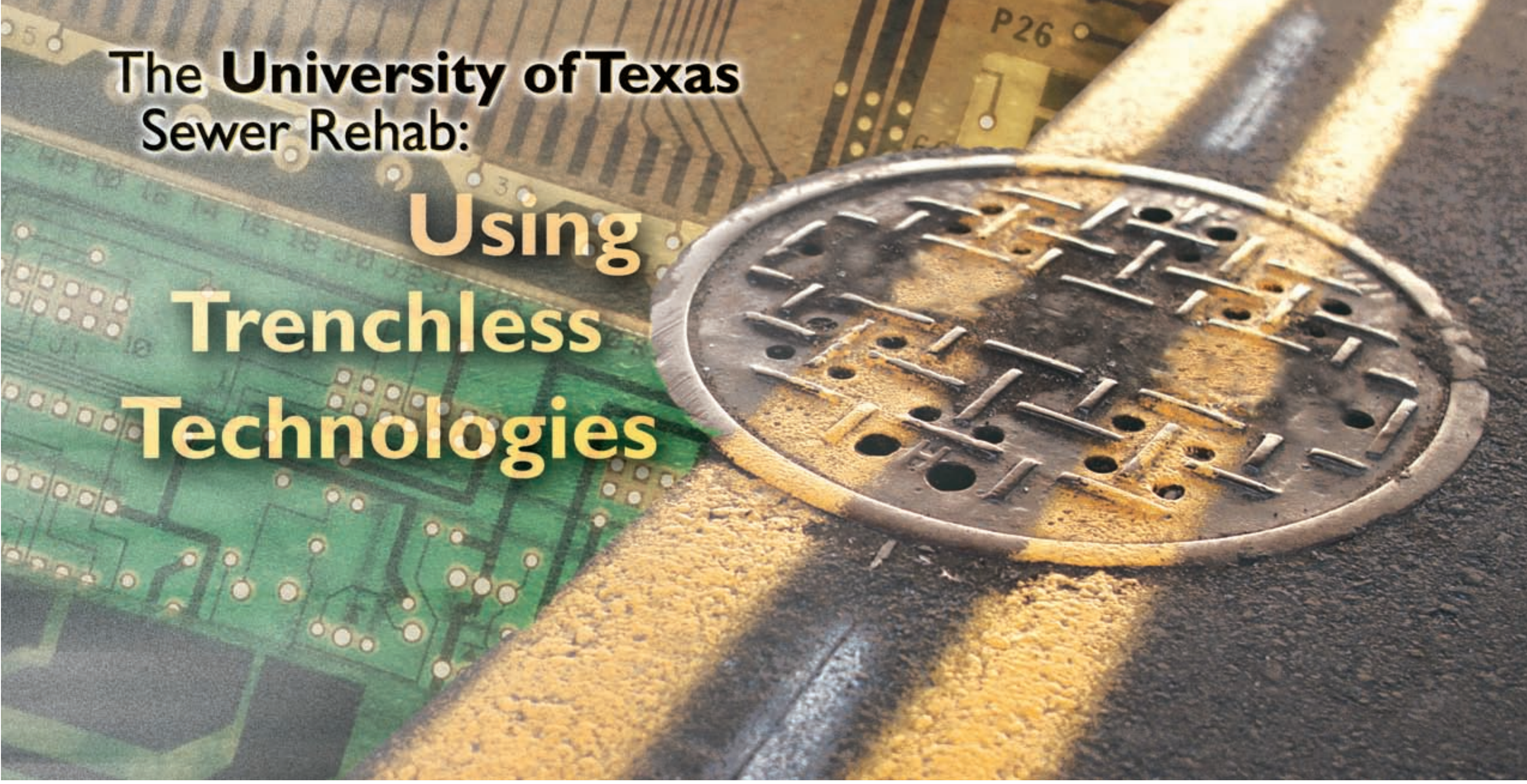
The University of Texas Sewer Rehab: Using Trenchless Technologies



by Leonard Friesenhahn, P.E.

"Out of sight, out of mind" is an adage your top administrators may apply to your campus wastewater collection system but as a facilities professional, you know how serious a sanitary sewer overflow can be. The structural failure and collapse of a sewer main can cause a blockage leading to the overflow of sewage from manholes and building drains. Sanitary sewer overflows can cause serious environmental and property damage with the potential for monetary fines and bad publicity for your school. Sewer main piping rehabilitation using trenchless technologies provides a number of innovative options to restore life to aging sewer mains without the inconvenience and significant expense of the open-cut method.

Aging infrastructure is becoming a major concern for facilities personnel, as many educational institutions are well into their second century of existence. The University of Texas at Austin was established in 1883 and over the past 121 years has grown to be the nation's largest single-campus university. Portions of the campus wastewater collection system have been in service since the 1930s. The university's Utilities and Energy Management (UEM) department is responsible for maintaining the nearly seven miles of sewer mains running beneath the 400-acre campus. UEM, headed by Juan Ontiveros, is a department of the Campus Planning and Facilities Management portfolio. The department is also responsible for generating electricity and steam, providing high-voltage electrical distribution, producing and distributing chilled water, and maintaining elevator and escalator systems.

In 2001, UEM began taking a more proactive approach to maintaining the campus wastewater collection system. UEM hired a contractor to clean and perform remote television inspection of all the university-owned sanitary sewer mains. Industry experts recommend thoroughly cleaning your sewer mains and performing a detailed, well-documented inspection every three to five years. The inspection videos and reports are useful in deciding which repair method to use and they also provide a record of the sewer's size and length, the location of taps and manholes, and the location and nature of any trouble spots. With a new baseline established, UEM performed a condition assessment of the sanitary sewer mains and identified the most critical areas for repair. UEM also used the inspection results to develop a long-term plan to rehabilitate the campus sanitary sewer mains, in an effort to add at least 50 years to the system's useful life. The inspection identified five sections of the most-heavily used sewer mains to be at or near collapse.

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Sewer liner (sock) at manhole. Black hoses circulate hot water to cure resin.

Workers feed epoxy-saturated 'sock' from refrigerator truck into manhole. Cold prevents resin from hardening prematurely.

At the University of Texas at Austin, funding for infrastructure improvements is appropriated annually. Of course, various groups lay claim to this funding, and UEM staff had some concern that the need for sewer repairs might not receive the priority that it deserved. UEM decided to promote the project with some audio-visual showmanship. UEM provided several videotapes from the sewer inspections and had a campus group edit them into a high-quality three-minute taped presentation, narrated by a professional with a "newscaster" voice. The effect was to make real for the first time this "out of sight, out of mind" problem. The video showed a type and extent of infrastructure damage that upper-level administrators had never seen before, and significant funds for repairs and rehabilitation were approved in 2001. You can see project photos over the Internet at www.utexas.edu/utilities/md.html.

The first step in the repair and rehabilitation process was to make point repairs where the piping was at or near collapse. The most severely damaged piping sections were found to be localized and of relatively short lengths. These point repairs were made using the open-cut method, which was the best option for pipe in such poor condition. A total of 527 feet of failing sewer piping was dug up and replaced. UEM took the opportunity to add three manholes in a 600-foot long straight run of piping to allow for better maintenance access. With all of the structural failures and near-failures repaired, the sewer mains were ready for trenchless rehabilitation.

UEM evaluated the various trenchless technologies available to rehabilitate piping found to have only limited structural damage. Some of the structural problems that can be corrected using trenchless technologies include pipe with pieces missing, radial and longitudinal cracks, infiltration, and offset joints. The trenchless technologies considered for our projects have included cured-in-place pipe (CIPP), deformed/reformed pipe, and pipe bursting.

The first trenchless repair option considered was cured-in-place pipe. This process uses an

Workers feed epoxy-satured 'sock' into manhole.

Juan Ontiveros, Jose Bustos, and Leonard Friesenhahn at the CIPP installation manhole.

pressed flat and folded over. This forms a U-shaped cross-section that is small and flexible enough to be pulled into a round sewer pipe of the same nominal diameter. When the liner pipe is in place inside the sewer, steam is circulated

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epoxy-impregnated felt tube or "sock" that is inverted into the host pipe to form a pipe-within-a-pipe. A water column is the driving force for the inversion process. The water pressure both inverts the sock into the sewer and expands it against the inside of the existing pipe. When the sock is in place, the water in the sock is circulated through a boiler and heated to 180 degrees Fahrenheit. Circulation at this temperature is maintained for a calculated amount of time, based on the size and length of the sock, to cure the epoxy resin. The curing time can range from one to eight hours or more once the curing temperature has been reached. Once cured, the sock becomes a solid, impermeable pipe-within-a-pipe. The sock ends are manually cut out at the manholes and the taps are restored by a special TV-guided robotic hole saw.

The second trenchless option considered was deformed/reformed pipe. This process uses thermoplastic pipe, either HDPE- or PVC-based, that has been heated until it softens and then

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through the liner causing it to re-soften and expand into its original round shape. After the liner cools, the ends are trimmed and any taps are restored from inside the sewer main.

The third trenchless option considered was pipe bursting. This method actually allows you to increase the diameter of your sewer main, if upsizing is needed. A pipe-bursting contractor winches a bursting head through the sewer that uses pneumatic or hydraulic force to push outward on the walls of the existing pipe. New HDPE sewer pipe is attached to the bursting head and is pulled in place as the original pipe breaks outward. Other pipe materials, including cast iron and steel, also can be used with this method. Excavation is typically required to restore existing taps to service. Also, a launching pit and a receiving pit are required for inserting and removing the bursting head. Pipe bursting has the potential to damage nearby underground utilities and can cause heaving of the grade level if the sewer is shallow or if the line is significantly upsized.

UEM developed rehabilitation project bid specifications with the help of sample specifications obtained from NASSCO (National Association of Sewer Service Companies). NASSCO is working to standardize sewer condition classifications and assessments for the industry and is a good resource for information related to sewer cleaning, inspection, and repair. UEM specifications require the successful bidder to provide a bypass pumping plan, a traffic control plan, and a detailed project schedule as part of the preconstruction planning process. The specifications emphasize that the bypass-pumping plan must include adequately sized pumps, a standby pump for each active bypass pump, and plenty of well-maintained hoses that do not leak. Even a tiny amount of leakage, just a few drops, at a hose fitting can upset some members of the campus community.

UEM's first trenchless rehabilitation used deformed/reformed pipe to line 215 linear feet of 10-inch concrete sewer main. After repairing a collapse using the open-cut method, video inspection showed the remaining pipe to have severe corrosion and pipe deterioration from hydrogen sulfide attack. A portion of this sewer main runs underneath the turtle pond, an area used by the Biological Sciences Department to study aquatic plant and animal life.

An open-cut repair was definitely not an option. UEM hired a contractor experienced with deformed/reformed pipe installation. The crew brought the project's deformed pipe to the site on a reel. The pipe was winched through the host pipe and, when in position, steam was injected inside the deformed pipe to expand it into its original round cross section. The entire installation was completed in one day.

UEM performed a second trenchless rehabilitation by hiring an experienced CIPP installation contractor to rehabilitate 1,569 linear feet of 12-inch sewer main piping spanning eleven manhole sections. A manhole section is considered to be the sewer piping running between any two manholes. The project's 12-inch sewer mains run through the center of campus and drain a number of large lab buildings as well as the famous UT Tower.

Since the access manholes are located in narrow, busy streets, the project was scheduled for the semester break between the summer and fall sessions when the student population was at a minimum. The contractor mobilized for the five-day project with a refrigerated truck carrying all of the wet-out liners for the project, a boiler truck for heating and circulating water to cure the inverted liners, bypass pumps, hoses, support equipment, and an experienced crew. Although the crew was faced with a variety of equipment problems, they were able to make the necessary repairs and avoid any failures in the installation and curing process. When the liner installation was completed, the contractor performed a post-installation TV inspection to prove the quality of the final product. This video documentation now serves as a new baseline for these manhole sections.

When you perform a periodic inspection of your campus wastewater collection system and the data indicates a need for rehabilitation, consider the trenchless technologies available. Trenchless technologies are constantly evolving, as new and improved processes are developed to provide innovative solutions for difficult problems. CIPP has provided an excellent solution for restoring life to the aging sewer mains at the University of Texas at Austin.

UEM recently completed its third trenchless rehabilitation project. This project used CIPP to rehabilitate 888 linear feet of 24-inch sewer main that drains the 80,000-seat football stadium and surrounding buildings. The Longhorns have some of the best athletic facilities in the nation, and now the same can be said of the stadium's wastewater collection system.