

**Amendment to OPSS 405 (Nov 2008) –
Construction Specification for
Pipe Subdrains**

OPSS 405.05 MATERIAL

OPSS 405.05.01 General

Subsection 405.05.01 of OPSS 405 is amended by deleting the first and second paragraphs in its entirety and replacing it with the following:

Perforated corrugated polyethylene pipe shall be used for all sub-drains. All sub-drain pipes shall include the connection of outlet to drainage structure or approved drainage outlet.

Outlet pipes shall be a non-perforated smooth inside wall pipe constructed of high density polyethylene or polyvinyl chloride.

OPSS 405.05.07 Granular

Subsection 405.05.07 of OPSS 405 is amended by deleting the first sentence in its entirety and replacing it with the following:

Granular material shall be according to TS 1010 and as specified in the Contract Documents.

OPSS 405.07 CONSTRUCTION

OPSS 405.07.02 Excavation

Subsection 405.07.02 of OPSS 405 is amended by deleting the first sentence in its entirety and replacing it with the following:

The trench shall be excavated beginning at the outlet end and proceeding toward the upper end true to the line and grade required. It is the Contractors responsibility to locate any and all buried utilities before the trench is excavated, to ensure that the flow of the pipe is not impeded.

OPSS 405.07.05 Bedding

Subsection 405.07.05 of OPSS 405 is amended by the addition of the following sentence:

Bedding material shall be clear stone as specified in OPSS 405.05.08.

OPSS 405.07.06.01 General

Clause 405.07.06.01 of OPSS 405 is amended by the addition of the following paragraphs:

The entire trench shall be wrapped with a Class 1 non-woven geotextile fabric according to OPSS 1860 and shall have a minimum thickness of 0.9 mm. Each section shall be overlapped by a minimum of 300 mm in all directions.

The upstream end of the subdrain shall be plugged with an approved polyethylene plug and the geotextile sock knitted sock shall be extended over the plug and tied with a knot. Where joints are required, they shall be constructed with approved polyethylene joint connectors and the geotextile sock shall be overlapped by a minimum 150 mm and secured in place with plastic cable ties.

OPSS 405.07.06.03 Connection to Drainage Structures

Clause 405.07.06.03 of OPSS 405 is amended by the addition of the following paragraphs:

The outlet invert elevation shall be located not less than 75 mm nor more than 150 mm above the drainage structure or ditch outlet.

Subdrains shall be connected to drainage structures by coring only. The use of jackhammers or saw cutting shall not be permitted. When two subdrains are to be connected to a drainage structure, a tee connection shall be made outside the drainage structure and then connected to a single outlet in the drainage structure. The tee connection shall be a snap-on, self-locking, male-ended tee.

OPSS 405.07.07 Embedment and Backfill Material

Subsection 405.07.07 of OPSS 405 is amended by deleting the first sentence in its entirety and replacing it with the following:

Embedment and backfill material shall be clear stone as specified in OPSS 405.05.08.

OPSS 405.10 BASIS OF PAYMENT

OPSS 405.10.01 Pipe Subdrain – Item

Subsection 405.10.01 of OPSS 405 is amended by deleting the second, third and fourth paragraphs in its entirety.



CONSTRUCTION SPECIFICATION FOR PIPE SUBDRAINS

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405.01 SCOPE

This specification covers the requirements for the installation of pipe subdrains.

405.01.01 Specification Significance and Use

This specification has been developed for use in provincial- and municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities and the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.

405.01.02 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.

405.02 REFERENCES

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

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 320	Open Graded Drainage Layer
OPSS 409	Closed-Circuit Television Inspection of Pipelines
OPSS 421	Pipe Culvert Installation In Open Cut
OPSS 501	Compacting

Ontario Provincial Standard Specifications, Material

OPSS 1004	Aggregates - Miscellaneous
OPSS 1010	Aggregates - Base, Subbase, Select Subgrade, and Backfill Material
OPSS 1801	Corrugated Steel Pipe Products
OPSS 1840	Non-Pressure Polyethylene Plastic Pipe Products
OPSS 1841	Polyvinyl Chloride (PVC) Pipe Products
OPSS 1860	Geotextiles

Canadian Standards Association (CSA)

G164-M92 (R2003) Hot Dip Galvanizing of Irregularly Shaped Articles

Bureau De Normalisation Du Quebec (BNQ)

3624-115 (2007) Polyethylene (PE) Pipe and Fittings - Flexible Corrugated Pipes for Drainage - Characteristics and Test Methods.

Water Research Centre (WRc) Publication

MSCC Manual of Sewer Condition Classification, 4th Edition, December 2003

405.03 DEFINITIONS

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

Backfilling means the operation of filling the trench with embedment and backfill material.

Backfill Material means the material used to fill the trench above the embedment material and below the lower of the subgrade or finished grade or the original ground.

Bedding means the embedment material placed in the subdrain and outlet pipe trenches below the pipe.

CCTV means closed-circuit television.

Embedment Material means the material used to fill the trench from the bottom of bedding to the height specified in the Contract Documents.

Knitted Sock Geotextile means a textile structure produced by knitting in a continuous tube specifically intended to cover perforated subdrain. Knitted geotextiles are suitable only for wrapping of perforated subdrain pipe.

OGDL means open graded drainage layer.

Outlet means the terminal 2.5 m of the outlet pipe.

Outlet Pipe means a non-perforated 100 or 150 mm diameter pipe that is placed for the purpose of conveying subsurface water from a subdrain to a proper outlet.

Subdrain means a perforated 100 or 150 mm diameter pipe that is placed for the purpose of collecting subsurface water and conveying it to a proper outlet pipe.

405.04 DESIGN AND SUBMISSION REQUIREMENTS

405.04.01 Submission Requirements

Upon request, prior to the placement of subdrain or outlet pipe, documentation from the manufacturer verifying that the material supplied meets the Contract requirements shall be submitted to the Contract Administrator.

405.05 MATERIALS

405.05.01 General

Subdrain shall be a perforated polyvinyl chloride pipe, polyethylene pipe, or corrugated steel pipe.

Outlet pipe shall be a non-perforated corrugated steel pipe or a non-perforated smooth inside wall pipe constructed of high density polyethylene or polyvinyl chloride.

Outlets shall be constructed of non-perforated corrugated steel pipe or double-walled polyethylene or polyvinyl chloride pipe having a minimum stiffness of 300 kPa.

405.05.02 Corrugated Steel Pipe Products

Corrugated steel pipe products shall be according to OPSS 1801 and as specified in the Contract Documents.

405.05.03 Polyethylene Pipe Products

Polyethylene pipe products shall be according to OPSS 1840 or BNQ 3624-115 and as specified in the Contract Documents.

405.05.04 Polyvinyl Chloride Pipe Products

Polyvinyl chloride pipe products shall be according to OPSS 1841 and as specified in the Contract Documents.

405.05.05 Geotextiles

Geotextiles shall be according to OPSS 1860 and as specified in the Contract Documents.

405.05.06 Fittings

Fittings shall be suitable for and compatible with the class and type of pipe with which they will be used.

Caps shall be polyethylene.

Galvanizing of rodent gates shall be according to CSA G164.

405.05.07 Granular

Granular material shall be according to OPSS 1010 and as specified in the Contract Documents.

405.05.08 Clear Stone

Clear stone shall be 19 mm, Type I or Type II, according to OPSS 1004.

405.05.09 Open Graded Drainage Layer Aggregate

OGDL aggregate shall be according to OPSS 320.

405.07 CONSTRUCTION

405.07.01 General

Contractor inspection reports shall confirm the following at each outlet pipe connection and at the midpoint between outlets:

- a) Trench alignment, grade, and width.
- b) Grade of bedding material.
- c) Condition of subdrain, outlet pipe, and geotextile.
- d) Compaction.

Contractor inspection reports shall be submitted to the Contract Administrator upon request.

Geotextile, subdrain, or outlet pipe damaged by exposure to sunlight or damaged by any other means shall be replaced.

The stability of the subdrain and outlet pipe trenches shall be maintained at all times during excavation and backfilling.

405.07.02 Excavation

Trenches shall be excavated to the lines, grades, and dimensions specified in the Contract Documents.

The excavation shall be inspected with grade checks and certified by the Contractor prior to placement of the pipe bedding.

405.07.03 Unstable Foundations

When unstable foundation conditions are encountered, the Contractor shall take the necessary steps to ensure a stable foundation as directed by the Contract Administrator. An inspection report to verify the foundation stability shall be submitted to the Contract Administrator upon request.

405.07.04 Geotextile

Subdrain shall be wrapped with a knitted sock geotextile.

When a geotextile wrapped trench is specified in the Contract Documents, wrapping of the subdrain with a knitted sock geotextile shall not be required, and the geotextile shall be installed as specified in the Contract Documents.

When OGDL or 19 mm clear stone embedment are specified in the Contract Documents, the subdrain trench and outlet pipe trench shall be wrapped with geotextile.

When granular embedment and backfill material are specified for an outlet pipe connection to a catch basin, the outlet pipe trench shall not require geotextile wrap.

405.07.05 Bedding

Bedding shall be placed in the trench to the depth specified in the Contract Documents prior to laying the subdrain or outlet pipe.

The pipe bedding grade shall be inspected with grade checks and certified by the Contractor prior to laying the subdrain or outlet pipe.

405.07.06 Laying Subdrain and Outlet Pipe

405.07.06.01 General

Pipe installation shall be according to OPSS 421 and as specified below.

The pipe shall be placed firmly on the bedding and secured in place to prevent any movement or disturbance during backfilling. Pipe with perforations on only one side shall be installed with perforations down. Pipe shall not be laid in water or on saturated bedding. Pipe shall not be used as a drain for the Contractor's operation.

Connections between the subdrain and outlet pipe shall be made with prefabricated 45° elbows or pre-manufactured pipe curves as required.

Outlet pipe shall be installed at all low lying areas, at the end of subdrain, and at a uniform spacing of 100 m along the length of the subdrain.

Subdrain and outlet pipe installation shall be inspected and approved by the Contractor prior to backfilling.

405.07.06.02 Outlets

405.07.06.02.01 General

The outlet shall have an internal diameter that is slightly larger than the outlet pipe diameter so that the outlet pipe can be inserted into the outlet a minimum distance of 300 mm.

Outlets shall extend beyond the front of the ditch or fill slope for a distance of 300 mm.

The ends of all outlets shall be fitted with galvanized rodent gates.

The joint between the outlet pipe and the outlet shall be wrapped with a 0.5 m width of geotextile.

405.07.06.02.02 Marking of Outlets

Each outlet location shall be marked with a 25 x 25 mm square galvanized steel bar, 2.2 m long, embedded from 0.6 to 1.0 m into the ground, adjacent to the outlet, clearly visible from the driving portion of the roadway.

405.07.06.03 Connection to Drainage Structures

Subdrain shall be connected to maintenance holes, catch basins, and ditch inlets by a 1 m section of non-perforated pipe. Subdrain and outlet pipe connections to concrete maintenance holes, catch basins, and ditch inlets shall be cored and grouted as specified in the Contract Documents.

405.07.07 Embedment and Backfill Material

Embedment material shall be clear stone, granular, or open graded drainage layer aggregate as specified in the Contract Documents.

Backfill material shall be as specified in the Contract Documents.

The Contractor shall ensure that the subdrain and outlet pipe are not damaged or dislodged during the placement and compaction of embedment and backfill material. Damaged or dislodged subdrain and outlet pipe shall be removed and replaced.

Any earth from cave-ins and all other unsuitable material shall be removed from embedment and backfill material.

Compaction of embedment and backfill material shall be according to OPSS 501.

At the termination of a day's work, backfilling shall be complete over all subdrain and outlet pipe placed.

405.07.07.01 Winter Grading of Material

All ice and snow shall be removed from all portions of the work area. Frozen material shall not be incorporated into the work. Material shall not be placed over frozen ground, ice or snow, except, at the Contractor's option, a single lift may be placed over frozen ground in which case final grading and compaction shall be done after the underlying materials have thawed.

405.07.08 Closed-Circuit Television Inspection

When specified in the Contract Documents, the Contractor shall inspect the drainage system using CCTV inspection to ensure that the subdrain and outlet pipes are intact and were not crushed or damaged during construction. CCTV inspection shall be according to OPSS 409.

CCTV inspection shall be based on selected sampling at locations identified by the Contract Administrator. A minimum of 5% of the entire length of subdrain pipe and 100% of the outlet pipes shall be video inspected and recorded. Where defective, damaged, or improperly installed pipe is encountered, the Contract Administrator may request additional CCTV inspection. The inspection shall be conducted following the placement of the granular course and prior to the placement of the pavement surface.

The equipment used for CCTV inspection of the drainage system shall be according to OPSS 409 with the following exceptions:

- a) The system shall be capable of providing CCTV inspection of subdrain and outlet pipes of minimum 100 mm inside diameter within a wet environment and shall be capable of negotiating a minimum 45° bend.
- b) The system shall be capable of inspecting a length of pipe up to 90 m by push rodding, pull cabling, jetting, or tractoring the camera through the pipe.
- c) The system shall be capable of recording the distance traversed by the camera to within 150 mm.

When the CCTV inspection report shows any of the following defects, as defined by the MSCC manual, they shall be identified to the Contract Administrator and the defective, damaged, or improperly installed subdrain and outlet pipe sections shall be removed and replaced:

- a) Fracture.
- b) Broken.
- c) Large joint displacement.
- d) Large open joint.

- e) Deformed pipe such that the camera is not able to navigate though the pipe.
- f) Ponding water.

Replaced subdrain and outlet pipes shall be re-inspected by CCTV to verify installation.

405.07.09 Management of Excess Material

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

405.08 QUALITY ASSURANCE

The Contractor shall demonstrate the outlet pipe is on grade and unobstructed for its full length after backfilling.

405.08.01 Acceptance Criteria

Acceptance of the subdrain and outlet pipes shall be installation according to the requirements of the Contract Documents and no damage or defects as defined in this specification. Subdrain and outlet pipe with damage or defects or that is improperly installed shall be removed and replaced.

405.09 MEASUREMENT FOR PAYMENT

405.09.01 Actual Measurement

405.09.01.01 Pipe Subdrain

Measurement of pipe subdrain shall be by length in metres horizontally along the centreline of the pipe between the ends of the pipe subdrain, including outlets, or between the upstream end of the pipe subdrain and the centre of a maintenance hole, catch basin, or ditch inlet.

405.09.01.02 CCTV Inspection

Measurement for a CCTV inspection of subdrain and outlet pipe shall be by length in metres on the ground surface along the centreline of the subdrain from the centre of one drainage structure to the centre of another drainage structure or the outlet end of the subdrain.

405.09.02 Plan Quantity Measurement

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

405.10 BASIS OF PAYMENT

405.10.01 Pipe Subdrain - Item

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

When excavation and backfilling of subdrain and outlet pipe overlaps the excavation and backfilling required for other work, payment for overlapping excavation and backfilling shall be made in accordance with the specifications for such other work as though no excavation and backfilling were required for pipe subdrain.

When subdrain and outlet pipe are placed below subgrade and the embedment and backfill material are the same material used in the road base or subbase, the embedment and backfill material shall be paid for with the road base or subbase item. When embedment or backfill material or both are different than the material used for the road base or subbase, payment for the embedment and backfill material shall be included in the Contract price for the pipe subdrain.

When unstable foundations are encountered, payment for stabilization shall be as Extra Work.

Maintenance of the stability of the trench shall be at no extra cost to the Owner.

Correction of any defective workmanship and defective or damaged material shall be at no extra cost to the Owner.

405.10.02 Closed-Circuit Television Inspection - Item

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

Re-inspection by CCTV inspection to verify the installation of replaced subdrain or outlet pipe shall be at no extra cost to the Owner.

**Appendix 405-A, November 2008
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

Note: This 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

The designer should specify the following in the Contract Documents:

- Pipe size, metal thickness, corrugation profile, and coating requirements of corrugated steel pipe. (405.05.02)
- Pipe size, type, and stiffness requirements of polyethylene and polyvinyl chloride pipe products. (405.05.03 and 405.05.04)
- The width, grade, and alignment of trench excavation. (405.07.02)
- Bedding depth. (405.07.05)

The designer should determine if the following is required and, if so, it should be specified in the Contract Documents:

- Type, Class, and Filtration Opening Size (FOS) of geotextile trench wrap. (405.05.05)
- Whether the subdrain trench and outlet are to be wrapped with geotextile. (405.07.04)
- Installation details of the geotextile trench wrap. (405.07.04)
- Material type(s) for embedment and backfill of subdrain and outlet pipes. (405.05.07 and 405.07.07)
- Tender item for the inspection of subdrain and outlet pipes by CCTV. (405.07.08 and 405.10.02)

In specifying material types for embedment material, the designer should be aware that certain granulars may have lower permeability and may not be suitable as a drainage medium.

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

OPSD 206.050	Subdrain Pipe Connections and Outlet Details - Rural
OPSD 207.044	Subdrain Pipe Connections and Outlets for Open Graded Drainage Layer
OPSD 216.021	Subdrain Pipe Connections and Outlet Details - Urban