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## SECTION 3

TRENCHING, BACKFILLING AND RESTORATION3.1 SCOPE

This section shall govern excavation, bedding, backfilling and restoration related to the installation of underground municipal utilities.

3.2 EXCAVATION3.2.1 General

The limits of the excavation shall be established and any asphalt or concrete shall be cut in neat straight lines by means of a saw or asphalt cutting wheel, in accordance with Standard Drawings T1 and T2. Care shall be exercised to minimize the undermining of any adjacent asphalt, curbs, sidewalks, etc. The trench shall only be excavated as far in advance of the pipe laying as permitted by the Engineer.

3.2.2 Grade/Alignment

The trench shall be excavated so that the pipe can be laid to the alignment, grade and depth required. All excavation shall be made exactly to lines and grades as shown on the drawings. No deviation from authorized lines and grades shall be made without the written authority of the Engineer.

3.2.3 Uniformity

The sub-grade shall provide a uniform and continuous support for the pipe bedding on solid undisturbed ground. Any over excavation shall be backfilled with sand or gravel and thoroughly compacted.

3.2.4 Trench Cross Section

The trench cross-section shall suit the utility being installed. Typical cross-sections are shown on Standard Drawings T1 and T2.

In general, the minimum width of trench below the crown of the pipe shall be not less than the outside diameter of the pipe plus 300 mm, or 600 mm whichever is the greater and the maximum width of the trench shall be not more than the outside diameter of the pipe plus 600 mm, plus allowance for trench support.

3.2.5 Rock

Where excavation is made in rock, or where excavation is made in a material which cannot provide an even, uniform, and smooth surface or where large stones are encountered in the trench, such material shall be removed to provide a clear distance between any part of projection of such material and the surface of all pipe and fittings to permit the minimum bedding depths noted below. The sub-grade shall then be compacted to 95% Modified Proctor Density. The finished sub-grade surface shall be shaped to provide a uniform and continuous support for the pipe bedding. All rock blasting and

excavation shall continue a minimum of 1.5 metres beyond all ends of line.

Any loose blasted rock shall be removed from the trench walls.

3.2.6 Unstable Sub-grade

Where the sub-grade of the trench is unstable and will not properly support the pipe, or where it contains material harmful to the pipe such as ashes, refuse, vegetable or organic matter, such material shall be excavated to the width, depth and length required and shall be disposed of in a manner approved by the Engineer.

The sub-grade shall then be made by backfilling with an approved sand or gravel compacted in maximum 150 mm layers to 95% of modified Proctor Density. The finished sub-grade surface shall be shaped to provide uniform and continuous support for the pipe bedding.

3.3 **SAFETY**

3.3.1 Shoring

Open cut trenches shall be shored and braced as required by the Accident Prevention Regulations of the Workers' Compensation Board to protect life, property and the work.

All Municipal employees have been instructed not to enter excavations which are not properly braced. No approval will be given to installations which cannot be inspected because of unsafe working conditions.

3.3.2 Barricades

Excavations shall be securely barricaded and fenced as required to protect construction personnel and the general public. Flashing barricades shall be provided at night in road and walkway areas. If additional barricades must be installed, the Municipality will charge the cost to the contractor.

3.3.3 Traffic Control

Traffic control shall be provided in accordance with Section 1.15.

3.4 **BLASTING**

3.4.1 Blasting for excavation will be permitted only with the approval of the Engineer and only when proper precautions are taken for the protection of persons or property. The procedure used in blasting shall conform to applicable Federal, Provincial and Municipal laws. A blasting permit must be obtained from the Municipality prior to blasting.

3.5 **SHORING**

3.5.1 When using movable trench support, care should be exercised not to disturb the pipe location, jointing or its bedding.

3.5.2 Removal of any trench protection below the top of the pipe and within 2-1/2 pipe diameters of each side of the pipe should not take place after the pipe bedding has been compacted. For this reason,

movable trench supports should only be used in either wide trench construction where supports extend below the top of the pipe or on a shelf above the pipe with the pipe installed in a narrow, vertical-wall subditch.

- 3.5.3 Any voids left in the bedding material by support removal should be carefully filled with granular material which is adequately compacted. Removal of bracing between sheeting should only be done where backfilling proceeds and bracing is removed in a manner that does not relax trench support.
- 3.5.4 When advancing trench boxes or shields, care must be taken to prevent longitudinal pipe movement or disjointing, and damage to existing municipal utilities.

### 3.6 BEDDING WITHIN THE PIPE ZONE

#### 3.6.1 Materials

- (a) Bedding materials shall be granular in nature, free of organic material, silt or clay.
- (b) PVC Pipe: Bedding material shall have a maximum gradation size of 8 mm, and maximum of 5% less than 0.075 mm when tested in accordance with ASTM C136.
- (c) Concrete and Ductile Iron Pipe: Bedding material shall conform to the following gradation limits when tested in accordance with ASTM C136:

#### Gradation Limits

<u>Sieve Designation</u>	<u>% Passing By Weight</u>
19.0 mm	90 - 100
12.5 mm	65 - 85
9.5 mm	50 - 75
4.750mm	25 - 50
2.36 mm	10 - 35
0.850mm	5 - 20
0.425mm	0 - 15
0.180mm	0 - 8
0.075mm	0 - 5

Other acceptable bedding materials for use only where shown on the construction drawings or as approved by the Engineer are, drainrock, well graded pitrun sand or native material.

#### 3.6.2 Depths

- (a) All pipe shall be bedded to a depth of 300 mm above the top of the pipe.
- (b) The minimum depth of bedding below any pipe or fittings shall be 100 mm in a uniform trench and 150 mm in rock.

#### 3.6.3 Installation

- (a) Bedding cross-sections shall be as shown on Standard Drawings T1 and T2.

- (b) Installation of bedding shall be in accordance with these standards and the manufacturer's recommendation for the pipe being installed. Placement and compaction procedures may vary depending upon trench conditions and the type of pipe and bedding being used.
- (c) Prior to placing bedding, the trench bottom shall be prepared to provide a uniform and continuous support for the pipe in accordance with Section 3.2.
- (d) Bedding under the pipe shall be placed by hand and compacted to 95% modified Proctor Density to the depth specified in Section 3.6.2.
- (e) Further bedding material shall be placed by hand around the pipe and thoroughly compacted with hand tampers in layers having a maximum depth of 150 mm to the same level as the top of the pipe. Bedding material at this point shall completely fill the void between the pipe and trench wall and shall be firmly compacted throughout. Compaction shall be 95% of modified Proctor Density. Care shall be taken in compacting above pipe invert grades to ensure that the pipe is not shifted laterally or vertically. In particular, care must be taken when bedding pipe in wet conditions to ensure that the pipe does not float upwards.
- (f) Care shall be taken when depositing the bedding in the trench with a machine. Initial bedding must be deposited in small quantities and placed by hand to ensure that the pipe is not displaced laterally or vertically.
- (g) Where the pipe has already been covered, bedding may be dumped directly in the trench in volumes not exceeding one-half (1/2) of a cubic metre and shall be spread evenly by hand to a thickness not exceeding 150 mm per layer. Each layer shall be compacted to 95% of modified Proctor Density against the trench wall while the material immediately over the pipe shall be left loose. The pipe bedding shall be leveled off 300 mm above the top of the pipe and shall not be mounded over the pipe.

The trench shall then be backfilled.

### 3.7 **BACKFILLING**

3.7.1 Backfill cross-section shall be in accordance with Standard Drawings T1 and T2.

#### 3.7.2 **Granular Backfill**

- (a) Where a pipe is installed beneath an existing or foreseeable future road, lane, curb, sidewalk, walkway, driveway, shoulder or other surfaces on which vehicular or pedestrian traffic normally travels the backfill shall be pitrun gravel, compacted to a minimum 95% modified Proctor Density. Compaction shall be in layers of 150 mm using a hand operated compactor or in 300mm layers using a Hoe Pack. If a Hoe Pack is used, granular material shall be extended a least 1.0m beyond the curb, sidewalk or future edge of pavement. Care must be taken to ensure that the compaction method does not adversely affect the pipe.
- (b) In areas of rock excavation, ensure that any voids in the trench walls are carefully filled and compacted.
- (c) If required to meet optimum moisture requirement, a controlled amount of water shall be

added to the gravel to ensure optimum moisture content for compaction.

- (d) Use of granular backfill other than import pitrun gravel will not be permitted unless specifically approved by the Engineer.
- (e) Granular backfill shall have the following gradation when tested in accordance with ASTM C136:

<u>US Standard Sieve Size</u>	<u>% Passing (by Weight)</u>
150 mm	100%
75 mm	100%
25 mm	50-85%
0.15 mm	0-16%
0.075mm	0-8%

### 3.7.3 Native Backfill

- (a) Suitable native materials as approved by the Engineer may be used as backfill where the pipe is installed in untravelled areas. A compaction of 90% modified proctor density is required in the untravelled areas. Backfill in these cases shall be free of stones over 150 mm size, frozen material, organic, or other perishable or objectionable material that would prevent property consolidation or might cause subsequent settlement.
- (b) Where it is required to replace topsoil it shall occupy the upper 200 mm of the trench and shall be heaped on top to allow for settlement

### 3.7.4 Testing

- (a) The Consulting Engineer will arrange for a testing firm to carry out tests to determine whether the applicable standards and specifications have been met. Where initial testing indicates non-compliance with the specifications, additional testing shall be required at the Contractor's expense.
- (b) The Contractor as directed by the Consulting Engineer shall supply specimens or samples for testing.
- (c) The types of tests listed below are the minimum testing requirements. The Engineer shall determine if additional testing is required.
  - (i) Regular sieve analysis of aggregate gradation on materials to be incorporated in the works.
  - (ii) Determination of optimum moisture content and Modified Proctor Density (ASTM D1557) on all materials to be used for import bedding, import backfill and native backfill.
  - (iii) Field density tests taken on the compacted backfill.
  - (iv) Other tests as may be required.

### 3.7.5 Large Excavations

Backfilling of large excavations containing structures such as vaults and manholes shall be to the same standard as the backfilling of trenches. Particular care shall be taken to ensure that placement of backfill and compaction is evenly distributed around the structure in order to avoid undue pressures at any one location.

### 3.7.6 Subsurface Drainage

Special attention shall be paid to accommodating subsurface drainage that might accumulate in utility trenches. Where necessary, trench dams and subsurface inlets connected to the storm drain system or other approved outlet shall be installed to intercept drainage.

### 3.7.7 Trench Dams

- (a) Trench dams shall be constructed on all utility main lines where grades exceed ten (10%) percent or where indicated on the construction drawings. See Standard Drawings T4, T4A and T4B for the trench dam design.
- (b) Trench dam spacing shall be as follows:

SANITARY AND STORM GRAVITY SEWERS		WATERMANS AND FORCEMANS	
SLOPE	MAX. SPACING	SLOPE	MAX. SPACING
10% - 15%	30 m	10% - Over	10 m
15% - 20%	25 m		
20% - 35%	20 m		
35% - 50%	15 m		
50% - Over	10 m		

- (c) If approved by the Engineer, concrete trench dams may be constructed of wetted sandbag sacks filled with wet pre-mixed concrete for areas inaccessible by construction equipment. Sacked concrete shall be laid in courses such that joints in succeeding courses are staggered. Courses shall be a minimum of nine (9) per vertical metre and shall be placed around the pipe and keyed into the trench walls to form a water tight dam.
- (d) If approved by the Engineer, clay trench dams shall be installed in 150 mm lifts, compacted to 95% modified Proctor Density and at the locations shown on the drawings or as directed by the Engineer.
- (e) Relief drains shall be installed on all trench dams to an acceptable watercourse or storm sewer system.



**3.8 RESTORATION****3.8.1 Roads**

- (a) Gravel filled trenches or cold-mix asphalt paved trenches shall be restored to the original surface prior to final paving.
- (b) Major arterial roads must be paved immediately following backfilling. Cuts in all other roads must be paved within three (3) days of backfilling. If weather conditions do not permit hot-mix asphalt, cuts shall be paved using cold-mix asphalt and replaced as weather permits.
- (c) In all cases, existing asphalt must be cut back a minimum distance of 300 mm from the top of the trench wall as shown on Standard Drawing T3.
- (d) Where the edges of any area requiring repaving extend outside the straight lines cut, further cuts shall be made so that the final patch will have a neat appearance.
- (e) Any area of pavement adjacent to the excavation which has become deformed due to excavation practices or blasting shall be removed and repaved as above.
- (f) Pavement cuts which have settled shall be removed and the trench recompacted and repaved.
- (g) All pavement markings shall be restored to match original.

**3.8.2 Concrete Curbs and Sidewalks**

- (a) Concrete curbs and sidewalk panels shall be removed to the nearest joint.
- (b) Following backfilling, sidewalks shall be restored immediately with crush gravel or a plywood walkway to match the existing sidewalk. Barricades and signs shall be placed as required.
- (c) Concrete curbs and sidewalks shall be replaced within three days of backfilling. If conditions do not permit the pouring of concrete, asphalt shall be used and replaced.
- (d) Concrete curb and sidewalk installation shall be in accordance with the requirements of Section 8.
- (e) Temporary access around or over the curing concrete shall be provided, and barricades and signs shall be placed as required.

**3.8.3 Other Areas**

- (a) Untravelled areas shall be restored to a condition equal to that found prior to construction.
- (b) Where topsoil is required it shall be placed at a thickness of 200 mm. If the installation is under a developed lawn, the soil shall be fine raked during the appropriate season, sown with a top quality grass seed at the rate of 50 grams of seed per square metre and rolled.

- (c) Untravelled areas which have settled shall be filled, regraded and restored as required.