

# Milwaukee Goes Deep To Reline Brick Sewer

## At 75 Feet, Repair Is One Of Deepest CIPP Jobs Ever Completed

by Joe Hastreiter, Contributing Editor

The 60-inch diameter brick combined sewer line on Milwaukee's (WI) North Side had faithfully done its job for over 100 years. But the line, which was buried 75 feet underground in the 1880s, demonstrated that the passage of time had taken its toll. Calcium and other mineral deposits were beginning to show up on the two-foot thick walls.

Although there are many miles of brick sewer lines still in operation in Milwaukee, it was clear that it was just a matter of time before the 60-inch line running under Humboldt Avenue would require major repairs.

Considering the depth, repairing the collapsed sewer on an emergency basis could cost \$1.5 - 2 million to repair. In late 2002, the city resolved the situation by installing a 42-mil thick National Liner cured-in-place liner through 758 feet of the old brick sewer.

Prior to proceeding with the \$659,000 project, the contractor, Visu-Sewer Clean & Seal Inc., a National Liner installer, did a thorough analysis. For the Pewaukee, WI, firm, this included walking the line and carrying out comprehensive videotaping. The crew focused particularly on areas where calcium deposits had accumulated and bricks had fallen away from the wall. These findings were used in certifying that the sewer was ready to be lined.

Samir Amin, construction supervisor in charge of inspectors for the city of Milwaukee, said the main advantage of using cured-in-place lining is the cost. "It is much cheaper than tunneling. At a depth of 70 feet and with a sewer of this diameter, tunneling would have doubled or tripled the cost," he said.

### Preparation took time

Because of the depth and diameter of the pipe to be lined, a 14-foot diameter shaft had to be installed on the upstream side of the

project. This is where the top of the old brick sewer was opened and through which the repair liner would be installed. Due to tough soil conditions, it required about 18 days to dig the shaft.

With the shaft completed, the crew carried out their preparatory work which included removing mineral deposits, conducting high pressure cleaning and installing water containment bulkheads at either end of the repair segment.

During the preparations, some problems were encountered with the bypass pumping system which set the project back several days. "We had to overcome a couple of difficulties when the plug blew out due to unexpected increases in dry weather flow," said Keith Alexander, president of Visu-Sewer.

With the old brick pipe certified to be lined, the Visu-Sewer crew was ready to move ahead with the installation of the 42 mil thick, needle-woven polyester felt liner. When work was ready to begin, the liner was brought to the job site directly from the manufacturer, Applied Felts Inc. of Martinsville, VA, on a flat bed truck. The 120,000 pounds of thermal-sensitive resin used to saturate the felt, was delivered in three tanker trucks.

At ground level, the flattened felt liner was carefully unfolded as it was moved from the truck and fed onto a sloped table. Next, resin and a catalyst system were injected. Later, down in the sewer, hot water would be used to activate these chemicals and cause the liner to harden.

As a final preparation step, the liner was moved through pinch rollers that squeezed it to a specified thickness and caused the resin to completely saturate the liner fabric.

### Pushing through water

Prior to the liner being fed down the shaft to the sewer, the leading edge was bound to a circular frame. This frame is used to hold the

*Although this 60-inch brick sewer had done its job well for over a 100 years, it was beginning to show signs of wear with calcium deposits and bricks falling.*

head of the liner rigidly in place while thousands of gallons of water are introduced to propel the remainder of the liner through the entire 758 feet of the host pipe.

Two seams that run the entire length of the liner were then cut about seven to 10 feet and pulled back (much like peeling a banana). These strips were then wrapped around and secured to the circular frame which was positioned at the top of the shaft.

Once the leading edge is secured, the crew pushed eight to 10 feet of the liner through the circular frame creating a pocket. The result is material hangs down from the frame and creates a pocket. Once the pocket was formed, water was added. As the volume and weight of the water grows, so does the length of the liner being drawn from the flat bed truck. The liner was fed down the shaft at about 10 feet per hour.

Ultimately, the water-filled pocket reached the full length of the sewer segment being repaired. At the same time, the liner is turned inside out, or "inverted." When firmly in place, 3 mils of very smooth polyurethane lined the inside of the sewer while resin-impregnated felt faced the 100-year-old brick wall. Over 200,000 gallons of water were used to invert the liner.

Following the inversion of the liner, it was time to "cook" the material and activate the thermal-sensitive resins and catalyst until they were hardened and cured the liner into place. This required heating the water to 160 to 180 degrees and maintaining the temperature for several hours.

### City pleased

The city was pleased with the results on the Humboldt Avenue job.



# National Liner®

## National Liner Installation Network

Visu-Sewer Clean & Seal, Inc.  
W230N4855 Betker Road  
Pewaukee, WI 53072-1430  
Phone: (800) 876-8478  
E-mail: visuinfo@visu-sewer.com  
Website: www.visu-sewer.com

American Water Services  
109 Applewood Dr.  
Longwood, FL 32750  
Phone: (800)-547-6193  
E-mail: mcannon@amwater.com  
Website: www.aet.com/UnderGround.htm

Boh Bros. Construction Co., LLC  
730 South Tonti Street  
New Orleans, LA 70153  
Phone: (800) 248-3377,  
(504) 821-2400  
E-mail: mgonzales@bohbro.com  
Website: www.bohbros.com

BRH-Garver, Inc.  
5402 Lawndale  
Houston, TX 77023  
Phone: (713) 921-2929  
E-mail: tommyschulz@brhgarver.com  
Website: www.brhgarver.com

Southwest Pipeline  
& Trenchless, Corp.  
539 W. 140th Street  
Gardena, CA 90248  
Phone: (310) 329-8717  
E-Mail: cscarratt@swpipeline.com  
Website: www.swpipeline.com



Above: Layers of felt are being examined as the crew prepares to inject the thermal-sensitive resin and catalyst system. Below: The resin-injected liner is lowered 75-feet to the sewer.



"They did an excellent job," said Construction Inspector Amin. "They gave us the product we were looking for and completed the work within the time frame and within budget." He noted there were certain issues that arose during the project, just because of its complexity. "But Visu-Sewer came up with a solution for them."

He explained that the preparation is what really takes the time. "The actual lining only required a matter of days." Amin commented that the construction process is a lot cleaner without all the digging and dust – and the traffic keeps moving. "We only had to divert traffic for one day when there was a problem with the bypass pumping flow control plan."

### Minimum disruption

The Milwaukee project demonstrated that the National Liner cured-in-place sewer repair system requires minimum excavation, and disruption of the street and the neighborhood. The young trees and grass in a nearby median stayed in place and there was not the seemingly endless staccato sound of air hammers and pavement-breaking machines tearing up two blocks of curbing and pavement.

Plus, when the job was completed, the finishing steps basically involved replacing the 14-foot shaft with a six-foot manhole, and putting down an asphalt patch. This contrasts with trench projects requiring considerable backfill, grading, forming and a parade of ready-mix concrete trucks.

The Humboldt Avenue project represented a rare moment. Brick construction of the 1880s joined with CIPP rehabilitation of the 21st century. Commenting on the elaborately constructed brick sewer, Amin recognized the construction craftsman of so many years ago. Considering the tools they had to work with, the work they were able to accomplish, "one brick at a time," is amazing.

Bricklayers of five generations ago would have toiled months to lay the 700-plus feet of sewer line. In contrast, the CIPP liner installed late last year only took a week to complete and caused only minimal disruptions. Even the buses continued to make their stops along Humboldt Avenue taking the residents to work in the morning and home at night. The limited excavation and staging area needed was confined to the inside lanes with buses running in the curb lanes.

Visu Sewer has had an ongoing relationship with Milwaukee's municipal division, and has handled several maintenance projects including emergency repairs. One such job was lining a collapsed 24-inch pipe on State Street, near a truck entrance to Miller Brewery. "It was eight feet deep, 200 feet long, and right down the center of the street," said Alexander. "Traditional sewer repair would have resulted in major disruption but with cured-in-place, it only required one eight-hour shift to do the job."

"Visu-Sewer has done previous work for us, but Humboldt Avenue is their deepest project to date," said Amin. The other projects were at 30, 40, and 50-foot depths. "They faced some adversity on this latest job but they handled it very professionally."

Since completion of the Humboldt Avenue project, Visu-Sewer has gone on to complete several projects of larger diameter in another city, including a 72 and 84-inch cured-in-place liner, ranging from 12 to 15 feet deep. "Humboldt Avenue stands as the deepest National Liner CIPP job we have completed to date and we are proud of it," said Alexander.