

Antiquated Sewers Get a Modern Makeover in



Large diameter felt tubing was readied for wet-out near the busy Wells Fargo Arena.

Sections of brick-lined sewers under downtown Des Moines, Iowa, were installed in the late 1800s. So when city engineers decided to upgrade the sewers in 2004 and 2005, the 19th century pipelines leaped into the 21st century with new thermoset liners, installed by Visu-Sewer Clean & Seal Inc., Pewaukee, Wis.

To minimize disruption to the bustling Iowa state capital, Visu-Sewer used trenchless cured-in-place pipe (CIPP) technology. To ensure long-term durability, the new liners are made with Vipel L704-FAH resin, a proven high molecular weight isophthalic polyester engineered by resin producer AOC LLC for CIPP use.

The latest Visu-Sewer project for the City of Des Moines rehabilitated more than 12,000 ft of brick sewer lines ranging in diameter from 18 to 60 in. In addition to the 19th century pipe, other pipes that received new liners were estimated to be 80 to 100 years old.

The liners were made in thicknesses ranging from 12 to 31.5 mm, depending on the diameter of the host pipe. Des Moines engineers established the thickness requirements using formulas established in ASTM F1216-05: "Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube."

"The brick itself has performed well," said City of Des Moines project engineer Jeff Hansen. "But the mortar is failing the test of time. To repair the sewers, we chose CIPP over sliplining a thermoplastic liner inside the old pipe. Compared to CIPP, sliplining would have left us with less flow capacity and would have caused significantly more surface disruption.

"With sliplining, we would have needed to dig more openings to be able to install the liner through the many curves in the system," Hansen said. With CIPP, Visu-Sewer

was able to install most of the new liner through existing manholes. We've used Visu-Sewer for CIPP projects before. They do very good work."

Resin-Saturated Felt

For the new pipe liners, Visu-Sewer used National Liner CIPP technology licensed from National EnviroTech Group LLC, Houston, Texas. National Liner technology calls for saturating a non-woven polyester felt liner with a corrosion-resistant thermoset resin, then inverting the liner (turning it inside out) through the pipe in need of repair.

Inversion was accomplished by pumping water inside the liner to create pressure. This keeps the inverted liner moving forward and expands the liner against the inner wall of the host pipe. After the entire length of an individual liner inversion was complete, the water was heated to 170 F. Pressure and heat were held for a specified time that varied by the diameter, thickness and length of the inserted tube.

Heat cured the previously liquid resin into a molecularly crosslinked solid, and the water was removed. The cured resin that was forced into cracks, joints and irregularities created a mechanical lock between the liner and host pipe. The structural integrity of the host pipe is improved, and the new liner gives the sewer a smoother interior surface for improved flow. Unlike the original pipe, the newly lined structure provides a seamless, continuous barrier against leaking.

For the Des Moines job, the felt liners were constructed by Applied Felts Inc., Martinsville, Va. The liners were made to predetermined thicknesses, diameters and lengths as dictated by planned insertions.

Most of the Des Moines liners were the same diameter from end-to-end. However, some host pipe segments that were originally thought to be 36-in. round cross-sections

By Ben Bogner

Iowa

ended up being 33-in. wide by 40-in. tall ovals. For these inversions, Visu-Sewer worked with Applied Felts to receive a liner that transitioned into a new dimension at the appropriate location.

According to Visu-Sewer project engineer Alex Rossebo: "Before the new liner is installed, we have to make sure the host pipe was exceptionally clean. Because these were combination lines and carried storm drainage during heavy rains, some pipe had above-average accumulations of silt that had to be removed before we could start the re-lining process. Larger pieces of brick and debris had to be manually shoveled toward our high-power vacuum unit."

Resolving Design & Process Issues

Visu-Sewer resolved design and process issues that arose during the Des Moines project. For example, Visu-Sewer workers knew how to negotiate the resin-saturated liner through sweeping bends in sections of 36-, 42- and 48-in. diameter sewers. Workers also installed sections of liner where the grade changed as much as 15 ft.

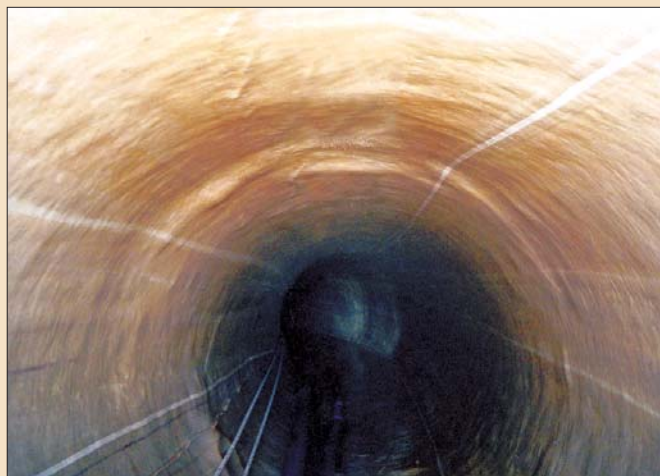
For both the sharp turns and steep grades, close attention was paid to adjusting the head pressure as the liner was inverted. If pressure got too low, the liner would not be adequately applied against the host pipe surface. If the pressure got too high, the liner could burst at the seam.



Pressure inverts the resin-impregnated felt tube through the host pipe.

Perhaps the biggest challenge occurred when temperatures soared past 100 F on certain scheduled inversion dates. To prevent the heat from "kicking in" the resin prematurely, Visu-Sewer crews used an air conditioned tent over inversion sites. Where needed, resin temperature was also kept low by using tarp-covered ice.

Because sewage never stops, by-passes were installed to keep line segments open and free while they were cleaned and lined. For the by-passes, Visu-Sewer ordered two 8-in. pumping systems made by Godwin Pumps of America Inc., Bridgeport, N.J., and obtained through Godwin distributor



The newly-lined pipe is structurally improved, smoother, seamless and leak-free.

Central Service & Supply of Ankeny, Iowa.

While one pump operated, the second served as a precautionary back-up, which did not have to be used. Bypassed sewage was conveyed in 12-in. diameter, semi-flexible polyethylene piping. Road ramps protected the temporary pipe system wherever it crossed traffic routes.

Vipel Isopolyester

The resin for the Des Moines liners was Vipel L704-FAH resin from AOC, Collierville, Tenn., the leading supplier of corrosion-resistant resins in North America. Visu-Sewer purchased the resin through distributor CIPPCON Inc. "We get terrific technical support from CIPPCON people," said Rossebo. "They are available 24/7 when needed and are extremely flexible in scheduling resin deliveries for onsite wet-outs. Jim McCormick with CIPPCON was there for our first onsite wet-out."

Installation crews benefited from the resin's predictable behavior and good processing characteristics. "Wet-out with the Vipel resin was never an issue, regardless of location," Rossebo stated. "Wet-out of liners up to 48 in. were performed at our facility in Pewaukee and transported to the jobsite in refrigerated trucks. For the 60-in. liners, three 'over-the-hole' wet-outs were performed onsite next to the Des Moines River. The longest over-the-hole wet-out and inversion was approximately 1,000 ft."

The Vipel resin belongs to the isophthalic polyester, or isopolyester, material family, which is chemically different than the polyester used to make fibers for the felt liner. Rossebo said the Vipel resin retains a high modulus of elasticity over time while providing excellent resistance to the corrosive environment of municipal wastewater.

AOC business manager Emilio Oramas added, "Isopolyesters have a proven history in CIPP use and continue to set the standard for most CIPP rehabilitation projects around the world today. We're pleased that this technology could help the people of Des Moines get a major infrastructure upgrade with little disruption to their daily lives."

The combination of the modern resin with antique brick has given new life to the more than 100-year-old sewers under downtown Des Moines. By merging old and new material technologies, the sewers are designed to still be in service when Des Moines prepares for its 2057 bicentennial celebration as a state capital.

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