Section 2549. Pipe and Manhole Rehabilitation

2549.01 DESCRIPTION.

This section was developed in conjunction with Sections 4050 and 6020 of the SUDAS Standard Specifications, with modifications to suit the needs of the Department.

A. Pipe Lining:

1. Resin impregnated, cured-in-place.

2. Deformed/reformed polyethylene.

3. Folded/formed polyvinyl chloride.

4. Sliplining.

B. Pipe spot repairs.

C. Rehabilitate existing manholes to waterproof and to prevent inflow and infiltration, to prevent corrosion, or to reestablish the structural integrity of the manhole. Includes construction of structural liners, protective liners, and ~~chimney seals~~ infiltration barriers.

2549.02 MATERIALS.

A. Pipe Rehabilitation.

1. Apply Article 4147.01.

2. The Engineer may allow substitutions. Provide as a minimum the following information for evaluation:

- **a. Product Information.**
  - **1)** Product name.
  - **2)** Year product first available in the United States.
  - **3)** Total footage or number of line segments installed in the United States.
  - **4)** Results of all available product testing, including but not limited to leakage, physical properties, pipe stiffness, chemical resistance, strain-corrosion, external loading, flow characteristics, infiltration/inflow reductions, structural capacity, and external hydrostatic loading capacity.
  - **5)** Samples of before and after product.
  - **6)** Design method.
  - **7)** Typical lining thickness for pipe sizes included in the project.
- **b. Manufacturer Information.**
  - **1)** Manufacturer name.
  - **2)** Years of experience manufacturing the product.
  - **3)** Country of manufacture of all product components.
  - **4)** Quality control procedures for product manufacture, including inspection requirements, testing procedures, and allowable tolerance levels.

5) Related ASTM standards, or other nationally recognized standards for product manufacturing.

c. Installer Information.

1) Installer name.
2) Completed project list for last five years including for each project and year completed, client name/address/contact person/phone number, footages installed by pipe diameter, and number of lateral reinstatements.
3) Detailed installation procedures, including estimated times for each task, lateral reinstatement methods, number of required excavations, and other items unique to each product.
4) Video of installation process, if available.
5) Evidence of properly trained personnel.
6) Related ASTM standards or any nationally recognized standards for product installation.
7) Available equipment list.
8) Detailed procedures for repairing the product in the event of future damage or failure and for tapping future service connections, including required specialized equipment or training.
9) Videos of two rehabilitated sewer sections showing before and after conditions.
10) Additional information may be required. The submittal of prequalification information in no way implies that the product, manufacturer, or installer will be deemed to be qualified. The Contracting Authority, in its sole discretion, will determine whether a product, manufacturer, or installer does or does not qualify as an approved equal.

B. Manhole Rehabilitation.
Apply Article 4147.02

2549.03 CONSTRUCTION.

A. Pipe Rehabilitation.

1. Public Relations Program.
Establish a Public Information and Notification Program for contacting each home or business connected to the affected sanitary sewer, informing them of the work to be done and when the sewer will be off line. The following specific steps are part of the Public Information and Notification Program:

a. Provide written notice to be delivered to each affected home or business describing work, schedule, how the work affects them, and a local telephone number of the Contractor they can call to discuss the project or their problems.

b. Personally contact each home or business on the day lateral verifications using closed circuit video inspection are to be performed. The homeowner or business will be asked to run water down their drain to verify each lateral. If the homeowner is unavailable, attempt other arrangements (cleanouts) to drain water through the lateral to verify each connection.

c. Provide written notice and personally contact the home or business the day prior to beginning inversion of the section of sewer to which they are connected.
d. Personally contact all homes or businesses that can not be reconnected within the time stated in the written notice.
e. Furnish and service portable toilets for use by the home or business occupants if so required by any affected served business or homeowner.

2. Special Requirements.
a. Prior to start of work, notify all affected parties 24 hours in advance as to the length of time their service will be blocked.
b. Notify the Engineer's Water Works Department to use meter and pay for water, if required.
c. Unless specified otherwise, the Contracting Authority will provide water for installation of cured-in-place pipe from a nearby hydrant through a separate valve mounted on the hydrant.

3. Examination.
a. Cleaning.
1) Clean and remove soil, grit, debris, and obstructions prior to video inspection or insertion of lining pipe, or both.
2) Do not flush debris to downstream sections.
3) Deposit removed material at an approved site.
b. Video Inspection.
1) Furnish the Engineer with a recording of sewers: 1) before the lining process and while the flow is being bypassed; and 2) after lining process and service reconnections have been completed.
2) Provide an on screen numerical display of camera location, indexed from the starting manhole, in feet (meters).
c. Service and Obstruction Location.
1) Coordinate and cooperate with the Engineer for service and obstruction location.
2) Locate the active sewer services by one of following:
a) Use video inspection to observe service locations, breaks, obstructions, and structural failures.
b) Insert a sounding device through the service, noting its location on the ground surface.
c) Dye testing.

4. Bypassing Sewage.
a. Submit a bypassing plan to the Engineer for review.
b. Plug the line at a point upstream of pipe to be rehabilitated if bypassing is required.
c. Pump flow to a downstream point or adjacent system as directed by the Engineer.
1) Provide pump and bypass lines of adequate capacity to handle all flows.
2) Provide adequate reserve pumps on site for emergency use and for storm flows.

5. **Obstructions.**
   - **a.** Remove all obstructions.
   - **b.** If an obstruction is encountered that cannot be removed by equipment operating within the pipe, excavate and remove the obstruction upon approval of the Engineer.
   - **c.** Place backfill material, compact, and restore the surface according to the contract documents.

6. **Temporary Sewer Service.**
   If full normal sewer service is not re-established within the times stated, provide temporary facilities or hotel accommodations for affected residents and businesses.

7. **Sliplining.**
   - **a. Excavation.**
     - **1)** For sliplining insertions, excavate at or near one structure and work from the existing manhole at the other end of the section to be pulled.
     - **2) Insertion Pit.**
       - **a)** For sliplining with segmented pipe (one pipe section at a time), construct the insertion pit as required to accommodate the length of individual pipe sections.
       - **b)** For sliplining with pipe that is to be welded together above ground and pulled into sewer, dig a pit length 12 times the inside pipe diameter and slope the pit end back to the ground surface at 2.5 (horizontal) to 1.0 (vertical).
   - **b. Test Head.**
     - **1)** Pull the pulling head with one short section of slipling pipe through the sewer before inserting the liner to test for taps or obstructions protruding too far into the sewer.
     - **2)** Attach cables to both ends of the test head to allow for removal if an obstruction is encountered.
   - **c. Installation.**
     Push segmented pipe into the host pipe according to the manufacturer's recommendations, or pull in a continuously welded pipe according to ASTM F 585.
   - **d. Service Reconnection.**
     - **1)** Allow the sliplining pipe to recover according to the manufacturer's recommendations.
     - **2)** Do not leave the sanitary service unconnected for more than 24 hours.
     - **3)** Complete reconnections involving excavation of service lines according to the local plumbing codes.
     - **4)** Reconnect excavated service connections according to the local plumbing code, except that the annular space between the host pipe and the sliplining pipe is to be filled with grout.
   - **e. Grouting.**
     - **1)** Before trimming the ends of the pipe and sealing, allow for the pipe to recover its original length according to the manufacturer's recommendations. Recovery time is at least equal to the time required to pull the pipe into place.

2) Fill the space between the sliplining pipe and the host pipe with CLSM complying with Article 2552.02, E, 3, or other material approved by the Engineer. Pump filler in from the lower end of the sliplining pipe.

8. **Resin Impregnated Cured-In-Place Pipe Lining.**
   a. Install according to the manufacturer's recommendations for this lining process and ASTM F 1216 unless noted otherwise.
   b. Use a resin impregnated tube, hydraulically inverted in place with an approved lubricant, and cured in place according to ASTM F 1216, Section 7.
   c. Make the tube continuous between manholes. The tube may span several manhole reaches as allowed by the equipment, properties of the CIPP, and the size and condition of the sewer.
   d. Ensure the tube is free of uncured spots, lifts (spots cured away from the sewer), and delaminations. Remove and replace deficient sections.
   e. **Service Reconnections.**
      1) Do not leave sanitary service unconnected for more than 24 hours.
      2) Complete reconnections involving excavation of service lines according to the local plumbing code.

9. **Deformed/Reformed High Density Polyethylene Pipe or Folded/Formed Polyvinyl Chloride Pipe Lining Installation.**
   Install according to the manufacturer's recommendations for particular lining material and process, unless specified otherwise.
   a. **Lining Installation.**
      1) Designate location where insertion is to begin, subject to the Engineer's approval.
      2) Transport lining to the site in one continuous length on spools compatible with manufacturer's designated process.
      3) Heat lining material at the job site as necessary for insertion. Pull lining into the sewer with appropriate pulling heads, cables, and heat distribution equipment.
      4) Ensure lining is continuous between manholes as allowed by the tensile properties of lining and the size and condition of the sewer.
      5) Connect fully inserted lining to the heat source distribution equipment.
      6) Round and expand by uniformly distributed heat, steam, and pressure and by mechanical devices.
      7) After lining has been expanded to a tight fit, cool gradually under pressure until the process is complete.
      8) Provide a continuous pipe lining, without joints, over the entire length of pipe.
      9) Ensure the lining is free of all material defects, pits, pinholes, cracks, crazing, folds, or unrounded sections.
      10) Repair all defects at no additional cost to the Contracting Authority.

b. Service Reconnections.

1) Do not leave sanitary service unconnected for more than 24 hours.

2) Complete reconnections involving excavation of service lines according to the local plumbing code.

10. Spot Repairs by Pipe Replacement.

a. Excavate trench according to Section 2552.

b. Remove existing pipe to the extent required and disconnect affected sewer services.

c. Install replacement pipe of the same nominal size as the existing pipe.

1) Use the same materials as specified in the contract documents that comply with Section 2504.

2) Place bedding material according to Section 2552.

d. Install pipe repair coupling.

1) Cut pipes to length require allowing no more than a 1/2 inch (13 mm) gap between butted pipe ends at coupling location. Cut pipes perpendicular to centerline.

2) Clean the outside surface of the existing and replacement pipes as required to provide a positive seal with the pipe repair coupling.

3) Wrap coupling around pipes, centered on butt joint, and tighten bolts according to manufacturer's recommendations.

e. Reconnect sewer services.

f. Place backfill material in trench according to Section 2552.

11. Cleanup and Closeout.

a. Verify that the services are reconnected and fully operable, with at least 90% of original capacity.

b. Submit initial and final video tapes, CDs, or DVDs to the Engineer.

c. Remove all equipment and debris.

B. Manhole Rehabilitation.

1. Submittals.

a. Concrete mix design, if required by the Engineer.

b. Catalog cuts of all mortar mixes, sealants, and liners.

2. ~~Rubber Chimney Seal~~ Infiltration Barrier.

Apply Article 2435.03, A.

3. Urethane Chimney Seal.

a. Prepare the surface according to the manufacturer's recommendations, including sandblasting, pressure washing, sealing leaks or gaps, and drying the surface.

b. Apply primer, prepare product, and brush-apply the seal to a minimum thickness of 175 mils (4.5 mm), covering 2 inches (50 mm) above the bottom of the frame and the entire adjustment ring area to 3 inches (75 mm) below the bottom adjustment ring.

4. **In-Situ Manhole Replacement, Cast-in-place Concrete.**
   a. **Preparation.**
      Prepare according to the forming system manufacturer's recommendations, including the following:
      1) Clean the existing surface to remove loose material and debris.
      2) Remove existing steps that might interfere with the erection of the forms.
      3) Control infiltration that may affect placement of concrete.
   b. **Installation.**
      Install and test according to the forming system manufacturer's recommendations, including the following:
      1) Place pipe extensions through the structure to maintain flow during installation.
      2) Erect forms inside the manhole. Secure the assembled internal forms to prevent shifting and to provide sufficient stiffness and strength to prevent collapse.
      3) Install a plastic liner when specified.
      4) Seal the forms at the bottom of the manhole to ensure the concrete does not enter the sewer.
      5) Carefully place concrete between the forms and the existing manhole walls. Place concrete from the bottom up to prevent segregation of concrete.
      6) Consolidate concrete as required to fill all pockets, seams, and cracks within the existing manhole wall.
      7) Remove the forms when the concrete has cured sufficiently.
      8) Weld and test joints if a plastic liner is installed.
      9) Apply a sealing strip around the circumference of the invert top where it meets the vertical wall and around all pipe penetrations to form a waterstop.
      10) Overlay the invert top with concrete or high-strength mortar. Vary thickness from 3 inches (75 mm) at the wall to 1/2 inch (13 mm) at the edge of the channel.
      11) Apply an epoxy lining to the invert top. Apply clean sand to the epoxy to create a non-slip surface.
      12) Seal the plastic liner to the manhole casting and existing pipe stubs as recommended by the manufacturer.
      13) Install a new casting.

5. **Centrifugally Cast Cementitious Mortar Liner with Epoxy Seal.**
   a. **Surface Preparation.**
      Prepare according to the manufacturer’s recommendations, including the following:
      1) Wash the interior with a high pressure washer.
      2) Plug active leaks with the appropriate sealing material.
   b. **Mortar Application.**
      Apply according to the manufacturer’s recommendations, including the following:
      1) Apply with a rotating centrifugal casting applicator, beginning at the bottom of the manhole.
      2) Retrieve the applicator head at the manufacturer's recommended speed to achieve the desired thickness.

3) Apply to the full required thickness utilizing multiple passes as necessary. Minimize the time between passes so subsequent passes are cast against fresh mortar.
4) Verify thickness with a wet gage at several locations to ensure proper depth.
5) Hand-apply high-strength mortar to the invert surface. Vary thickness from 3 inches (75 mm) at the wall to 1/2 inch (13 mm) at the edge of the channel.

c. Epoxy Seal Application.
Seal according to the manufacturer's recommendations, including the following:
1) Apply with a rotating centrifugal casting applicator or airless sprayer onto the fresh mortar liner.
2) If the epoxy seal is applied more than 24 hours after application of the mortar liner, or if the mortar liner is contaminated, clean the liner and then apply the epoxy.

d. Finishing.
Install a new casting.

2549.04 METHOD OF MEASUREMENT.

A. Pipe Lining.
Measurement for each type and size of pipe lining will be in linear feet (meters) along the centerline of the pipe lining from center of manhole to center of manhole.

B. Building Sanitary Sewer Service Reconnection.
Each active existing building sanitary sewer service reconnected to the pipe lining, including the services reconnected by excavating and reconnecting services or by trenchless reconnection methods, will be counted.

C. Spot Repairs by Pipe Replacement.
Both of the following methods will be specified for measurement of spot repairs by pipe replacement:

1. Spot Repairs by Count.
Each spot repair location will be counted.

2. Spot Repairs by Linear Foot (Meter).
Measurement will be in linear feet (meters) along the centerline of the replacement pipe.

D. ~~Rubber Chimney Seal~~ Infiltration Barrier.
Each rubber chimney seal installed on an existing manhole will be counted.

E. Urethane Chimney Seal.
Each urethane chimney seal installed on an existing manhole will be counted.

F. In-Situ Manhole Replacement, Cast-in-place Concrete.
Measurement of the vertical dimension of in-situ manhole replacement will be in feet (meters) from the lowest flowline to the top of the rim.

G. In-Situ Manhole Replacement, Cast-in-place Concrete with Plastic Liner.
Measurement of the vertical dimension of in-situ manhole replacement with plastic liner will be in feet (meters) from the lowest flowline to the top of the rim.

H. Manhole Lining with Centrifugally Cast Cementitious Mortar Liner with Epoxy Seal.
Measurement for depth of the vertical dimension of manhole lining will be in feet (meters) from the bottom of the lining to the top of the lining for each liner thickness specified.

2549.05 BASIS OF PAYMENT.

A. Pipe Lining.

1. Payment will be made at the contract unit price per linear foot (meter) for each type and size of pipe lining.

2. Payment is full compensation for pipe lining removal of internal obstructions, pipe cleaning, inspection, and all costs associated with the public information and notification program.

B. Building Sanitary Sewer Service Reconnection.

1. Payment will be made at the contract unit price for each reconnection.

2. Payment is full compensation for building sanitary sewer service reconnection.

C. Spot Repairs by Pipe Replacement.
Both of the following methods will be specified for payment of spot repairs by pipe replacement:

1. Spot Repairs by Count.
- **a.** Payment will be made at the contract unit price for each spot repair.
- **b.** Payment is full compensation for uncovering and removing existing pipe, placing backfill material for replacement pipe, and restoring the surface.

2. Spot Repairs by Linear Foot (Meter).
- **a.** Payment will be made at the contract unit price per linear foot (meter) of spot repair.
- **b.** Payment is full compensation for furnishing and installing replacement pipe and connections.

D. ~~Rubber Chimney Seal~~ Infiltration Barrier.

1. Payment will be made at the contract unit price for each chimney seal.

2. Payment is full compensation for all necessary compression or expansion bands and extension sleeves as necessary to complete chimney seal.

E. Urethane Chimney Seal.
Payment will be at the contract unit price for each urethane chimney seal.

F. In-Situ Manhole Replacement, Cast-in-place Concrete.

1. Payment will be at the contract unit price per vertical foot (meter).

2. Payment is full compensation for handling of sewer flows as required to properly complete the installation, invert overlay as recommended by the manufacturer, replacement of existing casting with a new casting, and testing the manhole upon completion.

G. In-Situ Manhole Replacement, Cast-in-place Concrete with Plastic Liner.

1. Payment will be at the contract unit price per vertical foot (meter).

2. Payment is full compensation for handling of sewer flows as required to properly complete the installation, invert overlay as recommended by the manufacturer, replacement of existing casting with a new casting, sealing at the frame and cover, sealing pipe penetrations as recommended by the manufacturer, and testing the manhole upon completion.

H. Manhole Lining with Centrifugally Cast Cementitious Mortar Liner with Epoxy Seal.

1. Payment will be at the contract unit price per vertical foot (meter) for each liner thickness properly installed.

2. Payment is full compensation for the handling of sewer flows during lining operations as required to properly complete the installation, and replacement of the existing casting with a new casting.