SprayWall Demonstrates Structural Performance for CMP Rehabilitation

University of Texas at Arlington

Short excerpts from study *Laboratory testing of invert-cut corrugated metal pipes renewed with polymeric spray applied pipe lining*

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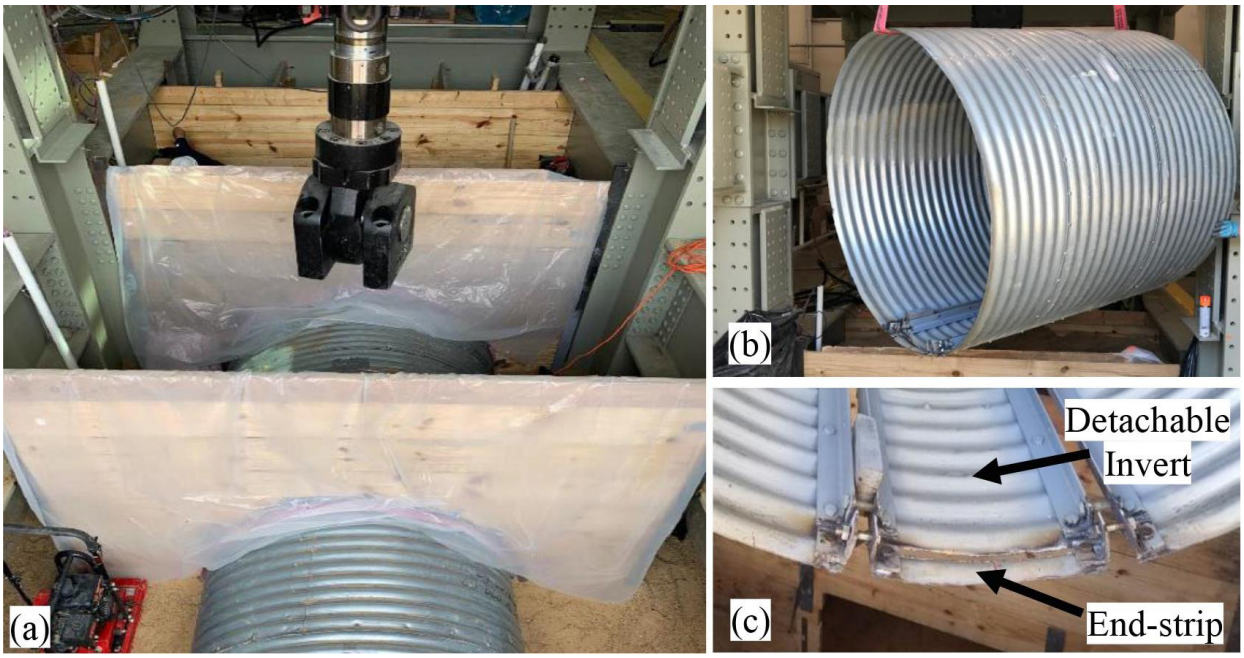

Sample images from the University of Texas at Arlington study confirming the feasibility of polymeric SAPL (SprayWall Structural Protective Lining Systems) application as a fully structural renewal method: (top left) CMP installation, (a) longitudinal configuration of CMPs in the soil box (25 ft × 12 ft × 10 ft) at CUIRE, (b) circular CMP sample, and (c) detachable invert and end-strip configuration for SAPL renewed CMP samples.

Objectives

1. Examine the performance of invert-cut corrugated metal pipe culverts renewed with a commercially available polymeric SAPL material through a series of full-scale laboratory soil box testing.
2. Compare the results of SAPL renewed CMPs with a same-size invert-cut bare (unlined) circular CMP.
3. Observe failure modes of CMPs renewed with polymeric SAPL.
4. Investigate the feasibility of polymeric SAPL application as a fully structural renewal method.

Methodology

Since December 2017, a group of researchers at the Center for Underground Infrastructure Research and Education (CUIRE) at the University of Texas at Arlington have been conducting a comprehensive study to develop structural design methodologies for polymeric and cementitious spray-applied pipe linings (SAPLs). The research program is sponsored by seven US DOTs of DelDOT, FDOT, MnDOT, NCDOT, NYSDOT, Ohio DOT (lead of the project) and PennDOT. The program includes five sets of full-scale soil-pipe structural testing. To investigate the soil-pipe structural capacity, the pipes were backfilled with SP soil and buried under

2 feet (610 mm) of soil cover. A monotonic displacement-control static load was applied through a rigid 20 × 40 inch (25.4 × 101.6 cm) steel load pad over the crown of the pipes.

The first set of the experiments included the control tests (i.e., unlined/bare pipes) that investigated the behavior and load carrying capacity of invert-cut arch and circular CMPs, which the results were presented previously in another study. This article presents the results of the second set of tests, which examine structural capacity of three fully invert-deteriorated circular CMPs, renewed with polymeric SAPL.

Surface Preparation and Polymeric SAPL Installation

After the CMPs were backfilled, they were renewed with different thicknesses of a commercially available polymeric SAPL material. Prior to the pipe installation in the soil box, the CMPs were power washed using pressurized water jet to be cleaned, and to remove the dust and dirt attached to the inside surface of the CMPs, similar to the pipe preparation procedure for lining infield recommended by SAPL vendors. In this study, SprayWall polymeric SAPL material was selected to renew the CMPs. SprayWall is a self-priming polyurethane lining by Sprayroq Protecting Lining System Company for pipe and manhole renewal that reinstates structural integrity, provides infiltration control and corrosion resistance. Its quick curing time allows the newly protected structure to be returned to service shortly after the completion of the application, which makes it ideal for utilization in water, wastewater and stormwater pipe renewal. Sprayroq recommends cleaning the host pipe from oil and other contaminates, which may cause formation of blisters, pinholes, foamed material, debonding, cracking or delamination of the SAPL from the host pipe.

The SAPL was applied up to 0.25 inches (6.35 mm) thick in a single application or lift with solidifying in approximately 8 seconds to complete curing process in 60 minutes. In the invert section, since it was not possible to spray the SprayWall directly on the soil, the fully detached invert section was left in place, and the 2-inch (50.8 mm) gaps between the invert section and the CMP's main body were filled with Styrofoam, as shown in Figure 7(a).

In this study, the vendor utilized a hand spray installation. In order to control the thickness during installation, with respect to the volume of the sprayed material coming out of the nozzle per unit of time (i.e., second), the installer could estimate the amount of material that was sprayed on the CMP's inside surface. In addition, by knowing the total volume of the required SAPL, the installer could estimate the number of passes required to reach the designed thickness. However, this type of installation requires the high proficiency and experience of the SAPL installer. The Sprayroq vendor calculated approximated amounts of 179.08 lb (81.22 kg), 358.16 lb (162.45 kg) and 716.33 lb(324.92 kg) of SprayWall material that were required, respectively, to apply the 0.25 inch (6.35 mm), 0.5 inch (12.7 mm), and 1 inch (25.4 mm) thicknesses, each on the inside surface of a 6-foot (1.8 m) long, 60-inch (1.52 m) diameter CMP.

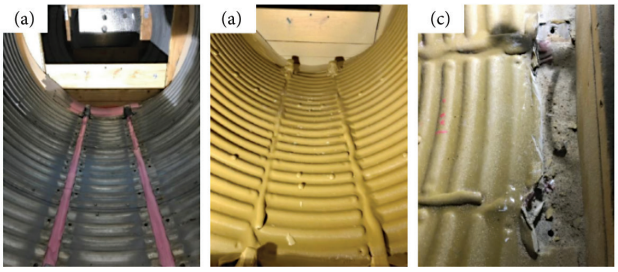

Figure 7. SAPL installation of invert-cut CMPs: (a) before SAPL installation (stage 2 of Figure 3), (b) after SAPL installation (stage 3 of Figure 3), and (c) end-strips detachment (stage 4 of Figure 3).*

Summary and Conclusion

In the absence of the host pipe's ring stiffness, the SAPL was able to resist the ring compression solely. Therefore, the polymeric SAPL can be considered structurally sufficient to withstand the applied load and improve the overall load-bearing capacity of the fully invert deteriorated host pipe.