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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | October 16, 2007 | Minor revisions by Legal Services |
| 3 | November 13, 2009 | Modified ‘Related Sections’ |
| 4 | June 4, 2012 | Addition of References and Replacement Parts sections on this page |
| 5 | June 28, 2012 | Reformatted to Remove White Space |
| 6 | April 24, 2015 | General Formatting |
| 7 | February 21, 2017 | Addition of Subsection 1.3 which highlights Contractor responsibilities under the Ontario Underground Infrastructure Notification System Act, 2012. Updated CSA standards. (AV) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

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**The on-line copy is the current version of the document.**

# GEneral

## Related Sections

### [Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.

### Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.

### Contractor is responsible for coordination of the Work.

### This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the section for the specific project it may be deleted.]

### [List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

### [List Sections specifying products installed but not supplied under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

### [List Sections specifying related requirements.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: [Optional short phrase indicating relationship].

### Section 02530 - Sewage

### Section 03200 - Concrete Reinforcement

### Section 03300 - Cast in Place Concrete

### Canadian Standards Association (CSA)

#### CAN/CSA 086-14, Engineering Design in Wood

#### CSA S269.1-16, Falsework and Formwork

#### CSA A179-14, Mortar and Grout for Unit Masonry

#### CSA A3000-13, Cementitious Materials Compendium

## Related Ontario Provincial Standard Specifications

### OPSS 180 – Management and Disposal of Excess Material

### OPSS 517 – Dewatering of Pipeline, Utility and Associated Structure Excavation

### OPSS 418 – Construction Specification for the Control of Water from Dewatering Operations.

### OPSS 577 – Temporary Erosion and Sediment Control Measures

## Locates

### The Contractor shall be deemed an “excavator” under the Ontario Underground Infrastructure Notification System Act, 2012, and shall comply with all applicable requirements of the Act.  The Contractor shall obtain locates of underground infrastructure from Ontario One Call prior to commencing an excavation or dig.

## Design Requirements

### The Contractor shall be fully responsible for the design of the construction shafts and the primary tunnel liner and for the method of construction.

### Acceptable tunnelling methods:

#### By tunnel boring machine (TBM)

#### Microtunnelling

#### Jacking and Boring

#### Jacking and Hand Mining

#### Hand mining with tunnel liner plates

### The tunnelling method shall be suitable to deal with changing ground conditions that may be encountered during the progress of the Work

### All design data submitted for review by the Consultant shall bear the stamp and signature of a professional engineer licenced to practice in the Province of Ontario.

## Submittals

### Submit primary liner design data to the Consultant for review at least 10 Working Days prior to commencing the Work.

## Safety Requirements

### Comply with latest revision of the Occupational Health and Safety Act and any related regulations.

### Ensure that all hoisting and air equipment is installed and ready for operation before commencing mining operations.

### Provide shafts and tunnels with electric lights of a sufficient number to ensure the proper completion and inspection of the Work.

## Construction Requirements

### The tunnel shall be constructed in the location and to the elevations shown on the Contract Drawings.

### The tunnel shall be adequately sized to permit installation of the secondary liner (sanitary sewer pipe) and in accordance with the applicable Ministry of Labour regulations. The minimum acceptable clear internal diameter after placement of the primary liner shall be 1,500 mm.

### The construction shafts shall be adequately sized to facilitate the tunnelling operations and the installation of the sanitary sewer piping and maintenance holes.

### No blasting shall be allowed.

### Tunnel construction shall commence at [ ] and shall proceed in a [ ] direction to [ ].

### The maximum departure from the horizontal alignment shown on the Contract Drawings shall not exceed 150 mm in 20 metres, or a total of 300 mm.

### The maximum departure from the vertical alignment shall not exceed 100 mm in 20 metres, or a total of 300 mm.

### The Contractor shall employ a qualified individual who is experienced in the construction of tunnels to supervise the Work at all times.

## Stability of Excavation

### Employ construction methods, plant, procedures and precautions as necessary to ensure that the excavations are stable, free from disturbance and dry.

### Construction methods may include, but are not limited to:

#### Tight timber and/or steel primary liner.

#### Ground water control systems employing well points, deep wells, eductors or compressed air.

#### Free water control systems employing drains, pipes and pumps.

#### Soil stabilization methods employing cement grouting, chemical grouting or chemical freezing.

### Employ construction methods, plant and materials necessary to ensure that the migration of soil material into the tunnel or shafts from adjacent ground and subsidence does not take place.

## Measurement and Payment

### The tunnel shafts at the proposed [identify MH locations] shall be considered as a separate lump sum item for payment purposes. Payment at the Contract lump sum price(s) shall be compensation in full for the supply of all materials and the performance of all Work required to construct the tunnel shaft(s) at the location(s) shown on the Contract Drawings and to the depth(s) required for the construction of the tunnel. The construction of the tunnel shafts will involve excavation within the overburden soils.

### The Contractor may elect to install an additional shaft between [identify MH location] at the location as shown on the Contract Drawings. No payment shall be made for this intermediate shaft. If required, the Contractor shall include all costs for the construction of the intermediate shaft in the unit price for the tunnel construction.

### The supply and installation of the maintenance hole structure within each of the construction shafts shall be paid for separately under the maintenance hole items. This payment is for the supply of all materials and the performance of all Work required to construct maintenance holes including, but not limited to, the backfilling of the shaft and surface restoration of all disturbed areas.

### Measurement for payment for tunnelling shall be from the centreline of the maintenance hole structure to the centreline of the maintenance hole structure based on Plan Quantity as shown on the Contract Drawings. Payment at the unit price shall be compensation in full for the construction and supporting of the tunnel.

### The supply and installation of the sanitary sewer within the tunnel shall be paid for separately under the sanitary sewer items. This payment shall include the grouting of the sewer pipe within the tunnel.

### Include all costs for supplying materials, equipment and labour necessary to construct the shafts and tunnels as required and as specified in the Contract Documents, all to the satisfaction of the Consultant.

### No extra payment is to be made for stockpiling or double handling of excavated materials.

### No extra payment is to be made for the primary lining or supports left in place.

### No extra payment will be made for extra excavation needed on account of soil heaving, subsidence or collapse of material into the tunnel or shaft.

### No extra payment will be made for the construction methods required to keep the excavation stable, free from disturbance or dry.

# PRODUCTS

## Materials

### Concrete shall meet the requirements of Section 03300 - Cast in Place Concrete with a 28 Day compressive strength of 30 MPa.

### Reinforcing Steel shall be in accordance with the requirements of Section 03200 – Concrete Reinforcement.

### Timber: in accordance with CAN/CSA-086.1-14 Engineering Design in Wood and CSA S269.1-16.

#### Manufactured Spacers:

### Cement Grout:

#### Cement in accordance with CSA A3000-13

#### Sand in accordance with CSA A179-14

#### Grout mix shall be approved by the Consultant.

### Primary Liner

#### The primary liner is to be selected and designed by the Contractor.

#### The design shall be subject to review by the Consultant.

#### Acceptable Methods:

##### Steel ribs and hardwood lagging

##### Jacking quality reinforced concrete piping

##### Welded steel piping

##### Bolted steel tunnel liner plates

### Secondary Liner

#### As detailed on the Contract Drawings

# EXECUTION

## Setting Out

### Establish the location of the construction shafts and tunnels from the lines and elevations indicated on the Contract Drawings or furnished by the Consultant.

### Provide labour, instruments and materials for setting out all reference points necessary to construct the tunnel and all appurtenances.

### Provide the Consultant with the facilities necessary to check the layout of the tunnel and all appurtenances.

## Alignment Holes

### Drill alignment holes near each bend with at least one hole in the straight section between ends and at any other locations specified on the Contract Drawings.

### Locate alignment holes at the time of construction.

### Use a 250 mm diameter steel casing driven in the drilled hole over the centre of tunnel for an alignment hole.

### Alignment holes may be used for ventilation purposes.

### Set the casing vertically and provide a removable steel cover plate.

### Remove the casing and fill the opening in the tunnel wall with concrete as the casing is withdrawn after the tunnel section is completed.

## Construction Shafts

### Provide construction shafts at the locations specified on the Drawings or as approved by the Consultant and the Ministry of Labour.

### Design shaft support shoring to support the soil, hydrostatic pressures and surcharge loadings to withstand all additional loadings and to withstand all additional loadings resulting from grouting or jacking operations. Submit the design for the shaft support system to the Consultant for review a minimum of ten (10) Working Days prior to the intended date for commencement of the Work.

### The Contractor shall install a shaft support system which provides an effective cut-off to the groundwater inflow in order to minimize the effect on the groundwater table in the areas adjacent to the shaft.

### Support construction shafts excavated in bedrock that do not require primary lining in a manner that prevents scaling and unravelling of the rock and protects the rock from weathering or deterioration.

### Support shaft excavations with steel liner plates or timber bracing capable of withstanding all loads to which it may be subjected during the progress of the Work.

### Construct shafts so that there is ample space for hoisting operations.

### Maintain shafts in a drained condition.

### Provide earth berms around the perimeter of the construction shaft to prevent surface water runoff from draining into the shaft excavation.

### Install 3.6 m high close sheeted insulated hoarding around the perimeter of the working area with gates and truck entrances at each shaft location.

### Remove all fencing upon completion of the Work.

## Tunnelling

### The method of tunnelling is to be selected by the Contractor and is subject to the review by the Consultant.

### Employ the services of a competent superintendent experienced in the construction of tunnels to supervise the Work at all times.

### Modify the tunnelling method as needed due to changing conditions which may be encountered during the progress of the Work, at no additional cost to the Region.

### Control ground water by using compressed air, an external dewatering method, or other suitable means.

### Provide hospital grade silencers on all generators required for the tunnelling operation.

## Primary Lining

### Design primary lining to support the soil and hydrostatic pressures and to withstand any additional loads caused by grouting or jacking thrusts. Submit to the Consultant for review 10 Working Days prior to the intended date for the commencement of the Work.

### Install the primary liner so that the exterior is tight to the excavated surface of the tunnel and which allows for the placement of the full designed thickness of the secondary lining.

### Fill all voids between the primary lining and the surface of excavation with grout as the primary lining is placed. If a continuous liner is used, grout the space outside the liner plates daily.

### Support tunnels excavated in sound rock that do not require primary lining in a manner that prevents scaling or unravelling of the rock and protects from weathering or deterioration

## Use of Compressed Air

### Supply complete compressing equipment and air locks required to supply and control the air pressure as required in the tunnels.

### Supply electrically driven compressors with stand-by diesel or gas driven equipment.

### Arrange stand-by equipment for low pressure air so that the equipment starts automatically in the event of a failure of the electric power supply.

### Install compressing machinery in a weatherproof building insulated against sound transmission.

### Provide compressors that are equipped with silencers and receivers on intake and exhaust lines.

### Operate all equipment in accordance with the Noise Control By-Law of the Local Municipality and in a satisfactory manner.

### Make any modifications to the equipment as necessary.

## Approaching Closure

### Exercise caution when approaching a closure while operating under compressed air.

### Reduce the air pressure to a safe limit when the closure is approached.

## Dewatering

### Keep the tunnel sufficiently dry at all times in order to permit the Work to be performed in a safe and satisfactory manner.

### Dewatering methods are subject to review by the Consultant.

### Internal drainage from the tunnel and shafts to the outlet is to [provide details for discharge].

### Provide fractionation tanks on the pump discharge prior to discharge to [ ].

### Conform to all conditions of the MOECC Permit to Take Water that has been issued for this Contract.

## Removal of Excavated Materials

### Separate good reusable excavated material from unwanted excavated material.

### Dispose of all surplus excavated material off Site at a location to be established by the Contractor.

### Comply with OPSS 180.

## Secondary Lining

### Provide secondary lining as shown on the Contract Drawings and in accordance with Section 02530 – Sewerage.

### Grout the annular space between the secondary and primary linings.

## Mixing Grout

### Mix grout in a mechanical mixer capable of maintaining the continuous supply of grout at a pressure of 1 MPa.

### Do not leave grout in the agitator for more than 30 minutes.

## Placing Grout

### Pressure grout the space outside of the finished secondary liner as shown on the Contract Drawings and to the satisfaction of the Consultant.

### Perform grouting through pipes a minimum of 40 mm in diameter.

### Provide a pressure relief valve on the grout piping to prevent over pressurizing and damaging the secondary lining.

## Wiring

### Install separate circuits for each lighting and power supply point.

### Install and securely support all wires in the shafts in waterproof conduits.

### Remove all wiring and conduits in the shafts and tunnels when directed by the Consultant.

## Monitoring During Construction

### The Contractor shall be required to implement a program to monitor noise, vibration and air quality levels during the tunnelling operation.

### The results of the monitoring shall be provided in writing to the Consultant on a weekly basis.

**END OF SECTION**