SECTION 822

MANHOLE REHABILITATION

I. GENERAL

1.1 DESCRIPTION OF WORK

A. These specifications include requirements to provide a system for manhole rehabilitation that includes lining the manhole interiors, internal sealing of the frame-chimney joint area, and reconstructing manhole benches and channels. It is the Contractor's responsibility to stop all active leaks in association with the lining of the manhole interiors.

B. This Work shall include the furnishing of all materials, equipment, tools, and labor as required for the rehabilitation of the manholes.

C. Rehabilitation products shall be applied to the manhole from the cover seat to and including the benches. The rehabilitation system must provide a non-prorated warranty as herein described in manholes to stop infiltration, prohibit root intrusion, protect the existing structure from further deterioration, and provide a surface coating resistant to sewer gases and chemicals.

D. 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 pipe rehabilitation, to the satisfaction of the Owner.

E. Products shall conform to Section 200 or applicable Special Provisions.

1.2 SUBMITTALS

Submittals shall be made by the Contractor in accordance with the procedures set forth in Section 105 - Control of Work, and as described below.

A. After notification of award, the Contractor shall provide the following information for review and approval. These items may be submitted prior to the notice to proceed for review and approval. Once the notice to proceed is issued, working days will start being counted, regardless of the submittal status. The project shall not be initiated until all of the listed information has been reviewed and approved by the Owner.

1. A comprehensive construction sequencing plan. At minimum the plan shall include the following.

a. A proposed schedule.
b. Identification of all proposed access routes.
c. Identification of set-up locations for lining installation.
d. Lining procedures.
e. Bypass Pumping Plan in accordance with Section 812 – Bypass Pumping.

f. Traffic Control Plan in accordance with the locality or VDOT requirements, as appropriate.

2. Letter identifying the crew members performing the Work. If any of the crew members are not identified on the original certification letter received during the pre-qualification process, then a new certification letter listing the crew member(s) must be received from the rehabilitation system supplier prior to initiation of the specific project.

3. Calculations (or letter from the manufacturer) supporting recommended liner thicknesses or wall coverage thicknesses.

B. Prior to initiation of a specific project, the Contractor shall submit the following information for review and approval.

1. Shop drawings and product data for the manhole rehabilitation method including a report outlining the process to be used in the rehabilitation of the sewer manholes. The report shall also include information specific to the job, such as coordination issues, access, timing, manufacturer's installation instructions and bypass pumping.

2. All measurements made by the Contractor to verify manhole depths, elevations, and locations of penetrations prior to ordering of material.

C. The Contractor for the manhole rehabilitation must have a minimum of 3 years experience using the proposed product in at least 50 manholes. All contractor employees and/or subcontractors performing Work on the manhole rehabilitation must be certified by the manhole rehabilitation system supplier as qualified to perform Work with the proposed product.

II. EXECUTION

2.1 GENERAL

A. Prior to performance of the actual Work carefully inspect the entire site and locate those manholes designated to be rehabilitated.

B. Cleaning: Cleaning of sewer lines and manholes shall be performed as specified in Section 810 - Sewer Line Cleaning.

D. Bypass Pumping: When required for acceptable completion of the rehabilitation process, the Contractor shall provide for adequate flow control including but not limited to required pumping and bypassing as stipulated in Section 812 - Bypass Pumping.

E. Site conditions may preclude the Contractor from mobilizing the sealing, coating and/or lining equipment near the manhole. If the manhole is inaccessible, as determined by the Contractor and the Owner, the Contractor shall hand apply the coatings and/or liners per the manufacturer's instructions and recommendations? Hand application shall be completed at no additional cost to the Owner.

2.2 REHABILITATION PROCEDURES

A. Place cover over invert to prevent extraneous material from entering the sewer lines.

B. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 1200 psi). Loose and protruding brick, mortar, and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with quick-setting patching mix in accordance with Section 200 - Products and Materials. The surface to be repaired must be clean and free of any loose materials with walls totally saturated with water.

C. Minor leaks shall be stopped using the quick-setting specially formulated infiltration control mix and shall be mixed and applied per manufacturer's recommendations. Some leaks may require weep holes to localize the infiltration during the application, after which the weep holes shall be plugged with the quick-setting infiltration control mix prior to the final liner application. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious or chemical grout. Manufacturer's recommendations shall be followed when pressure grouting is required.

D. After all preparation Work has been completed, remove all loose material and wash wall again.

E. Any bench, invert, or service line repairs shall be made at this time using the quick-setting patching mix per manufacturer's recommendations.

F. Invert Repair:

Invert repair shall be performed on all inverts with visible damage or infiltration. After blocking flow through the manhole and thoroughly cleaning invert, the quick-setting patch mix shall be applied to the invert in an expeditious manner. The mix shall be troweled uniformly onto the damaged invert extending out onto the base of the manhole sufficiently to tie into the structural/structurally enhanced monolithic liner to be applied. The finished invert surfaces shall be smooth and free of ridges. The flow may be re-established in the manhole within 30 minutes after placement of the mix. Upon completion of the invert repair and lining, there shall be a smooth transition from the invert to all of the lined and unlined incoming and outgoing connections.

G. Watertight Seal between Pipe Liner and Manhole Liner: Where a manhole has been lined through with a pipeline liner, the Contractor shall prepare a watertight seal and smooth transition between the pipe liner and manhole liner system. No leakage or gaps will be allowed. The method of sealing and preparing a smooth transition shall be approved by the Owner

H. Cementitious Liner Installation:

Described are procedures for manhole preparation, cleaning, application and testing. The applicator, approved and trained by the manufacturer, shall furnish all labor, equipment and materials for applying a cementitious mix with machinery specially designed for the application. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications which include:

- Elimination of active infiltration prior to the application.

- Removal of loose and unsound material and cleaning surfaces in accordance with Section 810 - Sewer Line Cleaning and per manufacturer's recommendations.
- Repair and sealing of the invert and benches.
- Spray application of a cementitious mix to form a liner.

1. Liner Application:

   Prior to liner application onto walls, manhole bench area shall be covered with plywood sections, which conform to the internal dimensions of the manhole, to prevent accumulation of liner material on bench.

   No application shall be made to frozen surfaces or if freezing is expected to occur inside the manhole within 24 hours after application. If ambient temperatures are in excess of 95^{o} F, precautions shall be taken to keep the mix temperature at time of application below 90^{o} F. Mix water temperature shall not exceed 85^{o} F. Chill with ice if necessary.

2. Mixing:

   For each bag of product, use the amount of water specified by the manufacturer and mix for 30 seconds to 1 minute after all materials have been placed in the mixer, using equipment per manufacturer's recommendation.

   Empty the mixed material into the holding hopper and prepare another batch with timing such that the nozzleman can spray in a continuous manner without interruption until each application is complete.

3. Spraying:

   a. First Application: The surface prior to spraying shall be damp without noticeable free water droplets or running water, but totally saturated. Materials shall be spray applied from the bottom of the wall to the top, to a minimum uniform thickness to ensure that all cracks, crevices, and voids are filled and a relatively smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond.

   b. Second Application (as necessary per manufacturer's recommendations): A second application is to be applied after the first application has begun to take an initial set (disappearance of surface sheen which could be 15 minutes to 1 hour depending upon ambient conditions) to assure a minimum total finished thickness of ½ inch. Again application shall be from the bottom up. The surface is then troweled to a smooth finish being careful not to over trowel so as to bring additional water to the surface and weaken it. Manufacturer's recommendations shall be followed when more than 24 hours have elapsed between applications.

c. Bench Application: The plywood covers shall be removed and the bench sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than ½ inch. The wall bench intersection shall be rounded to a uniform radius equal to the full circumference of the intersection.

d. The Contractor shall take precautions to keep overspray or excess material from entering the newly installed liner pipe and any other pipes in the manhole.

4. Curing:

Caution should be taken to minimize exposure of applied product to sunlight and air movement.

If application of second coat is to be longer than 15 minutes after completion of application of first coat, the manhole cover shall be set back in place. At no time should the finished product be exposed to sunlight or air movement for longer than 15 minutes before replacing the manhole cover.

The final application shall have a minimum of 4 hours cure time before being subjected to active flow.

Traffic shall not be allowed over manholes for 6 hours after rehabilitation is complete.

5. Testing:

Four 3-inches by 6-inch test cylinders or six 2-inch cubes shall be cast each day or from every 50 bags of product used. The test specimen shall be properly labeled and sent in for testing in accordance with the manufacturer's directions for compression strength testing as described in ASTM C 495.

H. Cured-In-Place Fiberglass Insert:

The installation of the approved liner system shall be in strict accordance with the manufacturer’s written instruction. This shall include re-grouting all inlet and outlet lines and benches as needed, plus the preparation, installation, curing, and finish operation, for the completion of the rehabilitation process.

I. Epoxy Coating Installation:

The installation of the approved epoxy coating system shall be in strict accordance with the manufacturer’s written instruction. This shall include re-grouting all inlet and outlet lines and benches as needed, plus the preparation, installation, curing, and finish operation, for the completion of the rehabilitation process.

2.3 LINER AND COATING ACCEPTANCE

At the direction of the Owner, all rehabilitated manholes shall be tested as follows.

A. Visually verify the absence of leaks.

B. Perform a vacuum test in accordance with Section 802 – Sanitary Gravity Sewer Systems.

2.4 MANHOLE STEP REMOVAL

The Contractor shall remove all steps. Removal shall consist of neatly cutting steps flush with the wall prior to any lining installation. The Contractor shall be responsible for proper disposal of steps.

2.5 MANHOLE FRAME AND COVER REPLACEMENT

A. Excavation and site restoration in paved and unpaved areas shall be in accordance with Divisions 3, 5, and 6 of these *Regional Construction Standards* to a minimum of established pre-construction conditions.

B. The Contractor shall remove and dispose of the existing manhole frames and covers, as specified on the Drawings. It shall be the responsibility of the Contractor, at no additional cost to the Owner, to repair any damage to the chimney or corbel caused by the removal of the existing manhole frame.

C. New replacement frames and covers shall be as specified in Sections 200 – Products and Materials, Section 802 – Sanitary Gravity Sewer Systems, and the *Regional Construction Standards* Standard Details.

D. Repair of Manhole Chimney and Corbel, Requiring Excavation (when directed by the Owner):

1. In Paved Areas:

a. The removal of the manhole frame shall be accomplished by making a square cut of sufficient size in the pavement.

b. Material in the exposed area shall be dug out to a sufficient depth to permit the required repairs. All excess material, including pavement, shall be disposed of as surplus material in accordance with Section 303 - Earthwork.

c. Backfill materials shall be in accordance with VDOT *Road and Bridge Standards.*

d. Backfill shall be replaced and compacted to prevent settlement and to restore the setting to a condition equal to or better than that found in accordance with Section 303 - Earthwork. Backfill shall not cover the manhole.

e. The surfacing needed to cover the exposed area (concrete or asphalt) shall conform to the existing pavement. It shall be placed to the same elevation and grade and have a thickness equal to or greater than the existing pavement.

f. Replacement of pavement not satisfactorily performed by the Contractor shall be reworked at no expense to the Owner.

2. In Unpaved Areas:

a. Only necessary excavation around manhole shall be performed.

b. Backfill shall be replaced and compacted to prevent settlement and to restore the setting to a condition equal to or better than that found in accordance with Section 303 - Earthwork. Backfill shall not cover the manhole.

c. Any private property which is removed for access to the manhole shall be replaced by the Contractor to existing or better condition to the satisfaction of the property owner.

3. The Contractor shall take all necessary precautions to prevent falling debris from damaging the manhole trough and/or entering the sewer. The damaged or deteriorated portions of the existing manhole chimney and corbel shall be removed and property disposed of by the Contractor.

4. The chimney and corbel shall be repaired or rebuilt with new brick or precast concrete grade rings as appropriate to reconstruct the chimney to the height needed for the frame and cover to meet the required grade. The manhole frame shall be sealed using either a manufactured or applied sealing method.

2.6 MANHOLE FRAME SEALING

The manhole frame and the chimney above the cone shall be sealed in accordance with the manufacturer's recommendations. Refer to the Contract Documents details for additional requirements.

2.7 FINAL ACCEPTANCE

After the various types of rehabilitation work have been completed, the Work shall be visually inspected for compliance and tested for water tightness by the Contractor in the presence of the Owner. If a water tightness test cannot be conducted on the proposed product and/or rehabilitated manhole, the Contractor shall note that with the manhole rehabilitation product shop drawing submittals and shall provide an alternate test method for review and approval by the Owner, at no additional expense to the OWNER. If a post-rehabilitation water tightness test is not provided, the Contractor will not receive full compensation for the manhole rehabilitation tasks. The Owner reserves the right to inspect the rehabilitated manholes during the warranty period. Any leakage or defects in the Work found by this inspection shall be corrected by the Contractor within 30 days from notice, at no additional cost to the Owner.

III. MEASUREMENT FOR PAYMENT

A. Measurement for payment for manhole rehabilitation will be the actual vertical distance measured along the center of the manhole from bottom of the frame to centerline of invert.

Payment under this item shall include all:

1. Equipment,
2. Incidentals for cleaning,
3. Labor,
4. Liner application,
5. Materials,
6. Removal of steps
7. Repairing,
8. Root removal,
9. Sealing of all surfaces including walls, chimney, inverts and benches
10. Surface preparation,
11. Testing,
12. Tools, and
13. Traffic Control.

B. Measurement for payment for manhole frame sealing will be on a unit price basis for the number of seals actually supplied, installed and tested, and accepted in accordance with the Contract Documents.

End of Section