



**CONSTRUCTION SPECIFICATION FOR  
PIPELINE INSTALLATION BY TUNNELLING**

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**415.01 SCOPE**

This specification covers the general requirements for pipeline installation by tunnelling.

**415.01.01 Specification Significance and Use**

This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

Use of this specification or any other specification shall be as specified in the Contract Documents.

#### **415.01.02 Appendices Significance and Use**

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

#### **415.02 REFERENCES**

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

##### **Ontario Provincial Standard Specifications, Construction**

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

##### **Ontario Provincial Standard Specifications, Material**

OPSS 1350      Concrete - Materials and Production  
OPSS 1440      Steel Reinforcement for Concrete

#### **415.03 DEFINITIONS**

For the purpose of this specification, the following definitions apply:

**Certificate of Conformance** means a document issued by the Quality Verification Engineer confirming that the specified components of the Work are in general conformance with the requirements of the Contract Documents.

**Pipeline** means to include sewers, culverts, watermains, and forcemains.

**Quality Verification Engineer (QVE)** means an Engineer retained by the Contractor for the duration of construction, qualified to provide the services specified in the Contract Documents.

**Rock** means natural beds or massive fragments, or the hard, stable, cemented part of the earth's crust, igneous, metamorphic, or of sedimentary origin, which may or may not be weathered and includes boulders having a volume of 0.5 m<sup>3</sup> or greater.

#### **415.04 DESIGN AND SUBMISSION REQUIREMENTS**

##### **415.04.01 Design Requirements**

The primary liner shall be designed to support all soil and hydrostatic pressures and to withstand any additional loads caused by grouting or jacking thrusts. The primary liner design and access shaft details shall bear the seal and signature of an Engineer.

##### **415.04.02 Submission Requirements**

When any of the following information is not specified in the Contract Documents, it shall be submitted to the Contract Administrator for review a minimum of 14 Days prior to commencing tunnelling operations:

- a) Design criteria.
- b) Materials.
- c) Construction shaft and portal details.
- d) Tunnelling method.
- e) Face support and other temporary support details.
- f) Primary liner and support design details.
- g) Material mixture for filling voids and procedures.
- h) Tunnel boring machine information, if applicable.
- i) Type and strength of rock bolts, if applicable.
- j) Lighting and ventilation details.
- k) Settlement monitoring plan.
- l) Excavation and dewatering plan.
- m) Testing and monitoring plan.

#### **415.05 MATERIALS**

##### **415.05.01 Concrete**

Concrete shall be according to OPSS 1350 and with a nominal minimum 28-Day compressive strength of 30 MPa, unless otherwise specified in the Contract Documents

##### **415.05.02 Steel Reinforcement**

Steel reinforcement for concrete work shall be according to OPSS 1440.

##### **415.05.03 Primary Liner**

The primary liner shall be as specified in the Contract Documents or according to the Contractor's submission.

#### **415.05.04 Rock Bolts**

Rock bolts and nuts shall have a minimum tensile strength of 400 MPa.

#### **415.06 EQUIPMENT**

The Contractor shall select and use Equipment and associated methods compatible with the selected dimensions of the tunnel and with the subsurface and groundwater conditions at the site.

#### **415.07 CONSTRUCTION**

##### **415.07.01 General**

The location of tunnels shall be established from the plan, lines, elevations, and tolerances as specified in the Contract Documents.

All reference points necessary to construct the tunnel and appurtenances shall be laid out prior to commencement of the tunnelling operation.

The Contract Administrator shall be provided with the assistance and access necessary to check the layout of the tunnel and associated appurtenances.

##### **415.07.02 Construction Shafts**

Construction shafts shall be provided at locations as specified in the Contract Documents or according to the Contractor's submission.

Shafts shall be maintained in a drained condition.

A secure fence shall be installed around the perimeter of the construction shaft area with gates and truck entrances. The fence shall be removed upon completion of the work.

##### **415.07.03 Stability of Excavation**

The construction methods, plant, and procedures employed shall ensure that the excavations are stable, free from disturbance, and maintained in a drained condition.

The construction methods, plant, and materials employed shall prevent the migration of soil material into tunnels or shafts.

##### **415.07.04 Tunnelling**

An individual with previous experience in the construction of tunnels shall supervise the work at all times.

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

Methods of excavating the tunnel shall be capable of fully supporting the face and shall accommodate the removal of boulders and other oversize objects from the face.

The tunnel shall be kept sufficiently dry at all times to permit work to be performed in a safe and satisfactory manner.

#### **415.07.05                    Dewatering**

Dewatering shall be according to OPSS 517.

#### **415.07.06                    Primary Liner**

The primary liner shall be installed so that the exterior is as tight as possible to the excavated surface of the tunnel and allows the placement of the full design thickness of the secondary lining.

All voids between the primary lining and the excavation shall be filled. If an unexpanded liner is used, the space outside the liner plates shall be grouted at least daily or more often as required.

Tunnels excavated in sound rock shall be supported in a manner that prevents scaling and unravelling of the rock and also protects the rock from weathering or deterioration.

Tunnels excavated in unstable rock shall be supported by means of rock bolts or another primary lining system in a manner that safely sustains the tunnel excavation.

#### **415.07.06.01                Primary Liner Support Systems**

Primary liner support systems shall minimize ground movement into the excavation, ensure stability, and maintain strength of the ground surrounding the excavation.

Primary liner support systems shall be compatible with encountered ground conditions, method of excavation, method of groundwater control, and with the placement of permanent liners.

Primary liner support systems shall prevent weathering, deterioration, loosening, or unravelling of ground surfaces exposed by excavation.

#### **415.07.06.02                Single Liner Systems**

Single liner systems shall be as specified in the Contract Documents.

#### **415.07.07                    Secondary Liner**

The secondary liner shall be as specified in the Contract Documents.

The void between the primary and the finished secondary liners shall be filled as specified in the Contract Documents or according to the Contractor's submission.

#### **415.07.08                    Testing and Monitoring**

Testing and monitoring shall be as specified in the Contract Documents or according to the Contractor's submission.

#### **415.07.09                    Certificate of Conformance**

A completed Certificate of Conformance shall be submitted to the Contract Administrator upon completion of the work. The Quality Verification Engineer shall affix their seal and signature to the completed Certificate of Conformance confirming that the following are in general conformance with the requirements of the Contract Documents:

- a) Work
- b) Material and installations

c) Inspection, testing, and test results

**415.07.10 Management of Excess Material**

Management of excess material shall be according to the Contract Documents.

**415.09 MEASUREMENT FOR PAYMENT**

**415.09.01 Actual Measurement**

**415.09.01.01 Tunnel**

Measurement of tunnel shall be by length in metres along the centreline of the tunnel from centre to centre of maintenance holes or chambers or to the ends of the tunnel, where no maintenance hole or chamber is installed.

**415.09.01.02 Rock Excavation in Tunnelling**

Measurement of rock excavation in tunnelling shall be by volume in cubic metres based on the neat lines of the tunnel as shown in the Contract Documents.

**415.09.02 Plan Quantity Measurement**

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

**415.10 BASIS OF PAYMENT**

**415.10.01 Tunnel - Item  
Rock Excavation in Tunnelling - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

**Appendix 415-A, November 2023  
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

**Note:** There is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

**Designer Action/Considerations**

This specification was written to encompass the requirements for the construction of pipelines and drainage conduits by the tunnelling method. It is not intended to be a specification for other tunnelling applications such as the transportation industry, mining, hydro electric, petroleum exploration industry, etc.

Engineering design based on geotechnical pre-design information is essential prior to the use of this specification for tunnelling projects.

The experience of the tunnelling Contractor is of prime importance. The designer may recommend prequalification of bidders.

The designer should specify the following in the Contract Documents:

- The strength of concrete required (415.05.01)
- Primary liner requirements. Alternatively, the designer may elect that the Contractor is responsible for determining the primary liner design details, in accordance with the Owner's specifications. (415.05.03)
- The plan, lines, elevations, and tolerances required for the tunnelling project. (415.07.01)
- Location of required construction shafts. Alternatively, the designer may elect to specify that the Contractor is responsible for determining shaft locations to suit the method of construction, subject to available access, and other Owner requirements. (415.07.02)
- The appropriate single liner systems type, class, dimensions, etc. (415.07.06.02)
- The appropriate secondary liner type, class, dimensions, etc. (415.07.07)
- The method of verifying the product installation. This may include reporting information from the tunnelling machine, daylighting, trace wire, survey, acoustic or magnetic location, GPS, closed-circuit television (CCTV) inspection, or mandrel tests. The designer should also specify the applicable leakage, infiltration, exfiltration, or pressure test requirements for the installation. This may apply to either the primary and secondary liner or just the secondary liner. (415.07.08)

The designer should consider providing benchmark and reference points for laying out the project.

The designer should consider specifying if the shafts are to remain in place or be removed upon completion of the project. If the shafts are to remain in place, further details should be provided as to how they should be covered or remain accessible for future use. The designer may determine if separate payment is appropriate for shafts.

The designer may wish to consider including a process regarding payment for failed tunnelling attempts in the Contract Documents.

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

**Related Ontario Provincial Standard Drawings**

No information provided here.