08046 Gravity Sanitary and Storm Cured-in-Place Pipe (CIPP) Lining

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08046-1 Scope

The section describes the design, methods, and materials approved for Cured-in-Place Pipe (CIPP) lining for gravity storm and sanitary sewer mains.

08046-2 Methods

CIPP methods shall conform to the following:

1. The current ASTM F1216 “Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube” for CIPP work done by inversion methods, or;

2. The current ASTM F1743 “Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe” for CIPP work done by pull-in methods, or;

3. The current ASTM F2019 “Standard Practices 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)”.

08046-3 Materials

Rehabilitation by Cured-in-Place Pipe (CIPP) methods shall mean the lining of existing sewers with a resin-felt tube or glass reinforced plastic structure.

Minimum material requirements shall conform to the current specification of the relevant CIPP method; ASTM F1216, ASTM 1743, or ASTM 2019.

08046-4 Design

The design objectives for CIPP rehabilitation include the following:

1. Maximize the structural enhancement of the sewer lining process by provision of a close fit liner with no annulus between the liner and the host pipe.

2. Increase or maintain the hydraulic capacity of the rehabilitated sewer.

3. Reduce infiltration and exfiltration.

4. Prevent root intrusion.

5. Provide sufficient chemical resistance to prevent future host pipe degradation related to the conveyance of sewage.

6. Minimize sewer service disruption as a result of the rehabilitation.

7. Minimize the time required to complete the rehabilitation.

8. Minimize disturbance of pavements and boulevards.

9. Minimize disruption to vehicular and pedestrian traffic.

10. Minimize the impact of construction on commercial, industrial, and institutional enterprises.

Partially deteriorated and fully deteriorated design shall be based on the modified AWWA formula as detailed in Appendix X1 of the current ASTM F1216 and the following minimum design assumptions shall be employed:

1. The groundwater table will be assumed to be one (1) m below the existing ground surface.

2. An enhancement factor (K) of 7.

3. The long-term value for the flexural modulus of elasticity (E_L) be deemed to be the projected value at fifty (50) years of a continuous application of the design load on the specific resin and felt composite approved for use.

4. The long-term value for the flexural strength (σ_L) shall be deemed to be the projected value at fifty (50) years of a continuous application of the design load on the specific resin and felt composite approved for use.

5. The minimum factor of safety (N) to be utilized in the restrained buckling analysis shall be two (2).

6. A minimum value for ovality of three (3) percent shall be used for the existing sewer unless a greater value exists.

7. Use Manning's formula with assumed "n" value of 0.012 for the CIPP and an "n" value for the host pipe based on the existing condition.

08046-5 Submissions

The following information is required prior to the commencement of the work.

- Liner Design – shall be summarized in a tabular format
- Operations Protocol
- Construction Protocol

5.1 Liner Design

1. The name and manufacturer of the resin and tube proposed for each liner including copies of relevant material specifications outlined in ASTM F1216, ASTM 1743, or ASTM 2019.

2. Liner thickness computations, including all design checks required by these specifications.

3. Confirmation that the hydraulic capacity of the lined pipe will have a hydraulic capacity equal to or greater than the existing pipe.

5.2 Operations Protocol

1. Resin impregnation procedure including catalyst type and dose.

2. The designated location of the wet-out facility.

3. Documentation that the resin proposed for use has not exceeded its shelf life as recommended by the manufacturer of the resin.

4. The volume of resin to be impregnated into each liner section including the proposed excess allowance for polymerization and migration (typically seven (7) percent) into cracks and joints of the host pipe.

5. The roller gap setting required to provide the final installed CIPP thickness based on the volume of resin proposed above.

5.3 Construction Protocol

1. Proposed main line and sewer connection flow control arrangements.

2. The minimum pressure to hold the tube tight against the existing conduit and the maximum pressure so as not to damage the conduit.

3. If the insertion is to be by pull-in methods provide the maximum allowable axial and longitudinal tensile stress for the fabric tube and the arrangement for monitoring pull-in forces during installation.

4. The number and location of heat source monitor gauges.

5. CIPP curing schedule indicating the temperature, staging, duration, and pressure required to achieve a proper cure of the resin and felt tube composite.

6. Anticipated timing for sewer connection and main line service reinstatement.

08046-6 Testing

6.1 Quality Control

6.1.1 Quality Control Records

1. The following quality control records shall be maintained:

    a) Summary of the resin impregnation process including:
        - Volume of resin supplied.
        - Excess quantity of resin added during the wet out to account for polymerisation and migration into the host pipe.
        - Roller gap setting.
        - Resin catalyst(s) used.
        - Time and location of the wet out.
        - Means taken to store and transport the resin impregnated CIPP from the wet out facility to the job site.
        - Means of curing internal point repair liners.

    b) Continuous log of pressure maintained inside the liner during the curing period.

    c) Pulling force used to pull or winch CIPP into place in the host sewer and measured liner elongation.

    d) Continuous log of temperature at boiler in and out and at all thermistors placed between the host pipe and the liner at all manholes during the initial cure, cure and cool down periods.

e) Final inspection of lined segments in accordance with Section 08125.

6.2 Confined Test Samples

At the City's request, testing samples may be required.

1. Provide necessary forms of the same diameter as the host pipe and secure a minimum three hundred (300) mm long full diameter confined test sample from each CIPP.

2. Locate the test sample form in an intermediate manhole or at a termination point and invert through the form.

3. Clearly label the test sample with the respective identification number of the sewer section along with the date in which the liner was installed and provide to the Project Engineer intact in the form.

4. The City will coordinate and pay for CIPP sample testing to confirm the relevant material specifications outlined in ASTM F1216, ASTM 1743, or ASTM 2019.

End of Specification 08046