SECTION 824

SEWER LATERAL REHABILITATION BY CURED-IN-PLACE METHOD

I. GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide all materials, equipment, labor and incidentals for the installation of cured-in-place pipe (CIPP) lateral lining. Existing laterals may be 3-inch to 6-inch nominal diameter, and may have a transition from 6-inch to 3 or 4-inch located between the mainline connection and the cleanout(s). The CIPP shall cure into a smooth, hard, impermeable, chemically-inert liner pipe and form a structurally sound liner pipe with a uniformly smooth interior providing hydraulic flow equal to or greater than the existing lateral in original condition. The CIPP must seal so that infiltration cannot reenter the sanitary sewers between ends of the liner.

B. Two types of lateral CIPP lining may be utilized:

1. One piece main and Lateral Liner

For lateral liners installed to the point of connection with the mainline sewer the lateral lining shall provide a non-leaking connection at the interface of the mainline and lateral pipelines through a one-piece, continuous liner that includes a full wrap of mainline sewer at the connection and lateral liner. Contractor shall install a hydrophilic, water stop material seal intended for use in wastewater applications, as approved by the Owner.

2. Standard Lateral Liner

a. For laterals rehabilitated from the mainline sewer to the public cleanout the lateral lining shall rehabilitate the public lateral only with no more than 12 inches of overlap into the private portion and shall include two (2) integrally-connected hydrophilic seals within the last 6 inches on each end of the lateral liner.

b. For laterals rehabilitated from the face of the existing structure or private cleanout to the public cleanout; the lateral lining shall rehabilitate the private lateral only with no more than 12 inches of overlap into the public portion and shall include two (2) integrally-connected hydrophilic seals within the last 6 inches on each end of the lateral liner.

c. The lateral lining process shall be accomplished using a flexible tube of particular length and sized for the various diameters and fittings encountered, including any transitions encountered, and a thermoset resin with physical and chemical properties appropriate for the application.

C. The Contractor shall contact the owner/residents prior to performing the rehabilitation Work to notify them of temporary sewer service disconnections. Notification shall be provided at least 48 hours in advance of any liner Work and the notifications shall be coordinated with the Owner at least seven (7) days in advance of notifying the owner/residents. Immediately prior to

installation of the lateral liner the contractor shall verbally notify the resident(s) that their sewer service will be temporarily interrupted and then notify the resident(s) again once sewer service is reestablished.

D. If the Contractor damages the sewer main or lateral during construction and is unable to complete the lining in a manner that is satisfactory to the Owner, the Contractor shall submit method of repairs to the Owner. Upon approval by the Owner, the Contractor shall make repairs at no additional cost the Owner and complete the CIPP installation.

E. The Contractor shall perform all required permanent landscape restoration of disturbed areas on private property and within the locality or VDOT right-of-way upon completion of the Work to the satisfaction of the Owner and/or VDOT.

F. The Contractor shall comply with the Contract Documents for erosion and sediment control and other applicable requirements to protect drainage structures, systems, and waters of the Commonwealth.

G. It shall be the responsibility of the Contractor to schedule and perform his Work in a manner that does not cause or contribute to incidence of overflows or spills of sewage from the sewer system. In the event Contractor's Work activities contribute to overflows or spills, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify the Owner in a timely manner.

1.2 RELATED DOCUMENTS

This Section references ASTM, NASSCO, and AWWA standards that are made part hereof by reference, and shall be the latest edition and revision thereof. If there is a conflict between these standards and this Section, this Section will govern. The testing specifications include but are not limited to the following:

A. ASTM D543 – Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.

B. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

C. ASTM D2990 – Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.

D. ASTM D5813 – Standard Specification for Cured-In-Place Thermosetting Resin Sewer Pipe.

E. ASTM F1216 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.

F. Products shall conform to Section 200

1.3 SUBMITTALS

A. Design Calculations

Submit structural design calculations and specification data sheets listing all parameters used in the liner design and thickness calculations based on Appendix X1 of ASTM F1216 for each

pipe segment/lateral.

B. Short-Term Physical Properties

Submit certified test reports demonstrating that the exact resin/liner combination to be used for this project meets the requirements for initial structural properties (performed in accordance with ASTM F1216 and ASTM D790) and chemical resistance (performed in accordance with ASTM F1216-Appendix X2).

C. Long-Term Physical Properties

Submit certified test reports demonstrating that the exact resin and comparable liner to be used for this project has been tested for long-term flexural modulus of elasticity and long-term flexural strength (i.e. 10,000-hour creep testing performed in accordance with ASTM D2990 for design conditions applicable to this project).

D. Installation Quality Control Plan

Submit plan or procedures that ensure proper materials and procedures are used in liner shipping and storage and in the resin impregnation process. Submit installation and quality control plan, including mainline sewer and lateral cleaning plan and cleanliness requirements, liner shot plan and sequence, liner installation standard procedures, temperature monitoring plan, and plan to manage flow to/from laterals during lining. The Contractor's Quality Control Plan shall be submitted for review by the Owner at least two weeks prior to the first CIPP installation.

E. Contingency Plan

Submit plan that includes methods and equipment to be used to repair unacceptable liner defects, for removing failed liners, and for availability and accessibility of backup equipment such as air compressors and boilers.

F. Installation Documentation

Submit installation reports for resin impregnation of each CIPP showing information such as resin lot numbers, volumes of resin, and catalyst used. Include a copy of the installation checklist so that each critical step in the resin impregnation process is checked off and initialed. Submit curing log of CIPP temperature and pressure at each lateral during the curing process to document that proper temperatures and cure times have been achieved. Installation documentation shall be submitted weekly.

G. Inspection Documentation

Inspection documentation shall conform to Section 811.

H. Project Experience

Resume of similar projects completed in the last 5 years for both one piece main and Lateral Lining and for Standard Lateral Lining. The following detailed information shall be included for each project included in the resume:

1. Location of project,

2. Name, phone and email for contact person from client for project,
3. Total length of liner installed,
4. Type of liner used during installation,
5. Number of installations of T-Liners and Standard Liners separately,
6. Number of years of experience installing liners for everyone that will be part of this project and their roles in the projects listed on resume

1.4 QUALITY CONTROL

A. Though the process may be licensed, no change of material, design values, or procedures may be made during the course of the Work without the prior written approval of the Owner. All liner to be installed under this Work may be inspected at the point of manufacture for compliance with this Section by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of plant inspection will be the responsibility of the Owner.

B. At the time of manufacture, inspect each lot of liner for defects. At the time of delivery, the liner shall be homogeneous throughout, uniform in color, free of cracks, holes, foreign materials, blisters, or deleterious faults.

C. The Contractor shall have a Quality Control Plan or Procedure in place that will allow the Owner to monitor the resin impregnation process.

1.5 WARRANTY

All lining Work shall be fully guaranteed by the Contractor for a period of 3 years from the date of Final Completion unless otherwise stipulated in writing by Owner. During this period, all defects discovered by the Owner shall be removed and replaced by the Contractor in a satisfactory manner at no cost to the Owner. The Owner may conduct independent television inspections, at its own expense, of the lining Work at any time prior to the completion of the warranty period.

1.6 DELIVERY, STORAGE, AND HANDLING

Care shall be taken in shipping, handling and storage to avoid damaging the liner. Adequately support and protect the CIPP while stored. Store CIPP in a manner as recommended by the manufacturer and as approved by the Owner. Extra care shall be taken during cold weather construction. Replace any liner damaged in shipment as directed by the Owner.

II. EXECUTION

2.1 EXISTING LATERAL INSPECTION AND PIPE PREPARATION

A. Clean laterals and mainline sewer prior to lining, such that the pipes are free of roots, grease, sand, rocks, sludge and other debris. It shall be the responsibility of the Contractor to clear the mainline of obstructions such as solids, roots, or broken pipe that will prevent the insertion of the liner.

B. As required, provide for continuous sewage flow in the sewer main during all inspection Work. The pump and bypass lines shall be of adequate capacity and size to handle the flow of the sewers and to allow CCTV observation of mainline packer throughout liner installation. The proposed bypassing system shall be reviewed in advance by the Owner. The review of the

bypassing system by the Owner shall in no way relieve the Contractor of his responsibility and/or public liability for any spills or overflows.

C. Inspect and confirm the inside diameter, alignment, length, and condition of each lateral to be lined. Field measure lateral diameters, including transitions in lateral diameters, and identify exact locations of fittings and bends. All dimensions shall be field verified by the Contractor prior to delivery of the liner. If unknown physical conditions in the Work area that differ materially from those ordinarily encountered are uncovered during the investigation, the Contractor shall not perform any additional Work on the lateral and shall immediately notify the Owner. If the existing lateral between the main line sewer and the cleanout location is found to be damaged through no act of the Contractor, contains an obstruction that cannot be removed by the conventional cleaning equipment, submit inspection documentation to the Owner and proceed to the next lateral liner installation.

D. For laterals found to have any actively leaking defects through the annular space at the reinstated lateral cutout in the sewer main cured-in-place pipe liner that would be categorized as "Runners" or "Gushers" by the *LACP/PACP Defect Rating Codes*, packer injection grout the connection and the first six-feet of the lateral pipe. For laterals found to have actively leaking defects in the lateral itself that would be categorized as Runners or Gushers by the *LACP/PACP Defect Rating Codes*, utilize lateral push packers to grout the lateral. Render the pipe free of Runners or Gushers and remove any excess grout prior to installing the CIPP. Contractor may, at no additional cost to the Owner, elect to stop any other leaks that would impact the integrity of the rehabilitation process.

E. Inspect lateral immediately prior to CIPP lining to demonstrate that the lateral is clean and free of roots, grease, sand, rocks, sludge, infiltration, or structural impediments that would affect the installation or long-term viability of the lateral liner. Perform Pre-Construction Inspection of laterals to be lined in accordance with Section 811 and submit to the Owner for approval prior to any CIPP lining activities.

2.2 BYPASS PUMPING

The Contractor shall monitor and maintain flows upstream of the installation to ensure that there is no flooding or damage to public or private property being served by the sewers involved. Contractor shall provide sewer bypass pumping, where necessary, in accordance with Section 812. All Work shall be conducted in a manner to not cause overflows. If necessary the Contractor shall install a cleanout upstream of the activities requiring the flow control at no additional cost to the Owner.

2.3 CIPP LATERAL LINING INSTALLATION PROCEDURES

A. Saturate tube with the resin in accordance with manufacturer's instructions. Complete a wet-out process control sheet for every lining completed. The control sheets shall provide, at a minimum, the following information:

1. Liner manufacturer
2. Liner diameter
3. Number of layers
4. Resin amount
5. Resin type
6. Resin manufacturer
7. Batch number

8. Hardener name
9. Batch number
10. Mixing ratios
11. Vacuum pressure of impregnation process
12. Wet-out start time and date.

B. For CIPP installed from the mainline, provide flow control in the sewer main sufficient to allow CCTV observation of mainline packer throughout liner installation.

C. Completely protect the resin-saturated lateral tube during positioning and installation. Insert lateral liner into lateral in accordance with manufacturer's instructions. The liner/bladder assembly shall include a means of controlling the speed of inversion and a means of ensuring that positive pressure is not created in the service lateral pipe.

D. The mainline tube shall include a seamless, molded, flange-shaped gasket attached to the main liner tube at the connection or four molded hydrophilic seal at the mainline termination ends. The gasket(s) must be a minimum of 2.5mm thick and must retain this consistent thickness under installation pressures. The lateral tube shall include a hydrophilic seal attached six-inches from the terminating end of the lateral tube.

E. After insertion is complete, apply a suitable recirculation system capable of delivering air, steam, or water, as required by the liner system manufacturer, uniformly throughout the section to achieve a consistent cure of the resin. Maintain the curing temperature as recommended by the liner system manufacturer. Prevent excessive temperatures that could scald or bubble the liner.

1. Water for Inversion Process

   If water is used to accomplish the inversion process, the Contractor shall complete an installation process control sheet for every lining completed. The control sheets shall provide the following information:

   a. Liner length
   b. Hydrostatic head at point of inversion
   c. Hydrostatic head at termination point
   d. Time when inversion process starts
   e. Time when curing begins and ends

2. Steam for Inversion Process

   The heating equipment shall be capable of delivering a mixture of steam and air throughout the liner bladder assembly to uniformly raise the liner temperature above the temperature required to cure the resin. The curing of the CIPP shall take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of the soil). The heat source temperatures shall be monitored and logged during the cure and cool down cycles. The manufacturer's recommended cure schedule shall be submitted and followed.

3. Air for Inversion Process

   If air is used in the inversion process, liner manufacturer shall provide the minimum

pressure required to hold the tube tight against host pipe and maximum pressure allowable to not damage the tube. Once the inversion has started, the pressure shall be maintained between the recommended pressure ranges until the inversion has been completed. Should the pressure deviate from within this range, the installed liner shall be removed. The Contractor shall complete an installation process control sheet for every lining completed. The control sheets shall provide the following information:

a. Liner length
b. Minimum pressure
c. Maximum pressure
d. Time and pressure when inversion process started and every ten minutes until inversion process completes
e. Time when curing begins and ends

F. After the curing process is complete, remove all installation and curing equipment from the host pipe. No material other than the cured CIPP shall remain in the host pipe. Remove any excess liner material protruding into sewer main or manhole by remote robotic cutting equipment or manual means, in accordance with manufacturer's instructions. Provide a finished CIPP that is continuous and free as commercially practicable of visual defects such as foreign inclusions, dry spots, pinholes, delamination, and wrinkles in any location in excess of 10% of the host pipe inside diameter.

2.4 POST-CONSTRUCTION INSPECTION OF COMPLETED WORK

Conduct Post-Construction Televised Inspection in accordance with Section 811.

2.5 FINAL ACCEPTENCE

A. All CIPP shall be continuous in length and wall thickness shall be uniform. Installed thickness of the CIPP lateral liner shall be within minus 10 percent and plus 15 percent of the design. The Contractor shall take into account any necessary allowance for longitudinal and circumferential expansion when sizing and installing the liner. The Contact tolerance is 1.0 mm. Where any space or gap between the outside surface of the liner and the inside surface of the existing pipe exceeds 1.0 mm, the liner fit will be deemed deficient and corrective action will be required. Where irregularities of the existing pipe exists such as offset joints, protrusions, bumps, and deformations, and the irregularities remain after the sewer has been prepared in accordance with the Contract Documents, exception to the Contact tolerance may be allowed in the irregularity zone. The exception shall not present an obstruction to sewage flow.

B. Acceptance of the CIPP lateral liner will be based on the Owner's evaluation of the resin impregnation quality control reports, CIPP temperature curing logs, and Post-construction Inspection video, which shall demonstrate:

1. Observed infiltration of the liner is zero.
2. All active service connections are open, clear and watertight.
3. There is no evidence of excessive wrinkles, cracks, lifts, scalds, blisters, or delamination in the CIPP.

C. If any defective CIPP is discovered after it has been installed, it shall be removed and replaced with either a sound liner or a new lateral at no additional cost to Owner. Any significant defects which, in the judgment of the Owner, will affect the integrity or strength of the liner, shall be

repaired or the liner replaced at the Contractor's expense. Significant defects shall be defined as any defect that may create a maintenance issue in the future such as inhibiting CCTV cameras or allowing solids to get caught on the defect; and, also any defect that appears to reduce the long-term structural strength or stability of the pipeline. Obtain approval of the Owner for method of repair, which may require field or workshop demonstration.

2.6 CLEAN UP

Excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor at no cost to Owner.

III. MEASUREMENT FOR PAYMENT

A. Measurement for payment for a one piece main and lateral liner will be per each based on mainline and lateral diameters and liner thickness up to the first three (3) feet into the lateral and then an additional cost per linear foot for the remaining lateral linear footage over the initial three (3) feet.

B. Measurement for payment for a standard lateral liner will be per linear foot of the actual distance measured along the centerline of the pipe from the beginning of the liner to end of the liner and will be based on the CIPP thickness and pipe diameter.

The cost per each for the standard lateral liner up to three (3) linear feet, the additional cost per linear foot for the remaining lateral linear footage over the initial three (3) feet and the cost for the standard lateral liner shall include all:

1. Clearing and grubbing,
2. Cost of potable water from the Owner or potable water utility/company,
3. Dewatering,
4. Documentations and certifications,
5. Erosion and sediment control,
6. Excavation pits,
7. Infiltration control,
8. Ingress and egress procedures,
9. Labor,
10. Mainline bypass pumping (up to 2 mgd) and flow control/bypass to maintain service for individual affected customers during lateral lining,
11. Materials,
12. Permits,
13. Pipeline cleaning, including debris and sediment collection and disposal,
14. Pre-, post-, and warranty television inspections,
15. Re-instatement of service connections,
16. Removal and replacement of manhole frames and covers as necessary,
17. Resident notification,
18. Sealing at manholes,
19. Site cleanup,
20. Site restoration,
21. Temporary service to affected properties,
22. Testing, and
23. Traffic control.

C. Measurement for payment for cleanout installation necessary for installation of CIPP liner or to monitor and maintain sewer flow during the installation will be per each.

D. Measurement for payment for removal and replacement of manhole frames and covers as necessary, will be per each.

E. Measurement for payment for removal of intruding service connections (ferrous or nonferrous) shall be based on the actual number of removed intruding connections. Connections shall be classified as either ferrous or non-ferrous, as separate Bid items. The price shall include all labor, incidentals, and materials to complete the Work. No payment shall be made for any incidentals that are required to complete the Work.

End of Section