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DRAFT

CONSTRUCTION SPECIFICATION FOR SEWAGE FORCEMAIN REHABILITATION BY CURED-IN-PLACE PIPE (CIPP) LINER

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D XXX.01 SCOPE

This specification covers the requirements for the rehabilitation of sewage forcemains by the installation of a tight fitting cured-in-place pipe (CIPP) liner.

D XXX.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 in accordance with the Contract Documents.

D XXX.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.

D XXX.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 180	General Specification for the Management of Excess Material
OPSS 401	Trenching, Backfilling, and Compacting
OPSS 404	Support Systems
OPSS 409	Closed-Circuit Television Inspection of Pipelines
OPSS 411	Construction Specification for the Cleaning and Flushing of Pipe Sewers, Catchbasins, Maintenance Holes, Ditch Inlets, and Oil-Grit Separators
OPSS 491	Preservation, Protection, and Reconstruction of Existing Facilities
OPSS 492	Site Restoration Following Installation of Pipelines, Utilities, and Associated Structures
OPSS 517	Dewatering of Pipeline, Utility, and Associated Structure Excavation
OPSS 539	Temporary Protection Systems

ISO

ISO 11296-4	Plastics Piping Systems for Renovation of Underground Non-Pressure Drainage and Sewerage Networks – Part 4: Lining with Cured-in-Place Pipe
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CSA Standards

S6 Canadian Highway Bridge Design Code

ASTM International

D638 Standard Test Method for Tensile Properties of Plastics
D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D2290 Standard Test Method for Apparent Hoop Tensile Strength of Plastic or Reinforced Plastic Pipe
D2990 Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
D4541 Standard Test Method for Pull-Off Strength of Coating Using Portable Adhesion Testers
F1216 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
F1743 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)
F2019 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled-In-Place Installation of Glass-Reinforced Plastic (GRP) Cured-In-Place Thermosetting resin Pipe (CIPP)

American Water Works Association (AWWA)

M28 Liner Classifications

D XXX.03 DEFINITIONS

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

Contract Administrator means the Owner's Project Manager or its authorized representatives.

Cured-In-Place Pipe (CIPP) Lining means the rehabilitation of existing pipe in place by installation of a tube with one or more layers of flexible non-reinforced or reinforced resin-impregnated material.

Engineer means a professional engineer licensed by Professional Engineers Ontario to practice engineering in the Province of Ontario.

D XXX.04 DESIGN AND SUBMISSION REQUIREMENTS

D XXX.04.01 Design Requirements

The engineering design shall be in accordance with current ASTM and AWWA design standards for pressure pipe rehabilitation with the following criteria:

a) Design conditions:

Unless otherwise specified in the Contract Documents, CIPP liner design shall assume fully deteriorated condition (as defined in ASTM F1216 X1) of the existing pipe.

b) Parameters for design:

Unless otherwise specified in the Contract Documents:

- i. Design life of 50 years (See Note B1 Below)
- ii. Safety factor of 2 applied to ASTM F1216 Equations X1.1 and X1.3

- iii Safety factor of 2 applied to ASTM F1216 Equation X1.7
- iv. Groundwater table at ground surface
- v. Soil modulus of 6.9 MPa
- vi. Soil density of 2124 kg/m³
- vii. Ovality of existing pipe of 2% (See Note B2 Below)
- viii Depth of cover of 3m
- viii. Design Operating Pressure as specified in Contract Documents (See Note B3 Below)
- ix. Live Load as per Canadian Highway Bridge Design Code (CHBDC) CL-625-ONT Truck, or AASHTO HL-93 Truck
- x. Vacuum of minus 101 kPa (See Note B4 Below)

Note B1: In the context of this OPSS, design life relates to the appropriate selection of values for the design properties for the CIPP liner where the appropriate values of these properties are dependent on applied stress over time. The time/stress dependency relationship for CIPP forcemain liner design properties shall be determined by appropriate long-term testing of the complete liner composite material, not just the resin, unless the CIPP liner to be used is not reinforced. However, the choice of the values for the properties used in design shall also be dependent on the applied stress situation over time in the actual forcemain liner installation. For forcemains where the internal pressure is expected to fluctuate (including periods of no pressure due to on/off cycling) consideration should be given to treating the external load as a long-term effect meaning that an appropriate reduction to the value to short-term test flexural modulus should be used to account for the long-term time/stress dependency of the flexural modulus. The components of external load include ground water pressure, soil pressure, live load pressure and vacuum pressure. Similarly, when there is fluctuating internal pressure (including on/off cycling) consideration should be given to treating the internal pressure as a long-term effect meaning that an appropriate reduction to the value of short-term test tensile strength should be used to account for the long-term time/stress dependency of the tensile strength.

Note B2: Where actual ovality of the forcemain to be lined exceeds 2%, the F1216 X1 design method shall not be used because F1216 Equation X1.7 does not account for ovality of the existing pipe. Where existing pipe actual ovality exceeds 2%, an installation specific design method shall be used that accounts for the ovality in the liner's internal pressure resistance design and such design method shall be approved by the Contract Administrator.

Note B3: The design operating pressure represents the maximum operating pressure and is commonly above the normal operating pressure. In the design of forcemain liners, other pressures may be relevant to design, such as transient surge pressure and test pressure. All relevant pressures shall be addressed in the Contract.

Note B4: In accordance with ASTM F1216 Design Method, vacuum is treated as an external pressure. For design purpose, use of short-term liner flexural modulus is acceptable for vacuum resistance.

D XXX.04.02 Submission Requirements

The design for the CIPP liner shall be submitted to the Contract Administrator for approval at least 14 Days prior to installation. The design calculations shall show technical assumptions, CIPP liner material properties, Creep Retention Factor, identify the design formulas used, and show the minimum CIPP thickness for all equation thicknesses, and the final design thickness.

The engineering design shall illustrate the installation conditions (i.e., depth of pipeline, water table, pipe invert and crown, ovality condition of host pipe, and full details of the parameters used).

Comparative flow capacity (pre and post lining) calculations for the CIPP liner shall be provided upon request of the owner.

The design work shall bear the seal and signature of an Engineer.

The following information shall be submitted to the Contract Administrator at least 7 Days prior to commencing Work:

- a) A work plan outlining the schedule, procedures, and work site including:
 - Wet-out plan;
 - CIPP cure plan;
 - sampling plan;
 - QA/QC plan;
- b) A list of personnel, including backup personnel, with their qualifications and experience.
- c) A traffic control plan, including pedestrian movements, when specified in Contract Documents.
- d) Project specific safety plan, including the contractor safety manual, confined space entry and emergency procedures.
- e) Temporary forcemain bypass plan, when specified in contract documents.
- f) CIPP Manufacturer's technical data containing complete information on:
 - i. Material composition and physical properties
 - ii. Recommendations for transportation, handling, and storage
 - iii. Installation procedures
 - iv. 3rd party ASTM D2990 testing
- g) Basic Contingency plans for the following potential conditions:
 - ii. Improper placement of the CIPP liner
 - iii. Damage to the host pipe
 - iv. Failure of CIPP liner to meet design physical properties
 - v. Product damaged during installation
- h) A notice to residents impacted by the work.
- j) Shop drawings providing dimensional information on the pipes to be lined and the corresponding CIPP liners to be used.

D XXX.05 MATERIALS

Diameter range with pressure ratings shall be determined based on manufacturers' specifications and independently qualified test data and published capabilities of the product(s).

D XXX.05.01 CIPP Liner

The CIPP liner shall have the following minimum characteristics:

- i. Flexural modulus of 1,724 MPa tested in accordance with ASTM D790 or ISO 11296-4
- i. Flexural strength of 31 MPa tested in accordance with ASTM D790 or ISO 11296-4
- ii. Tensile strength of 21 MPa tested in accordance with ASTM D638 or ASTM D2290

Regardless of the minimum values listed above, the actual values determined by testing samples from actual liner installations shall meet or exceed the short-term test values of these properties that were used in the design of the liner for the installation. For example, if a liner installation was designed using a

short-term test tensile strength of 80 MPa (reduced as appropriate for long-term design), installation sample short-term test result must be at least 80 MPa, not just the 21 MPa listed above. Otherwise the liner is deficient (subject to a design reconciliation based on as tested properties).

The finished CIPP liner shall meet the chemical resistance, abrasion resistance, and bacteriological resistance requirements in accordance with the Contract Documents.

D XXX.05.02 Tube

The CIPP tube shall consist of one or more layers of materials capable of carrying resin able to withstand installation loads (e.g. inversion pressure, abrasion, tensile pull load), curing temperatures, and shall be compatible with the resin system used. The material shall be capable of stretching to fit irregular pipe sections and negotiate bends without excessive folds or wrinkles as defined in the Contract Documents. Cutting or grinding of wrinkles and folds shall not be permitted. The tube shall be fabricated to a size that fits tightly to the internal circumference and the length of the original pipe when installed.

D XXX.05.03 Resin

The CIPP resin shall meet the requirements of ASTM F1216 or ASTM F1743 or ASTM F2019, and shall, as required, adhere to the host pipe to prevent leakage and delamination/movement, except when the CIPP liner installation requires that there be no bond to the host pipe (e.g. bridge crossings).

D XXX.05.04 Calibration Hose

Calibration hoses used for inflation of CIPP shall comply with the requirements of ASTM F1743.

D XXX.05.05 Preliners

Preliners shall be approved by the Engineer and shall have no detrimental effects on CIPP liner performance. A preliner shall not be used when leak tightness of the liner is premised upon bond or adherence of the CIPP liner to the existing forcemain.

D XXX.07 CONSTRUCTION

D XXX.07.01 General

The Contract Administrator shall be notified at least 14 days in advance of starting work.

The Contractor shall determine the size and length of all existing pipes to be rehabilitated prior to undertaking the installation of any CIPP.

All required equipment shall be on-site and in satisfactory working order prior to commencing the installation of a CIPP section.

Work shall progress and continue as required to minimize downtime on pipelines.

At least 7 Days prior to commencement of work, the Owner shall advise, in writing, all residents who may be affected by the rehabilitation process about the nature, duration, and expected date of any interruption in service. The Contractor shall notify all affected residents or businesses of the specific time and duration of any disruption to their service at least 24 hours in advance and shall endeavour to minimize their inconvenience. During the course of the rehabilitation and any associated service interruption, the residents shall be kept informed by the Contractor regarding any matters that affect them. When the rehabilitated forcemain is put back into service, residents shall be advised immediately by the Owner either verbally or in writing.

D XXX.07.02 Preservation and Protection of Existing Facilities

Preservation and protection of existing facilities shall be according to OPSS 491.

D XXX.07.03 Transporting, Unloading, Storing, and Handling Materials

Manufacturer's recommendations for transporting, unloading, storing, and handling of materials shall be followed.

D XXX.07.04 Trenching, Backfilling, and Compacting

Trenching, backfilling, and compacting for any access pits shall be according to OPSS 401.

D XXX.07.05 Support Systems

Where required for excavation or similar situations, support systems shall be according to OPSS 404.

D XXX.07.06 Dewatering

Where required for dewatering procedures to stabilise the ground and keep excavations free of water, or similar situations, dewatering shall be according to OPSS 517.

D XXX.07.07 Temporary Protection Systems

The construction of temporary protection systems shall be according to OPSS 539.

Where the stability, safety, or function of an existing roadway, railway, watercourse, other works, or proposed works may be impaired due to the method of operation, protection shall be provided. Protection may include, but not limited to, sheeting, shoring, and piling where necessary to prevent damage to such works or proposed works.

D XXX.07.08 Forcemain Flow Control

When specified in the Contract Documents or when required to perform the work, the forcemain flow shall be controlled in the pipeline being CIPP lined. Method of flow control shall be acceptable to the Contract Administrator.

Any pumps and temporary flow lines shall be of adequate capacity and size to handle forcemain flows.

When interruption of forcemain flows is necessary to properly conduct the inspection and rehabilitation operations, methods of flow control shall be used. The Contractor is to make all necessary arrangements with the owners, property managers, and residents of each building.

Unless otherwise specified in the Contract Documents, during the inspection and rehabilitation, forcemain flows shall be controlled as required in order to enable proper inspection of the pipe invert. After the work is completed, flows shall be restored to normal.

When a pumped flow control is in operation, the Contractor shall maintain a primary and stand-by pump and pump power supply on-site. Sufficient power supply and hoses shall be on-site in order to allow the pump to discharge into the next downstream sewer section. The stand-by pump and power supply shall be of an equal or better capability than the primary pump and power supply. Unless otherwise specified in the Contract Documents, no pumps or related equipment shall be disconnected or removed from the work site until after the Contractor has recorded the post-installation video.

All flow control pumping shall be in place and operational prior to the final pre-installation inspection. When specified in the Contract Documents, all flow control pumps and related equipment shall be silenced or contained within an acceptable sound reduction structure.

D XXX.07.09 Pipeline Cleaning and Preparation

The cleaning method shall be approved by the Engineer and shall not damage the existing pipe walls or appurtenances, where such damage will negatively affect the performance of the lined forcemain. The pipe shall be cleaned as many times as necessary, and in each direction as necessary, to obtain results that are satisfactory to the Engineer.

When viewed without magnification, the cleaned, prepared pipe surfaces shall be free of all sharp edges and protrusions that may cause point loads on the finished CIPP. It shall also be free of all visible contamination (e.g. sediment and biofilm), loose corrosion products (e.g. rust and graphite), dust, oxides, loose coatings/linings, and any other foreign matter. Previously-applied coatings and linings shall be completely removed unless the residual coating/lining is tightly bonded and the manufacturer and Engineer agree that the residual coating/lining can be safely lined with CIPP without compromising performance and integrity of the lined forcemain.

The waste from cleaning and preparation operations must be handled and disposed in accordance with the contract requirements.

When the filling or repair of voids or gaps in the existing pipe is necessary to ensure CIPP structural integrity, a detailed procedure outlining the process and materials to be used shall be submitted to the Engineer for approval.

D XXX.07.10 Closed-Circuit Television (CCTV) Inspection

CCTV inspection shall be according to OPSS 409.

At least two CCTV inspections of each pipeline section shall be completed as follows:

a) Post Preparation CCTV Inspection

After completion of the preparation of a pipeline section, a CCTV inspection of the full length of the pipeline section shall be made and submitted to the Contract Administrator. Prior to the delivery of the 24-hour service interruption notice and any lining installation taking place, approval of the prepared section shall be obtained from the Contract Administrator.

b) Post-Lining CCTV Inspection of Complete Rehabilitation

After completion of all lining work and before returning to service, a CCTV inspection of the full length of the pipeline section shall be made and submitted to the Contract Administrator for approval.

The final CCTV recording shall be submitted to the Contract Administrator for approval immediately upon completion of the work, but no more than 48 hours after the CIPP installation in each section.

The inside wall of the access point at each end of the pipeline section shall be clearly visible on the inspection video.

This CCTV inspection will be used to determine the following:

- Fit and finish (no annular space and liner sized correctly),
- No evidence of stress concentrations (bumps, bubbles, delaminations)
- Tight fit of the liner to the host pipe
- No excessive folds or wrinkles

- Liner has no dry or soft spots
- No evidence of liner damage

D XXX.07.11 Cured-In-Place Pipe (CIPP) Installation

Wet-out shall be completed in accordance with manufacturer's recommendations to achieve full and consistent resin distribution. The manufacturer shall specify the process to be used, the volume of resin required, and any other applicable parameters.

The installation of the CIPP shall be according to the manufacturer's procedure.

Before installation begins, the Contractor shall obtain manufacturer's recommendations of the minimum pressure required to hold the tube tight against the existing pipes and the maximum allowable pressure, so as not to damage the liner tube.

Prior to inserting the lining, the pipe must be prepared and in the state specified in Section XXX.07.08.

D XXX.07.12 Curing and Cool-Down

The CIPP installation shall be according to ASTM F1216 or ASTM F1743 or ASTM F2019 as applicable to the type of liner being used. Qualified personnel shall execute and monitor the curing process and maintain records, including lining temperatures and internal pressure and/or UV light intensity and duration throughout the curing and cool-down process. These records shall be made available to the Contract Administrator upon request.

The CIPP shall be inserted and cured in accordance with the manufacturer's parameters and procedures required for the process, or as specified in Contract Documents.

Readings shall be made and recorded at intervals as specified by the liner system manufacturer:

- a) Heat Cured Systems: Measure and record the interface temperature at the downstream and upstream ends of the liner as well as any accessible intermediate access points with a thermocouple at the crown and invert of the host pipe. The time required for the cure shall be determined by the liner system manufacturer and shall be adjusted to suit the lengths, diameter, thickness, field conditions, and ambient temperature applicable to each pipe lining section.
- b) UV Cured Systems: Measure and record the number of lamps on, the rate of travel of the light train, and total duration of the curing process. The time required for the cure shall be as specified by the liner system manufacturer.

For heat-cured systems, the CIPP shall be cooled as per resin manufacturer recommendations before relieving the hydrostatic head. Care shall be taken in the release of the static head so that a vacuum does not develop that could damage the newly installed CIPP. Prior to releasing the water used for curing the liner, the water shall be cooled to the ambient temperature of the receiver (i.e. watercourse or sewer) into which it is to drain.

D XXX.07.13 Inflation Bladder Removal

For pulled-in-place installations where inflation bladders are required, all portions of the bladder material shall be removed from the CIPP.

D XXX.07.14 CIPP Termination

The CIPP termination at and through sections shall be fully bonded and fully conforming to the host pipe, and be neat and free of obstructions to form a leak tight seal between the CIPP and the host pipe. If the CIPP termination fails to make a watertight pressure seal with the existing pipe, a seal shall be applied at this point. The sealing process shall use a material compatible with the CIPP and host pipe.

D XXX.07.15 Hydrostatic Pressure and Leakage Testing

The lined forcemain shall be pressure tested for leakage. The test pressure shall be 120 per cent of the operating pressure for the forcemain location being tested. The Contract Administrator will provide the operating pressure to the Contractor for the test section(s).

The test duration and allowed make up water shall be in accordance with ASTM F1216 Section 8.3.

All pressure test results shall be reported immediately to the Contract Administrator.

D XXX.07.16 Site Restoration

Site restoration shall be according to OPSS 492.

D XXX.07.17 Management of Excess Material

Management of excess material shall be as specified in the Contract Documents.

D XXX.08 Quality Assurance

Quality assurance for the CIPP lining shall, at a minimum, include:

1. Review of the Post-Lining Final CCTV inspection.
2. Testing of samples from (and representative of) the installed CIPP liner and determining the wall thickness of the installed CIPP liner
3. Testing samples of uncured resin

1. Review of Post-Lining Final CCTV Inspection

The CIPP liner shall be continuous from start to finish without breaks, separations, thinning or any other indication that a discontinuity exists.

The CIPP liner shall fit tightly to the host pipeline and any geometric shape changes in the liner shall only be accepted if they reflect the geometric shape of the cleaned and prepared host pipeline. Any misshapes in the liner that are not a reflection of the shape of the host pipe are deficiencies in the liner.

The CIPP liner shall not have any lifts, sags, bubbles, protrusions, holes, pinholes or any indications that the liner wall has any separations by delamination.

The CIPP liner shall have no leaks or infiltration through the wall of the liner.

The CIPP liner shall have no indications of soft zones, uncured liner or marked discolouration.

The CIPP liner shall have no peeling or blistering of its surface.

2. Testing of CIPP Liner Samples and Liner Wall Thickness

Samples for testing shall be taken from the finished liner in accordance with the requirements of ASTM F1216, F1743 or F2019 as applicable to the type of liner being used. CIPP restrained and field-cured samples shall be taken from the finished CIPP at an access point and be sufficient in size to meet the requirements of the testing specifications in the Contract Documents. For CIPP greater than 400mm where a restrained sample is not possible, a flat-plate sample shall be provided. Test samples shall be taken by the independent owner designate who is responsible for the sample chain of custody. Testing is to be done by an independent testing laboratory approved by the Contract Administrator. The samples shall be tested at a third party testing agency experienced in the testing of CIPP liners.

The samples shall be tested for flexural strength and flexural modulus as per ASTM D790 or ISO 11296 testing methods and tensile strength by ASTM D638 or D2290 methods. When using ISO 11296, measure flexural strength in accordance with ISO 178 until rupture occurs or until a maximum strain of 5% is reached, whichever occurs first.

The test results shall meet or exceed the values used in the design of the liner for the installed section from which the test sample is applicable otherwise the CIPP liner is deficient, subject to design reconciliation. It is noted that the values used in design are typically greater than the minimum qualifying properties in various standards, such as ASTM F1216 etc. and therefore such standard minimum values are not normally the relevant basis to which test values are compared.

When the sample is the appropriate type (restrained cylindrical sample) the sample shall also be measured for liner thickness in accordance with ASTM D5813. When samples are not the appropriate type for determining liner thickness, liner thickness shall be determined in a manner approved by the Contract Administrator. The thickness to be determined is the liner structural thickness and shall not include the thickness of any non-structural zones or layers.

The liner thickness shall meet or exceed the required thickness otherwise the liner is deficient, subject to design reconciliation. The required thickness is the thickness determined by the applicable liner design or a contract specified minimum thickness, whichever is greater.

Frequency of Sampling and Testing

Unless otherwise specified in the Contract Documents, samples shall be taken from each CIPP installation.

Plate Sample De-rating

Unless otherwise specified in the Contract Documents, test results from plate samples shall be de-rated by 15% to arrive at values to be compared to the required values.

Design Reconciliation

In situations where one or more of the tested properties or measured thickness do not meet requirements, a design reconciliation of the original design using as tested properties as the only changed input may be performed on the approval of the Contract Administrator. Where the design reconciliation shows that required liner performance is obtained using test properties and test thickness, the liner shall not be deficient. Design reconciliation is not permitted if flexural strength, flexural modulus or tensile strength is less than the qualifying minimum values given in the applicable standard (such as ASTM F1216) or as specified otherwise in the contract documents.

Process Records

The Contractor's CIPP liner wetout logs and cure records shall be made available to the Contract Administrator upon request.

3. Testing Samples of Uncured Resin

The Contractor shall facilitate the laboratory in obtaining a sample of the approved resin for the project from the resin manufacturer. The laboratory shall produce an infrared spectrograph of the approved resin.

The Contractor shall supply a sample of the resin used in the wetout when requested by the Contract Administrator. The Contract Administrator shall send a sample of the submitted resin from the project to a 3rd party testing laboratory for verification and confirmation vs the manufacturer's supplied resin sample.

D XXX.09 MEASUREMENT FOR PAYMENT

D XXX.09.01 Actual Measurement

D XXX.09.01.01 Cleaning and Preparation of Host Pipe

Measurement for host pipe cleaning and preparation shall be by length along the horizontal centreline of the host pipe between connecting points or, if there is no connecting point, to the end of the host pipe.

When the connecting point is a structure, measurement for host pipe cleaning and preparation shall be to the centre of the structure.

D XXX.09.01.02 Product Installation

Measurement for a product installation shall be by length along the horizontal centreline of the product between connecting points or, if there is no connecting point, to the end of the product.

When the connecting point is a structure, measurement for a product installation shall be to the centre of the structure.

D XXX.10 BASIS OF PAYMENT

D XXX.10.01 Product Installation, "*type, diameter, or use of product*" - 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.

Any extraction of reaming tools or other equipment, including extraction by excavation, shall be the responsibility of the Contractor and shall be done at no extra cost to the Owner.

Costs associated with the filling of identified voids shall be as specified in the Contract Documents. Any additional work done for the filling of additional voids identified in the CCTV inspection shall be paid as Extra Work. Filling of voids occurring as a result of Contractor's operations shall be done at no extra cost to the Owner.

D XXX.10.02**Closed-Circuit Television Inspection**

When the Contract does not contain a separate tender item for CCTV inspection, the Contract price for product installation shall include full compensation for all labour, equipment, and material to do the work of CCTV Inspection.

Appendix XXX-A**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

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.