provided by the Owner are those provided by the environmental study.

3.7 FILL AND COMPACTING MATERIALS

- .1 Densities achieved by compacting are percentages of calculated maximum densities based on the ASTM D698 and ASTM D1557 standards.
- .2 Use backfill materials that comply with the types defined in Section 2.1.
- .3 The specifications shown on the Departmental Representative's drawings for the various layers of fill material are minimum backfill specifications after compacting.
- .4 Backfill the area around completed structures to the levels indicated on the drawings, with the various layers of fill material specified thereon.
- .5 Unless otherwise indicated on the drawings, compact the various materials to achieve the densities indicated below:
 - .1 type 1: 95% Modified Proctor
 - .2 type 2: 95% Modified Proctor
 - .3 type 3: 90% Modified Proctor
- .6 Take the necessary measures to ensure the type 3 backfill material retains enough moisture to enable it to be compacted to the specified density.
- .7 Take care not to damage membranes, wall and slab insulation during backfill operations.
- .8 Unless otherwise indicated, install the backfill material in uniform horizontal layers not exceeding 300 mm in compacted thickness to the specified levels. Compact each layer before placing the next layer.
- .9 During the work, if tests indicate that the materials do not comply with the requirements described in these specifications, remove and replace the unacceptable materials at no additional cost and resume work.
- .10 After the backfill work is completed, rough grade the entire property to the levels and slopes required to ensure surface water runs away from the building and the topsoil and sod can be placed in accordance with the required slopes and levels.

3.8 BACKFILLING

- .1 Backfill the area along the walls only after the structural slabs are built at [] of elevation.

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- .2 Do not start backfilling before completion of the drainage, waterproofing and insulation work, and before the Departmental Representative has inspected the site and given his authorization.
- .3 The surfaces to be backfilled shall be free of debris, snow, ice, water or frozen earth. The backfill shall not contain any frozen material, ice, snow or debris.
- .4 Place the backfill material around the structures in compliance with the specifications of paragraph 3.8 of this section and the Departmental Representative's directives.
- .5 Do not place backfill material around or above cast-in-place concrete structures within 24 hours of removing the forms from the concrete.
- .6 Simultaneously backfill each side of walls or other structural component to ensure the stresses exerted by the soil cancel one another out. The difference in backfill height shall not exceed 500 mm.
- .7 When the earth is likely to exert uneven pressure temporarily on walls or other structures:
 - .1 allow the concrete to cure for at least 28 days, and wait until it is strong enough to support the pressure exerted by backfilling and compacting, and until it is approved by the Departmental Representative.
 - .2 if the Departmental Representative gives his approval, install supports or cross bridging to neutralize the uneven pressure and leave them in place until the Departmental Representative authorizes their removal.
- .8 Unless otherwise indicated by the Departmental Representative, remove the falsework from the excavations as backfilling progresses.
- .9 During backfilling:
 - .1 Do not remove the cross bridging before the fill material has reached the levels at which the cross bridging has been installed;
 - .2 Remove the sheet piles, as to keep the compacted backfill at least 500 mm above the bottom of the sheet piles.
- .10 Spread the backfill material in uniform horizontal layers not exceeding 150 mm in compacted thickness to the [specified levels]. Compact each layer before spreading the next layer.
- .11 Carry out dimensionally stabilized backfills at the specified locations.
- .12 Consolidate and level these dimensionally stabilized backfills using internal vibrators.
- .13 Install the drainage system in the backfill, according to the Departmental Representative's directives.

3.9 INSPECTION AND TRIALS

- .1 The materials and compacting analyses shall be performed by a testing laboratory designated and paid for by the Owner.

3.10 FROST PROTECTION

- .1 When backfilling is performed under freezing conditions, defrost and heat the material before placing and compacting it. Protect the ground against frost until the backfilling operation is completed.

3.11 BLIND DRAIN INSTALLATION

- .1 Conduit bed: place a layer of type 2 fill at least 150 mm thick; compact to specified levels, to 95% of maximum density, Modified Proctor. Then dig a shallow trench in the final surface to prevent the drain from moving.
- .2 Installation of the conduits:
 - .1 Ensure that the inside of the conduits and couplings are clean before installing them;
 - .2 Slope the conduits downward to the coupling points shown on the mechanical drawing (minimum slope: 2 mm per metre);
 - .3 Do not use any concrete, masonry components, stones, piece of wood or any other type of shim to give the conduits the desired slope;
 - .4 Connect the conduits using the type of couplings recommended by the manufacturer;
 - .5 Insert plugs into the ends of the drains;
 - .6 Every time the work is interrupted, protect the ends of the conduits against any damage and prevent foreign material from entering.
- .3 Installation of the drainage fill:
 - .1 Place the drainage fill after having the Departmental Representative approve the installation of the conduits.
 - .2 Place a 150 mm layer of drainage fill on each side of the conduit and a 300 mm layer above the conduit.
 - .3 Install the drainage fill by hand in 150 mm layers. Compact by gently tamping. Take care not to move the conduits.
 - .4 The backfill shall be covered with geotextile membrane complying with section 2.1.5.

3.12 SITE RESTORATION

- .1 Once the work is completed, remove any surplus material and debris, re-grade the slopes and correct any defects identified by the Departmental Representative.
- .2 Re-install the topsoil [according to the Departmental Representative's directives].
- .3 Re-install the sod to its pre-excavation level.

- .4 Restore the surfaces of roads [and sidewalks] 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.

END OF SECTION