MICHIGAN

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

FOR

**PIPE LINER FOR BOX CULVERT**

GLD:MRR 1 of 4 APPR:LLR:DMG:07-12-24

**a. Description.** This work consists of applying a coating to the inside of an existing box culvert, installing a slide in place pipe liner and grouting the annular space at the locations and limits shown on the plans. Conduct the work in accordance with the standard specifications, the manufacturer’s installation guidelines and as specified herein.

All culvert cleaning, disposal, maintaining flow, corrective actions to remove obstructions, coating, installation of bulkheads, installation of pipe liner, grouting and site preparation is included in this work.

**b. Materials.**

1. Furnish two 36 inch diameter corrugated or spiral ribbed steel pipes to serve as a liner meeting the requirements of Class D culvert in accordance with Table 401-1 of the Standard Specifications for Construction.

Furnish low density cellular concrete grout (LDCCG) to fill the annular space between the existing culvert and the newly installed pipe liner. Furnish LDCCG as follows:

A. Portland cement in accordance with *ASTM C150/C150M* Type I or II.

B. Water in accordance with section 911 of the Standard Specifications for Construction.

C. Fly ash in accordance with subsection 901.07 of the Standard Specifications for Construction and compatible with the foaming agent.

D. Ensure the foaming agent is in accordance with *ASTM C869/C869M* when tested in accordance with *ASTM C796/C796M*.

E. Admixtures in accordance with *ASTM C494/C494M* and as recommended by the manufacturer of the foaming agent.

F. Cast wet density range of 35 to 45 pcf in accordance with *ASTM C138/C138M.*

G. Minimum 28 day compressive strength of 200 psi in accordance with *ASTM C495/C495M.*

H. Ensure mix design for the LDCCG is furnished by the manufacturer of the foaming agent.

I. Ensure mix design limits the heat of hydration to less than 160 °F.

2. For each work day or for each 100 cubic yards placed, cast four test cylinders measuring 3 inches by 6 inches at the point of placement.

Furnish Quadex Qm-1s, Strong-Seal MS-2A, Mainstay ML-72, or approved equal to coat the invert of the existing culvert.

For the bulkheads furnish Grade 4500 concrete in accordance with section 1004 of the Standard Specifications for Construction and epoxy coated steel reinforcement in accordance with section 905 of the Standard Specifications for Construction. Furnish reinforcement bar adhesive anchorages in accordance with section 712 of the Standard Specifications for Construction.

3. Submit the following for Engineer approval:

A. Resume and contact information of the QC Administrator for the LDCCG. Ensure QC Administrator is in accordance with section 1002 of the Standard Specifications for Construction.

B. A plan for the pipe liner installation, bulkhead installation, the system used to facilitate the sliding of the pipe(s) into the existing box culvert and the method to secure the pipe(s) in place during the grouting operation. Plan must address how bulkheads will be formed, and concrete will be poured. The bulkheads are allowed to stop within 8 inches of the roof of the existing culvert and the remaining un-poured concrete portion of the bulkhead can be filled with grout.  Plan must also evaluate the size of the pipes and connections used for the liner compared to the inside dimensions of the existing box culvert to confirm the pipe and pipe connections will fit inside.

C. Submit calculations demonstrating the allowable lift thickness for LDCCG placement based on the means and methods which will not damage the pipe liner or the bulkheads. Submit the plan at least 14 calendar days before pipe liner installation.

4. At least 14 calendar days before the grout placement, submit the following:

A. LDCCG mix design indicating proportions of all components and admixtures. Ensure the mix design is accompanied by independent laboratory test results of the specified properties.

B. Description of equipment for placement, location of injection ports and step by step procedures for sampling, testing, transporting, and curing the LDCCG.

C. Resume of the proposed grouting specialist(s). The grouting specialist must have a minimum of 5 years' experience in underground grouting applications, including projects with grout mixes, equipment, grouting methods, and control testing as specified herein. Perform grouting operations under the supervision of the proposed grouting specialist(s).

5. At least 14 calendar days before the coating placement, submit the following to the Engineer:

A. Description of equipment for placement of invert coating and step by step procedures for sampling, testing, transporting, and curing the coating.

B. Resume of the proposed coating specialist(s). The coating specialist must have a minimum of 5 years' experience in applying similar coatings with similar working conditions and substrate. Perform coating operations under the supervision of the proposed coating specialist(s).

**c. Construction.** Furnish a minimum notice of 10 work days to the Engineer prior to starting the work. Submit all required documentation to the Engineer for approval prior to starting the work. Do not begin work until approval is received from the Engineer.

Propose and undertake corrective action to eliminate any obstruction revealed by pre-installation cleaning and inspection that cannot be removed by conventional pipe cleaning equipment that prevents the pipe liner from being properly installed. Ensure the proposed corrective action is approved by the Engineer prior to commencement of the work.

Furnish sufficient pumps, sandbags, and any other labor and equipment necessary to sufficiently remove debris and divert storm water, if necessary, prior to the start of work on the culvert. Furnish a contingency plan for dewatering the areas of the culvert being worked on in the event of a storm event. Ensure this contingency plan is reviewed and approved by the Engineer prior to work being performed.

Continuously monitor all pumps and equipment to ensure they are in working order. Follow local noise ordinances if pumping is required on a 24 hour basis.

Thoroughly clean the existing culvert prior to pipe liner installation and dispose of all debris in accordance with subsection 205.03.P of the Standard Specifications for Construction.

Coat the invert of the existing culvert with 1 inch (±1/4 inch) of coating material to seal the surface. Measure coating thickness from the original non deteriorated culvert surface. Complete surface preparation, material mixing, application and curing in accordance with the manufacturer’s recommendations.  It is possible the surface preparation may be too aggressive and could further damage the culvert. Complete an initial inspection of the culvert between the proposed bulkhead locations and notify the Engineer within 24 hours where surface preparation in accordance with manufacturer’s requirements may not be desirable. Detail what specific surface preparation requirements could damage the culvert and propose a different method to avoid culvert damage to achieve desired surface preparation for Engineer approval. The presence of a manufacturer’s representative on site is required during surface preparation and coating operations.

In the event the coating is damaged during pipe installation, submit a repair procedure to the Engineer for approval at least 7 calendar days prior to performing any repairs or installing the LDCCG. Protect the repair area from any damage. Repair or replace damaged work at no cost to the contract.

Construct bulkheads in accordance with the plans and this special provision.

Grout the annular space with LDCCG between the pipe liner, the coated invert and the existing culvert walls and roof in accordance with the approved installation plan. Ensure the filling of the annular space is conducted in the presence of the Engineer.

Grout an initial section of box culvert against the lower bulkhead and allow it to set-up before pouring the remaining lifts. Design the length of this initial section to not damage the pipe liner but also to support the subsequent lifts of grout. After this initial section is complete, grout the rest of the culvert to the upstream bulkhead in lifts designed by the Contractor to not damage the pipe liner. Allow each lift to set-up in accordance with the manufacturer’s requirements. Setup is defined for the project as no longer being able to flow and being able to support the loading from future lifts. Ensure the minimum required compressive strength required to apply additional lifts is in accordance with the installation plan based on the chosen means and methods.

Furnish video inspection of pipe liners before performing the grouting procedure to verify pipe sections are properly connected and no voids exist where LDCCG may penetrate into the pipes. Video inspect the inside of pipe liners after grouting procedure is complete to verify LDCCG has not migrated into the pipe liner, damage to the pipe liner has not occurred, and the pipe liner has not floated or otherwise moved. Remove any spilled grout within the pipes to the satisfaction of the Engineer at no cost to the contract.

The Engineer will base acceptance of grouting on Visual Inspection (VI) as described in the *MQAP Manual* and by comparison of anticipated grout required compared to actual grout installed.

**d. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

**Pay Item Pay Unit**

Pipe Liner, 36 inch Foot

**Pipe Liner, 36 inch** includes all labor, equipment and materials to furnish and install dual 36 inch pipes, dewatering, video inspection before and after LDCCG placement, culvert surface preparation and invert coating, reinforced concrete bulkheads, reinforcement anchorages and LDCCG placement necessary to complete the work as described.

Corrective action to remove obstructions revealed by pre-installation inspection that cannot be removed by conventional pipe cleaning equipment are included in this pay item and will not be paid for separately.