

EXCAVATING AND BACKFILLING FOR BUILDINGS

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**Part 1 General**

**1.1 SUMMARY**

- .1 Related Sections:
  - .1 Section 02 41 13 - Selective Site Demolition.
  - .2 Section 07 21 13 – Board Insulation: perimeter foundation insulation and frost barrier

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D698, 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, 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, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
  - .2 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

**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 0.25 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> 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.

EXCAVATING AND BACKFILLING FOR BUILDINGS

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- .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.
- .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 under excavated areas:
- .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 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Inform Contract Administrator at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.
  - .3 If required by Contract Administrator, submit 20 kg samples of granular fill material specified including representative samples of excavated material.
  - .4 Ship samples prepaid to testing agency clearly marked, in tightly closed containers to prevent contamination and exposure to elements.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Storage and Protection:
  - .1 Protect existing features in accordance with applicable local regulations.
  - .2 Existing 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 Utility or City, establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

EXCAVATING AND BACKFILLING FOR BUILDINGS

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- .3 Confirm locations of buried utilities by careful test excavations or soil hydrovac methods.
- .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
- .5 Where utility lines or structures exist in area of excavation, obtain direction of Contract Administrator before removing or re-routing or otherwise disturbing utilities or structures.
- .6 Record location of maintained, re-routed and abandoned underground utility lines.
- .7 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
  - .1 Conduct, with Contract Administrator, 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 Contract Administrator.
- .4 Protect bottoms of excavations from softening. Should softening occur, remove softened soil and replace with compacted low density concrete fill to satisfaction of Contract Administrator.
- .5 Protect bottoms of excavations from freezing.
- .6 Effect approved methods to minimize dust as a result of this work.

**Part 2 Products**

**2.1 FILL MATERIALS**

- .1 Granular fill: crushed, pit run or screened stone, gravel or sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious substances and graded within the Manitoba Infrastructure and Transportation 2002 Aggregate Grading Specification:

EXCAVATING AND BACKFILLING FOR BUILDINGS

Passing Sieve Size		Type A ( base course A )		Type C ( base course C )	
Metric	Imperial	Granular	Crushed Stone	Granular	Crushed Stone
37.5mm	1 1/2"			100%	
25 mm	1"			85-100%	100%
19 mm	3/4"	100%	100%		
16 mm	5/8"	80-100%			
4.75 mm	No. 4	40-70%	35-70%	25-80%	25-80%
2 mm	No. 10	25-55%			
425 µm	No. 40	15-30%	15-30%	15-40%	
75 µm	No. 200	8-15%	8-17%	8-18%	8-20%
Min. Crush Count		35%	100%	15%	100%
Maximum Los Angeles Abrasion loss		35%	35%	40%	40%
Maximum Shale Content		12%		20%	
Maximum Clay Balls		10%			

- .2 Earth fill: selected earth material from excavation or other sources, approved by Contract Administrator for use intended, unfrozen and free from rocks larger than 76 mm, cinder, ash, sods, refuse or other deleterious materials.
- .3 Sand: clean, washed, coarse sand free from clay, shale and organic matter.
- .4 Shearmat: honeycomb type bio-degradable cardboard 200 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.

**3.2 STRIPPING OF TOPSOIL**

- .1 Do not use topsoil stripped from Site for finish grading or landscaping work. Remove from Site.

**3.3 STOCKPILING**

- .1 Stockpile fill materials in areas designated by Contractor. Stockpile granular materials in manner to prevent segregation.

EXCAVATING AND BACKFILLING FOR BUILDINGS

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- .2 Protect fill materials from contamination.
- .3 Do not stockpile material on completed pavement where damage to pavement may occur..

**3.4 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 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.
- .3 Protect open excavations against flooding and damage due to surface run-off.
- .4 Dispose of water in manner not detrimental to public and private property, or any portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .5 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 Excavate to lines, grades, elevations and dimensions as indicated for installation, construction and inspection of work specified.
- .2 Excavate to well defined lines to minimise quantity of fill material required.
- .3 Remove concrete, masonry, paving, walks and other obstructions encountered during excavation
- .4 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.
- .5 Dispose of surplus and unsuitable excavated material off Site.
- .6 Do not obstruct flow of surface drainage.
- .7 Restrict vehicle operations directly adjacent to open excavation.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter. Notify Contract Administrator when soil at bottom of excavation appears unsuitable and proceed as directed by Contract Administrator.
- .9 If frozen material is encountered during excavation remove frozen material before installation of any foundation.
- .10 Correct unauthorized over-excavation at no extra cost as follows:

EXCAVATING AND BACKFILLING FOR BUILDINGS

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- .1 Fill under bearing surfaces and footings with concrete specified for footings .
- .2 Fill under non-bearing surfaces with earth fill compacted to not less than 95 % of Standard Proctor maximum dry density.
- .11 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.

**3.6 FILL TYPES AND COMPACTION**

- .1 . Compaction densities are percentages of maximum densities obtained from ASTM D698 – Standard Proctor Dry Density. Dimensions specified herein are minimum dimensions after compaction.
- .2 Use types of fill as indicated or specified below.
- .3 Exterior side of perimeter walls and grade beams
  - .1 Where slabs-on-grade are adjacent to building: use Type A fill to subgrade level; compact to 98% density.
  - .2 Where landscaped areas are adjacent to buildings: use Type A granular fill to subgrade level; compact to 95% density. Sloped clay cap away from building for positive drainage.
- .4 Under structurally supported concrete slabs: use earth fill to underside of void form. Compact to 98% density.
- .5 Under slab-on-grade (sidewalks): provide minimum 150 mm thickness Type A granular fill to underside of slab; compact to 95% density.

**3.7 BACKFILLING**

- .1 Do not proceed with backfilling operations until Contract Administrator has reviewed installations and work that backfilling will conceal.
- .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 Prior to placing fill under slabs on grade compact existing subgrade to obtain same compaction as specified for fill. Remove soft and unsuitable material and fill with acceptable material.
- .5 Do not backfill around or over cast-in-place concrete until concrete has fully cured and backfilling operations have been reviewed by Contract Administrator.
- .6 Place backfill material in uniform layers not exceeding 150 mm loose thickness. Compact each layer before placing succeeding layer.
- .7 Backfill simultaneously on both sides of walls, grade beams, piles and other installations to equalize loading. Difference not to exceed 1.00 m.

EXCAVATING AND BACKFILLING FOR BUILDINGS

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- .8 Place material under, around and over installations until 600 mm cover is provided. Do not dump or place material directly on installations.
- .9 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
  - .1 Permit concrete to cure until it has sufficient strength to withstand earth and compaction pressure, or
  - .2 If acceptable to Contract Administrator, erect bracing or shoring to counteract unbalance, and leave in place until removal is authorized by Contract Administrator.
- .10 Use methods to prevent disturbing or damage to foundations, piles, buried services, drainage system or other installations that backfilling will conceal. Notify Contract Administrator of any damage and make good at no additional cost to Contract.

**3.8 RESTORATION**

- .1 Upon completion of Work, remove waste materials and debris, trim slopes and correct defects noted by Contract Administrator.
- .2 Dispose of surplus or unsuitable material from Site.
- .3 Clean and reinstate areas affected by work as directed by Contract Administrator.
- .4 Reinstate pavements disturbed by excavation to thickness, structure and elevation which existed before excavation.

**3.9 INSPECTION AND TESTING**

- .1 Testing of fill materials and compaction will be carried out by an independent testing agency appointed by the City under separate contract.
- .2 If, during progress of work, tests indicate fills and compaction do not meet specified requirements, remove defective fills, replace, compact and retest at no extra cost to the Contract.

**END OF SECTION**

**BORED CONCRETE PILES**

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**Part 1           General**

**1.1           RELATED SECTIONS**

- .1   Section 03 20 00 - Concrete Reinforcing.
- .2   Section 03 30 00 - Cast-in-Place Concrete.

**1.2           MEASUREMENT PROCEDURES**

- .1   Supplying and placing cast-in-place concrete piles will be measured on a lineal metre basis.
- .2   The length to be paid for will be total number of lineal meters of piling placed in position and accepted by the Contract Administrator.
- .3   Supplying and placing reinforcing steel will be considered incidental and no measurement will be made for this Work.
- .4   Heating of concrete will be considered incidental and no measurement will be made for this Work.

**1.3           REFERENCES**

- .1   American Society for Testing and Materials (ASTM)
  - .1    ASTM A36/A36M, Standard Specification for Structural Steel.
  - .2    ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .2   Canadian Standards Association (CSA)
  - .1    CSA-A23.2, Methods of Test for Concrete.
  - .2    CAN/CSA-G30.18, Billet Steel Bars for Concrete Reinforcement.

**Part 2           Products**

**2.1           MATERIALS**

- .1   Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2   Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing.

**2.2           SOURCE QUALITY CONTROL**

- .1   Concrete tests: to CSA-A23.2.



BORED CONCRETE PILES

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**Part 3 Execution**

**3.1 FIELD RECORDS**

- .1 Maintain driving record for each shell, including elevation of bedrock, driven depth of pile, cut-off elevation of shell and protruding core.
- .2 Provide Contract Administrator with three copies of records.

**3.2 LOCATION AND ALIGNMENT OF PILES**

- .1 Piles shall be placed at the locations shown on the Drawings or as directed by the Contract Administrator.
- .2 Piles shall not deviate more than 1% out-of-plumb. Piles shall not be more than 50 mm off centre measured at cut-off elevation.

**3.3 EXCAVATION**

- .1 Excavation for piles shall be made with equipment designed to remove a core and provide shafts with the required diameters and depths shown on the Drawings.
- .2 Upon reaching the required elevation, the bottom of the shaft shall be cleaned and, if called for, belled out to the required dimensions and elevations as shown on the Drawings or as directed by the Contract Administrator.
- .3 The excavated material shall become the property of the Contractor and shall be removed from the Site.
- .4 Upon completion of belling and cleaning out the bottom to the satisfaction of the Contract Administrator, the reinforcement shall be set in place and concrete poured immediately. Under no circumstances shall a hole be left to stand open after boring has been completed.
- .5 If any pile is condemned because of caving, it shall be filled with lean mix concrete and a new shaft bored as near as possible to the location shown on the Drawings. Payment will not be made for condemned piles.

**3.4 SLEEVING**

- .1 Where required, steel sleeving shall be used to temporarily line the shaft to prevent bulging or caving of the walls prior to concrete placement.
- .2 The sleeve shall be designated and constructed to resist all forces which may tend to distort it.
- .3 The sleeving shall be withdrawn as the concrete is placed in the shaft. The sleeving shall extend at least 1.0 metre below the top of the freshly deposited concrete at all times.
- .4 The clearance between the face of the shaft and the sleeving shall not exceed 25 mm.

## BORED CONCRETE PILES

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### 3.5 SHAFT INSPECTION

- .1 Concrete shall not be placed until the shaft has been inspected and approved by the Contract Administrator.
- .2 The Contractor shall have available suitable light for the inspection of each bore throughout its entire length. The Contractor shall have video equipment available to visually inspect bore holes that cannot be inspected from the top of the pile.
- .3 All improperly set sleeving, shaft, bell or bottom shall be corrected to the satisfaction of the Contract Administrator.

### 3.6 PLACING REINFORCING STEEL

- .1 Reinforcement shall be:
  - .1 Placed in accordance with the details shown on the Drawings.
  - .2 Rigidly fastened together.
  - .3 Lowered into the shaft intact before concrete is placed.
- .2 Spacers shall be utilized to properly locate the reinforcing steel cage in the shaft.

### 3.7 MIXING AND PLACING CONCRETE

- .1 Mixing and placing concrete shall be done in accordance with the Specifications for Cast-in-place concrete.
- .2 Concrete shall not have a free fall of more than 2.0 m and shall be placed so that the aggregates do not separate or segregate.
- .3 Concrete shall be placed to the elevations shown on the Drawings. Laitance on the top of the pile shall be removed before placing the crawl space slab. The concrete shall be vibrated throughout the entire length of the pile.
- .4 The shaft and bell shall be free of water prior to placing of concrete. Concrete shall not be placed in or through water unless authorized by the Contract Administrator.
- .5 In the event that tremie concrete is allowed by the Contract Administrator, the concrete shall be placed as specified herein.

### 3.8 TREMIE CONCRETE

- .1 The shaft of the pile shall be pumped clear of water so that the bottom can be cleaned and belled.
- .2 Pumping shall then be stopped and water shall be allowed to come into the shaft until a state of equilibrium is reached. Concrete shall then be placed by means of tremie pipe.
- .3 The tremie pipe shall have a suitable gate in the bottom to prevent water entering the pipe. The bottom of the pipe shall be maintained below the surface of the freshly placed

**BORED CONCRETE PILES**

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concrete at all times during placement. The pipe shall be capable of being raised or lowered quickly in order to control the flow of concrete.

**3.9 COLD WEATHER PRECAUTIONS**

- .1 Heating of the concrete shall be done in accordance with the Specifications for Cast-in-place concrete.

**3.10 QUALITY MANAGEMENT**

- .1 Quality control:
  - .1 The contractor shall be responsible for quality control testing in accordance with the Specifications for Cast-in-place concrete.
- .2 Quality Assurance
  - .1 The Contract Administrator will undertake quality assurance testing in accordance with the Specifications for Cast-in-place concrete.

**END OF SECTION**