

SECTION 027414
CULVERT REHABILITATION FLEXIBLE LINING PROCESS

1. SCOPE

This specification shall govern all work necessary to rehabilitate gravity storm sewer lines using a flexible liner process. Lining and method of installation shall be similar or equivalent to the Insituform[®] or Inliner Lining Process where a flexible tube saturated with thermosetting resins is inserted into the line using water pressure.

2. MATERIALS

The lining material shall be a polyester fiberfelt tubing, lined on one side with polyurethane and fully impregnated with a liquid thermal setting resin. The resin shall bond to concrete. The tubing shall be properly sized for the diameter and length of sewer pipe to be lined. The proposed lining material thickness shall be as follows:

<u>Existing Sewer Line I.D. (Inches)</u>	<u>Minimum Liner Thickness (Inches)</u>
24"	.50"

The liner material shall conform to the structural standards listed below:

Tensile Strength at yield 73%	ASTM D-638 3000 psi
Flexural Strength	ASTM D-790 3000 psi
Modulus of Elasticity	ASTM D-638 300,000 psi
Flexural Modulus	ASTM D-790 300,000 psi
Impact Strength	ASTM D-256 2.5 FT-lb/In
Shear Strength	ASTM D-732 7400 psi

Prior to the use of the lining material, the contractor shall submit, for approval, satisfactory certification from an approved testing laboratory, that the material meets or exceeds the above criteria.

After placement, test for modulus of elasticity shall be conducted by an Independent Laboratory. Two field liner specimens shall be required.

In addition, satisfactory evidence shall be provided that the liner materials will withstand the corrosive effects of effluent, liquids and gases normally found in a municipal storm sewer system.

3. CONSTRUCTION METHODS

- A. **Cleaning:** All lines to be rehabilitated shall be clean and dry during the installation of the liner. The contractor shall select the method of cleaning. It is anticipated that a high velocity jet nozzle sewer cleaner will be used. However, the contractor shall utilize such other equipment as necessary to clean the line. The contractor shall take such precautions as necessary to protect the line from further damage during the cleaning process and shall be responsible for repairing any such damages. All materials resulting from the cleaning operations shall be removed at the downstream manhole of the section being cleaned. Disposal of this material shall be as provided in the Special Provisions.

- B. Inspection: Upon completion of the cleaning operation and prior to insertion of the liner material, an inspection shall be performed. The interior of the main shall be carefully inspected to determine the location and extent of any condition which may prevent proper installation of lining materials or bonding of materials to the pipeline shall be noted so that these conditions can be corrected.
- C. Repairs: Any obstacles or conditions detrimental to liner installation shall be corrected by making an excavation at that point and effecting the necessary repairs. The method and extent of the repairs shall be approved by the Engineer.
- D. Maintain Flows: Storm water flows, that may intermittently occur, shall not be restricted during project.
- E. Liner Installation: Rehabilitation of the sewer pipe shall be accomplished by the installation of flexible liner by an inversion process wherein the flexible tube is saturated with resin turned inside out and forced in the existing line using water pressure. The contractor shall begin this phase of the work until there are sufficient materials on hand to complete the job.

The fiberfelt tube shall be vacuum impregnated with sufficient resin and catalyst system to achieve the liner thickness specified. Once impregnated, the tube shall be inserted through an existing manhole by means of an inversion process and the application of a hydrostatic head sufficient to fully extend it to the next designated access point. The hydrostatic head shall be sufficient to hold the liner tight to the existing pipe wall, produce ☐dimples☐ at side connections and flared ends at the entrance and exit access points.

After inversion is completed the contractor shall supply a suitable heat source and water recirculation equipment. The equipment shall be capable of delivering hot water to the far end of the pipe section through a hose, which has been perforated per manufacturer ☐s recommend raise the water temperature in the line section above the temperature to effect a cure of the resin.

The heat source shall be fitted with suitable monitor to gauge the temperature of the incoming and outgoing heat exchange circulating water. Thermocouple shall be placed between the impregnated tube and the invert at the far access point to determine the temperature and time of exotherm. Water temperature in the pipeline during the cure period shall not be less than 150 F as measured at the heat exchanger return line.

Initial cure shall be deemed to be completed when inspection of the exposed portions of the liner appear to be hard and sound and the thermocouple indicate that an exotherm has occurred. The cure period shall be of a duration recommend by the resin manufacturer modified for the lining process during which time the recirculation of the water and cycling of the heat exchanger to maintain the temperature continuously.

The contractor shall cool the finished liner to a temperature below 100 F before relieving the static head in the inversion stand pipe. Cool-down may be accomplished by the introduction of cool water into the inversion stand pipe to replace water being drained from the downstream

end. Care shall be taken in the release of the static head such that a vacuum will not be developed that could damage the newly installed liner.

- F. Branch of Service Connections: After liner has been cured, the contractor shall reconnect the existing active branch lines as designed by the Engineer. This shall generally be done without excavation and in the case of non-man entry pipes from the interior of the pipeline by means of a television camera and a cutting device that re-establishes them to not less than 90 percent capacity.
- G. Inspection of Completed Work: A final inspection will be required upon completion of rehabilitation operations. It is the intent of the plans and specifications that the entire length of the completed rehabilitation be inspected.
- H. Clean Up: After all installation work has been completed the contractor shall clean the area around the work site and return the ground cover to a like or better condition as existed prior to construction. All pavement disturbed shall be repaired as specified elsewhere in these specifications.

4. MEASUREMENT AND PAYMENT

Unless specified otherwise in the Proposal, Sanitary Sewer Rehabilitation - Flexible Lining Process shall be measured and paid by the linear foot for each size installed, complete in place.