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# Pipe Relining Guide 2014

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THRIVE AND GROW CONTINUES TO PIPE RELINING

Welcome to the 2014 Pipe Relining Guide, a special supplement to Trenchless Technology. We are happy to again bring this supplement to you, which is filled with informative and interesting stories from the world of pipe relining.

A recent informal survey conducted by Trenchless Technology showed that a majority of utilities across the United States are routinely using trenchless relining methods to address the condition of their underground infrastructure. Eighty-four percent of the utilities polled said CIPP is the most commonly used method. According to Global Water Intelligence (2009), the global pipeline rehabilitation market exceeds $8 billion and was expected to top $10 billion by 2016, with CIPP spending estimated to be at least $1 billion. Let that sink in for a moment — $10 billion by 2016.

We have between 700,000 and 800,000 miles of public sewer mains and many are approaching the end of their useful life. The 2013 ASCE Report Card for America’s Infrastructure noted that the capital investment needed to address our sewer collection system infrastructure would total about $300 billion over the next 20 years — twice the current level of investment by all levels of government — with pipes representing the largest capital need.

Pipe relining has become the go-to method to address many of these infrastructure issues, allowing municipalities to improve and upgrade their water and wastewater pipes in ways that are cost-effective and minimally invasive. Pipes thought to be a lost cause or need disruptive and costly dig-and-replacement find a second and lengthy life through the use of trenchless pipe relining.

Trenchless technology — and the pipe relining market in particular — has been a bright light within the construction community the last few years, succeeding against the backdrop of a devastating recession that crippled the construction industry. Our underground infrastructure doesn’t care about a bad economy; its age and deterioration need addressed.

As you will find within the pages of the 2014 Pipe Relining Guide, there are interesting stories to tell of work being done within the pipe relining market — from case studies showcasing the multiple methods of relining to the latest trends in the market. All good stuff!

When it comes to pipe relining, CIPP remains the cornerstone of the rehab market, whether the curing method be steam or ultraviolet (UV) light. This segment continues to expand its reach and gain acceptance in municipalities across the United States and Canada. But there’s more to pipe relining than CIPP — there’s close-fit lining (Swagelining, fold-and-form), sliplining, spiral wound, spray lining and panels.

While pipe relining has always been a strong option for gravity sewer applications, new markets are emerging. These include pressure pipes, storm water/culverts and water lines. Some are gaining acceptance quicker than others but the innovative technology and thinking have made these markets something to watch. I can’t wait to see where the technology takes us.

In reading all of the articles in the 2014 Pipe Relining Guide, I marvel at the widespread usage of pipe relining and the different circumstances in which it can be used. We cover pipe relining in virtually each issue of Trenchless Technology and even that monthly coverage is an enormous undertaking but well worth the effort by our staff and those who contribute their stories. And there are more stories to tell.

I am looking forward to seeing how trenchless pipe relining will continue to flourish in the coming years — an exciting and dynamic market with untapped potential still to be unleashed!

Managing Editor,

Sharon M. Bueno

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Trenchless Pipe Relining Continues to Thrive
NEW MARKETS, TECHNOLOGIES EXPAND FOOTPRINT

By Jim Rush

The trenchless pipe relining market has come a long way since it was first used to mend a section of a London sewer back in 1971. First viewed as a premium process — and viewed by some with suspicion — pipe relining has become a mainstay within sewer systems across North America.

While pipe relining — notably slip lining — has roots predating the 1970s, it was the invention of the cured-in-place pipe (CIPP) method — the “Insituform” process — by Eric Wood that fueled the growth of the trenchless rehabilitation market. Wood and his company, Insituform, completed its first U.S. installation in 1976 and were granted a U.S. patent for CIPP in 1977, planting the seed for market growth. The expiration of the patent in 1994 led to new entrants into the marketplace and increased competition.

Of course, the technology itself matured over the years, too. It was also about this time that we began to recognize the need to re-invest in our infrastructure that was beginning to show its age. Landmark publications like the Water Infrastructure Network (WIN) report (2000) and the EPA Gap Report (2002) began opening ours eyes to the problem by documenting multi-billion dollar needs in water and wastewater investment. According to Global Water Intelligence (2009), the global pipeline rehabilitation market exceeds $8 billion, and was expected to top $10 billion by 2016 (the CIPP spending was estimated at $1 billion).

As a result of the convergence of technology and opportunity, the trenchless relining market has flourished, even remaining strong through the worldwide economic recession in 2007-2008. Throughout most of its history, trenchless pipe relining, including CIPP, has been strongly linked to gravity sewer applications. And while that market outlook remains strong, new developments in trenchless relining methods are also emerging.

Here, we take a look at some of the developing trends within the trenchless relining market. In brief, they include: applications outside of the traditional gravity sewer market and the continued evolution of pipe relining methods.

Relining Market Overview

A recent informal survey by Trenchless Technology showed that a majority of utilities across the United States are routinely using trenchless relining methods. Of the utilities polled, 84 percent claim CIPP as the most common method, and industry experts agree there have been several significant developments in CIPP and across the pipe relining market.

Some of the major innovations in pipe relining have taken place in CIPP work, and according to the Trenchless Technology survey, it remains the preferred method. Industry-wide, it is estimated that CIPP has been used to rehabilitate more than 35,000 miles of pipe since the early 1970s.

The biggest changes in CIPP work have been in technological advancements and improved procedures, production and equipment, according to Dave Fletcher, national sales manager for Applied Felts.

“While it has a successful and proven track record of high performance and impressive design life, until now CIPP applications have primarily focused on gravity lines that use traditional felt liners,” he said. “All of that is changing rapidly with new and exciting innovations in this market being designed to rehabilitate pressure pipes, potable water and lateral sealing. CIPP can accommodate modifications to traditional applications because of its flexibility, structural components, corrosion resistance and economic advantages.

Manufacturers like Applied Felts are answering the call for liners that are stronger, thinner and can withstand the high internal pressures required for pressure pipe applications. Liners reinforced with fiberglass blend the properties of felt and fiberglass to create liners that are stronger than ever before. In addition to added strength, the liners are typically thinner than traditional liners so they deliver significant resin savings and can lower overall material costs. Custom combinations of liner, resins and coatings help to create CIPP applications for even the most challenging rehabilitation projects.”
faster installation times. But there are other methods available, including UV-cured pipe, which is popular in Europe.

UV CURING

In the United States, Reline America and Saertex are two leading suppliers of UV-cured products and services. Despite the fact that it is still in its startup phase in the U.S. market, UV is gaining acceptance.

“The UV market is growing well and steadily,” said Reline America president Mike Burkhard. “We have installed nearly 2 million ft to date, and our contractors just installed a 54-in. diameter, 400-ft long shot in record time. Our municipal installers will have installed approximately 100,000 ft by the end of this year.”

As with other methods of lining, technical improvements are being developed to improve the efficiency of UV-cured CIPP. “We are currently testing a product that will include an attached inner veil for greater abrasion resistance and increased flexural properties by 25 percent over our current liners,” Burkhard said.

“New ancillary equipment breakthroughs, especially for large diameters, have enabled faster liner installations. We are in the final stages of building our first 2,000-watt curing system to add more speed and greater depth to the curing process. We have steadily increased the quality aspect of installations through product development that has allowed the installation process to be more machine driven, which was all done in-house.”

Some of the advantages of UV over traditional curing methods include increased automation, less environmental impact and improved structural characteristics, Burkhard said.

CULVERT REHAB

Another area of growth for the trenchless relining market is for rehabilitating culverts that were constructed to divert storm water under newly built roadways. Like municipal water and sewer systems, these culverts were built in the post-war years as America began to expand rapidly and are in need of repair. Culverts represent an area in which trenchless methods are still in the early stages. In fact, part of the problem is identifying where the culverts are and what condition they are in, said Mohammad Najafi, a professor at the University of Texas-Arlington and director of the Center for Underground Infrastructure Research and Education (CUIRE).

“The industrial growth during 1950s marked a rapid development in construction of high-speed, high-capacity roadway infrastructure,” Najafi said. “Today, the United States has 3,981,521 miles of roadway. During the construction of these roadways, millions of culverts were installed under them. The philosophical saying, ‘out of sight is out of mind’ applies as more importance has been given to preserving the physical infrastructure on the surface like roadway, pavement, bridges, guardrails, etc., than underground infrastructure. Various theories, models, frameworks and management plans are developed to track, inspect, maintain and repair the surface infrastructure. However, the invisible critical components of culverts have been neglected.

“The location and condition of these pipes comes to notice only when there is a problem such as settlement or complete failure of a roadway. The deterioration of culvert pipes and other components is a growing problem for transportation agencies. The deterioration of pipes because of their increasing age or change of service conditions, such as increasing flow due to changing watershed conditions, increases the wear and tear of these pipes. Various
structural, hydrological, environmental and economical (lack of proper maintenance) factors, may accelerate the deterioration process."

The Michigan Department of Transportation — a member of CUIRE — estimated that there are 200,000 culverts in the state. If that number is typical for other states and populations numbers, that means there are in excess of 6.5 million culverts across the county.

Culverts, however, pose some challenges that are quite different from gravity flow pipes in municipal settings. "The variety in material types, shapes, backfill materials, types of roads located above and environmental conditions make every single culvert unique in terms of its behavior and durability," Najafi said. "There have been many studies in order to identify the key parameters affecting culvert behavior, but the success rate in providing standard solutions to the problems remained to be low. Had the culvert behavior been completely understood it would have been much easier to manage the culvert inventory by timely renewal and repair efforts. Wide geospatial distribution of drainage infrastructure assets further complicates the management of these assets. Therefore, the first and most important step in the culvert asset management procedure should be the establishment of a database consisting of asset inventory and asset condition information. By monitoring this database the department of transportation officials will be able to identify the critical culverts before failure and to take necessary steps in a timely manner to repair, rehabilitate or replace these culverts.

"Culverts are open ended and sometimes bypassing flow is more difficult than gravity sewers. Additionally, they might be hard to reach and the lengths are short. In the majority of cases, the access points are difficult to find due to vegetation and soil deposits. One further difference is that culverts are shallow compared to gravity sewers, and they take heavy traffic loads."

CIPP lining is popular for rehabilitating culverts, but many other methods are used, including sliplining, spray-on linings, spiral wound and panel lining.

**CENTRIFUGALLY CAST CONCRETE PIPE (CCCP)**

Various pipe coatings have been available in the marketplace for some time and are starting to gain momentum, according to Bill Shook, president of AP/M Permaform, which offers the CentriPipe CCCP system.

"The technology of vertical centrifugal spray casting has been used for decades for lining manholes," Shook said. "Basically, CCCP uses its bi-directional ‘SpinCaster’ to apply uniform and densely compacted layers of cementitious material to the inside of failing sewers, creating a new, structurally sound, joint-free, waterproof pipe that adheres tightly to the original pipe.

"[CCCP] is as an extremely versatile and effective solution for most trenchless large-diameter, storm or sanitary sewers where the rehabilitation must be trenchless, structurally sound, and optimize flow capacities. The fiber-reinforced materials developed by AP/M Permaform have high tensile strengths, cure quickly and stick to a variety of materials including CMP cast iron, steel plating, brick and clay. It can be used in pipes 36 in. and larger and can be applied to round, arched, box, elliptical and other odd-shaped pipe."

**LOOKING FORWARD**

UV lining, culvert rehab and CCCP are just a few of the areas within the trenchless relining market that are gaining momentum and present market opportunities going forward. Lateral and manhole rehabilitation and water main lining have been at the forefront of the trenchless market for a long time now, but we are just scratching the surface on the work to be done in those areas. Additionally, the renewal of force mains is becoming a greater need across the country as these vital links are aging just like the gravity flow sections.

"The ASCE Report Card states that addressing the nation's sewage collection infrastructure needs may require an investment of more than $500 billion over 20 years," Shook said. "Similarly dire assessments apply to the underground pipes and culverts that divert stormwater. Replacing and rehabilitating America's underground pipes is an ongoing challenge that will continue for the next several decades."

The trenchless relining market has grown steadily over the last 40 years, and with new markets and technologies emerging, it promises to grow over the next 40 years and more.

*Jim Rush is editor of Trenchless Technology.*
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Development of a Rehabilitation Strategy for Sewer Pipe Lining

BY KELLY KOLPAK

D evelopment of a rehabilitation strategy for lining sewer pipes first involves asking some questions about the system, such as: Where are there maintenance problems? Where have collapses and failures occurred? When were the sewers built? Are there Sanitary Sewer Overflows (SSOs) or basement backups? What areas have high flows? What parts of the system are near bodies of water — creeks, rivers, lakes, etc.? What parts of the system are most critical to keep working? Is the pipe rehabilitation addressing only sewer mains or also sewer laterals?

How these questions are answered will provide direction to a lining project. Establishment of a priority list based on both the likelihood of having an issue and the consequence of that issue to the community is the first step in the process.

INITIAL SYSTEM ASSESSMENT

An initial approach to system assessment would be to look at the age and materials of the sewer system. Identifying which areas are made of older materials such as clay, concrete or asbestos cement, particularly those located in or close to parkways or backyards where roots can be more of an issue would go higher on the priority list. Areas that are made of plastic PVC (polyvinyl chloride), truss pipe or HDPE (high-density polyethylene) can be put lower on the list (although defective installation can occur with all materials).

Proving that it isn’t always about age, sewers built pre-WWII are sometimes in much better condition than those built immediately after. The rapid pace of construction that occurred during the large-scale migration of people from downtown areas to the suburbs during the 1950s and 1960s oftentimes resulted in the use of inferior sewer materials. Consequently, systems built in that timeframe sometimes deteriorate faster than systems that are 100 years old.

FURTHER INVESTIGATION AND ANALYSIS

The investigative process to determine which pipes need lining usually comes from more detailed TV inspections. Prioritizing where to conduct TV inspections can be based on the initial system assessment from age and material, as well as issues such as backups, blockages and grease. Sometimes the recommendation to televise can be driven by other field investigations that include smoke testing, visual pipe inspection, full descent manhole inspection and zoom camera inspection. Another investigative technique that can be used to identify likely candidates for lining is dyed water flooding. Flooding the storm sewer that crosses or is near a sanitary sewer, in conjunction with televising the sanitary sewer can identify sewers with leaky joints or lateral connections that leak. Use of the National Association of Sewer Servicing Companies (NASSCO) pipeline assessment and certification program (PACP) standards when televising sewers is important for being able to rank the sewer from the operations and maintenance (O&M) standpoint, as well as a structural standpoint. This ranking assists in the identification of areas in the system that requires more immediate attention versus areas that need no rehabilitation.

If the decision is made to investigate sewer laterals, similar investigation techniques can be utilized. Televising of the lateral can be done from both a cleanout, as well as from a camera launched from the main. Similarly, dye flooding can be performed by soaking the ground surface over the lateral with dyed water to simulate a storm event. Defects found in the sewer main such as breaks, roots and leaks can also be identified in the lateral. NASSCO has inspection standards for laterals, as well as mains, the lateral assessment certification program (LACP). Similar to how the PACP works, the ranking of observations in the lateral assist with determining where lining would be recommended.

CRITICAL SEWERS

Development of a meaningful rehabilitation plan requires identification of those places where a sewer failure would result in major disruption or public inconvenience such as a collapse under an expressway or a railroad, large pipe near
a hospital. These are considered “Critical Sewers.” In addition, sewers in locations that pose significant access issues, again pipes under expressways or railroads, as well as sewers in backyards. Backyard sewers can be difficult to access because of trees, garages or other obstructions. Trees can be damaging to sewers no matter where they are located; not only with root penetration, but large trees can also collapse the sewer. In backyards, tree removal itself may be problematic and expensive, to say nothing of access to a sewer to perform a point repair.

LINING FOR STRUCTURAL OR FLOW BENEFITS?

When mainline lining was first introduced, there was the expectation that it would structurally rehabilitate the sewer and be the solution to infiltration/inflow (I/I) problems. However, while the structural benefits of lining are well established, I/I reduction benefits have not been born out. Interstitial flow migrations between the liner and the host pipe, as well as along the pipe in the trench, have been documented. This migrating flow appears at the manhole or at the lateral connections to the main. The use of seals during the liner installation can prevent I/I from traveling through the interstitial space to the manhole. Preventing this migrating flow from entering the sewer at the service lateral connections involves sealing the connection and potentially some distance up the lateral. The most effective method of sealing the service lateral connection and the lateral itself is by lining both the connection and the lateral with a single piece liner. Lateral lining, while much newer than mainline lining, has progressed significantly in the last few years and can be performed from either the cleanout or the sewer main.

Because of the reluctance of public agencies to rehabilitate private parts of the sewer system, lateral lining is usually not implemented until after a mainline lining program is significantly far along. However, to leave the door open for lateral lining in the future, a few actions should be taken during the mainline lining process. This would involve cutting back protruding taps to a half an inch or less, and not just lining over them, as well as ensuring that reinstated laterals are fully open and brushed.

Another important way to enhance the flow reduction effects of the mainline liner is to only reinstate service laterals that are actually active. Identification of live and dead laterals prior to lining is critical and can be accomplished by lateral televising and/or dye testing. The resulting connection information can be valuable to the system owner and should be incorporated into the GIS database.

It may be that there is no preparation needed prior to lining a main, however, in the case of a structural issue such as fractures or pipe collapse, a point repair may be required prior to lining. In addition, locations with active I/I will require grouting prior to lining. Some owners grout mainlimes in preference to mainline lining, while others grout defective joints prior to lining, which doubles up on the I/I barriers. A common technique is to grout at least five feet up each service lateral, where a buffer is created around the deepest part of the pipe, alleviating some of the groundwater migration at the connection.

HOW MUCH TO LINE?

The decision of how much of a sewer pipe to line is made by balancing the cost of repairing individual repairs with the cost of lining the pipe. A sewer with a single location requiring a point repair, but otherwise in good condition, and not in a critical location would likely not be a candidate for lining. However, a sewer with five or six leaking joints would likely be a good candidate. The per foot cost of lining sewers less than 15 in. in diameter has come down to a point where it is more cost-effective to line the whole sewer, rather than a few short liners or point repairs.

Local ordinances, political factors, and cost will factor into how far a lateral will be lined. The cost of lining laterals is still relatively high. Some municipalities line all the way to the house, others will line just the connection. One approach is to line everything in the right of way to ensure that the lateral crossing under a storm sewer or storm ditch is lined.

A COMPREHENSIVE STRATEGY

Sewer main lining is a proven method of sewer rehabilitation in many cases, but planning ahead and prioritization is critical prior to the implementation of a sewer main lining project. Sewers identified as needing immediate rehabilitation or in critical areas should be put on the list ahead of other non-critical sewers. It may not be possible to make a decision about lining of laterals before sewer mains are rehabilitated; however, planning will allow for actions that will not prevent the later installation of lateral liners. Additionally, owners can enhance the effectiveness of mainline liners for I/I reduction by the use of seals and only reinstating live service laterals.

Kelly Kolpak, marketing coordinator at RJN Group, wrote this article with contributions by Catherine Morley, P.E., Karol Giokas, P.E., and Joseph Sullivan.
Testing — it’s a word that has been met with some apprehension by many involved in the cured-in-place pipe (CIPP) over the years. However, testing is a critical function of the quality control process as it relates to the cured-in-place pipe industry.

With the inception of CIPP in North America in the 1970s, quality control and testing became based on testing by manufacturers for the pre-requisite approval of liner designs. As the technology gained acceptance by the pipe rehabilitation industry, there became an ever increasing amount of concern over verification of product installation and the projected design life of the material. It was determined that testing was critical to verify the structural integrity and the resistance to chemical substances contained within the liner.

Testing of CIPP liners is a useful and effective tool for installers, municipalities and engineers. Testing can provide information that will assist with the design strengths of a liner, long-term values of the product and provide a critical step in quality control process of a CIPP liner by determining if the liner meets ASTM strength minimums stated in ASTM F1216, F1743 and D2019.

**WHY TESTING?**

Thus, an opportunity presented itself for testing of CIPP by independent third party testing laboratories using a variety of testing methods. Many laboratories took it upon themselves to begin conducting testing on CIPP materials. Certified laboratories go through a comprehensive accreditation process to achieve accreditation by the American Association for Laboratory Accreditation (A2LA), which meets ISO 17025 and ISO 9001 standards.

These accredited labs are called upon as an independent third-party to perform a large number of tests on variety of lining materials — both cured laminates from the field, as well as the raw materials. These tests include liner thickness, water tightness, short-term flexural and tensile tests, long-term creep and chemical tests. Testing of materials is also a critical component in the development of new products.

One of these labs is HTS Pipe Consultants located in Houston. Established in 1979 by Tom Schultz and Larry McMichael, HTS was developed with plans to test a number of construction materials (concrete, soils, asphalts, etc.). However,

Now we have the opportunity to work with another new product: felt/fiberglass liner. With the introduction of the fiberglass liner into the United States, it is critical for testing laboratories to understand the European specifications and testing methods.
in 1988, HTS began testing CIPP samples for projects with the City of Houston. This led to HTS becoming a recommended test lab for many contractors, engineering firms, municipalities and government agencies throughout the United States. As the popularity for testing has grown and expanded, HTS Pipe Consultants has increased the number of customers located in the United States, Canada, Mexico and Australia. To date, HTS has tested more than 50,000 samples over the years. From short-term flexural testing to long-term chemical testing, HTS has been in the forefront of CIPP testing in North America.

There are a number of reasons for the success of a test lab over the years. The most important has been the ability to perform the quality testing, as per ASTM standards, in a timely manner that enables the customers to expedite the continuity of the contract the material is being tested for. Secondly is the ability to address and overcome the revisions in ASTM standards. A third reason is the ability to work with customers on “hot button” items, such as liner thicknesses. Individuals who have been around the cured-in-place pipe industry may remember the thickness issues with CIPP samples for projects with the City of Houston during the early 1990s.

**TESTING NEW PRODUCTS**

The exciting part for many people in the testing industry is the introduction of new materials and products. The evolution of resins, liners and coatings has called on labs to perform testing on these products. The third-party testing results on these products allows the manufacturer to introduce the product to the industry.

Now we have the opportunity to work with another new product: felt/fiberglass liner. With the introduction of the fiberglass liner into the United States, it is critical for testing laboratories to understand the European specifications and testing methods. There is a dramatic difference in determining the liner thickness according to European specs. Like felt laminates, the thickness measurement determines the span of the test machine. This measurement is critical due in part because the span for flexural testing is determined by the thickness measurement.

Rick Eastwood is vice president of business development for HTS Pipe Consultants, which is based in Houston.
Data Management in Wisconsin
CITY OF MADISON USES SEWER INSPECTION SOFTWARE TO KEEP UP WITH SYSTEM NEEDS
BY MARY SHAFER

When it was time for the City of Madison, Wis.’s engineering department to purchase a new CCTV camera rig at the beginning of this year, operations manager Kathleen Cryan assembled her field technicians to weigh in on their wish list for the new equipment.

One unanimous requirement was that it must interface with the Pipelogix Inc. sewer inspection software package they had grown to know and depend on since 2000.

Cryan and company realized they needed to bring their analog CCTV system into the 21st century. She spent three to four months researching what the industry had available in digital setups, and would have final decision-making authority on the purchase. The second requirement was that the camera’s output must integrate with GIS software, to allow the department to track historic pipe conditions.

All bidding vendors were required to perform onsite demonstrations of their products with Madison’s field staff. “We wouldn’t buy a system like this without testing it, having our technicians operate the equipment in our field conditions,” explains Cryan. “Their input and buy-in is critical to the decision-making process. If it doesn’t work for them, it doesn’t work for us.”

STICKING WITH A WINNER

Since first purchasing Pipelogix in 2000, the City replaced its original CCTV van with an Aries vehicle setup in 2007. This year’s purchase would expand its fleet with a side-scanning camera system, and would also need to interface seamlessly with the established software. The previous system comprising the vehicle, camera equipment, computer and software cost $142,000, and the Aries setup was $175,000.

Pipelogix flexible asset management interface, filtering capabilities, choice of report formats and excellent technical support are some of the package’s features that have made it a hit with the City. Its versatility in working with all CCTV systems was a major selling point when first purchased nearly 15 years ago. “We had no software, but knew we couldn’t keep doing paper and VHS,” Cryan recalls. “We knew we needed to go to a more modern digital system. We looked for a manufacturer who was going to be around for a while and offer good tech support. We needed a package we wouldn’t outgrow quickly, that would be supported and upgraded.”

Her research took roughly three to four months. “I went to the Pumper/Cleaner show to look at equipment, did a lot of Internet research and read trade publications. I also contacted other municipalities doing the same type of work, to see what they were using and would recommend. We finally decided that Pipelogix being at the forefront of this industry niche bodes well for us not being left behind. We’re looking to develop a database of information that’s taking a long time to obtain, and we want it to be usable well into the future.”

As a significant part of that growth, Cryan and crew needed a camera that could take advantage of the Pipelogix GIS module, which would be added to the existing package once the new camera was purchased. The department was already using the core software, a number of report readers, and the manhole module. They ended up choosing an IBAK Panorama side-scanning camera from for $277,000.

The Pipelogix GIS module integrates with Madison’s industry-standard ESRI ArcGIS mapping software, and Cryan is talking with Pipelogix about providing customization that will allow data to be ported to/from the City’s newer GT Viewer GIS Microstation software in the future.

FINDING THE GROOVE

“Previously, all 13 techs rotated through the CCTV area,” Cryan says. Once we got the software, we were getting more downtime due to the significant learning curve and we found that didn’t work. They need to be on the equipment regularly to gain proficiency and be effective. We had four operators plus the floor supervisor go for PACP certification training through Pearpoint, then subsequently at local NASSCO trainings. That made it a much smaller number of equipment operators — two primary and two backup, in two vans — keeping them proficient.”

The software is used daily, to pinpoint immediate problems and fully code pipes so the City can rate them to plan its capi-
tal improvement program for trenchless rehab or reconstruction. They also tele-
vise new pipes to verify proper installa-
tion and to check backed-up pipes to see
if technicians need to change pipe clean-
ing equipment, such as switching nozzle
types or using a rodder for small-diameter
lines. ‘Pipe surveys can help us fine-tune
our cleaning frequency, nozzle or flail use,’
Cryan says. ‘Every pipe in our system has
a specific schedule for cleaning.’

CRITICAL DECISION-MAKING TOOL

The City’s management engineering
division, responsible for storm and sanita-
tary sewer systems, are the primary us-
ers of the software. Aside from the two
field technicians, one floor supervisor
and an office technician use it every day.
Madison’s engineers use it when looking
at potential problem areas, to plan recon-
struction and to view reconstructed pipes
before accepting possession, for a total
of about 10 regular users. The City runs a
Monday-to-Friday day shift and night shift,
plus a single weekend shift. Due to the of-
ten brutal winter climate in this northern
city, says Cryan, ‘We work from about mid-
April through the end of October, with an
incredible amount of scheduled overtime.’

Along with the Pipelogix and ArcGIS
packages, Madison works with the Accela
Civic platform for licensing, permitting
and asset management. ‘Our goal is to
move our sewer work order systems into
that program,’ says Cryan. ‘When that hap-
pens, we’ll create the work order in Accella,
then upload it into the van. Pipelogix has
already done some of that kind of porting
work with us and a consultant, to develop
a script that would push the information
from Accela to Pipelogix and back.’

Currently, though, Pipelogix is used in
several different areas: post-backup for a
segment of pipe, or reconstruction of a
significant area that requires pre-design
and post-construction acceptance tele-
vising. Timelines for applications vary
widely: It could be a week, or a project
could be open for a couple years.

TYPICAL DEPLOYMENT

Usually, technicians take a work order
into the field and open the Pipelogix ap-
plication. They complete new project
header information with Pipe ID and in-
formation on diameter, material, location,
previous cleaning, weather and traffic con-
ditions at time of visit, and other pertinent
details. Then they put the camera in the
line. As it encounters a structural element,
it’s documented with clock location and
coded with PACP for any issues. Engineers
later review the tabular report and view
the video to get an idea of what they’re
dealing with on each length of pipe, and
what their recommendations should be.

For immediate problems, technicians
make a quick-and-dirty field assessment.
The field survey is taken back to the of-
cine to code, then scored for prioritiza-
tion in the City’s trenchless rehabilitation
program. All pipes with a given severity
rating are brought up using filters, with
exceptions programmed in the search
(for example, nothing with open soil) to
prioritize and map out rehab projects.

‘We have a pavement rating program for
streets, with a numerical pavement rating,
10 being brand new,’ explains Cryan. ‘As
pavement deteriorates, these ratings drop.
We use that system to prioritize projects.
Once we’ve televised all pipelines in the
whole city, we hope to create the same
kind of system to drive our rehab and re-
construct programs for sewers.’ The City
has 760 miles of sewer pipelines, and is
about four years into a 10-year process of
getting all pipes televised at least once.

For its trenchless rehab program, Madi-
son uses collected data to identify and
group pipes to be recommended for addi-
tion to an annual lining contract. Engineer-
ing uses it to identify pipes that should be
put into an ongoing five-year capital im-
provement plan for reconstruction. Their
IT department stores report data on the
city’s network, where it’s backed up on a
virtual server every night.

Quality control protocols include mul-
tiple reviews by the field technician who
captures the data, the floor supervisor
who checks for proper data entry and
completion, an office technician who
does the detailed coding, and engineers
who review reports and videos for spe-
cific projects. Any questions are reviewed
with those who did the survey or coding.

FUTURE PLANS

Based on the success of their use of Pip-
elogix pipeline survey software package,
Madison is field-testing an IBAK manhole
camera. This would allow manhole inspec-
tion with 3D digital images, data from which
they would enter into Pipelogix. Cryan em-
phasizes the importance of doing due dili-
gence before such significant purchases.

‘Everyone needs to do their own re-
search and see the equipment in action in
their own environment. It’s absolutely criti-
cal to involve field staff in the decision. It’s
a tool and they have to see the value in it and
be comfortable using it. I wouldn’t rely on
anyone else’s research. I’d read everything I
could find, consult people who have a sys-
tem and are using it, and find out why they
chose one and not another. Trade shows are
a good starting point, but that’s all it is.’
Based on such research, one can hardly
argue with the outcome. ‘Pipelogix seems
to be on the cutting edge of this industry.
That gave us confidence for long-term
relationship with both the software and
the company. It’s a pretty robust package,
and we certainly haven’t used all its capa-
bilities, so we have lots of opportunity to
grow with the software. We’re light years
ahead of where we were.’

Mary Shafer is a technical writer with
Creative Raven.
Seeing the (UV) Light
WASHINGTON DULLES INTERNATIONAL AIRPORT USES UV CIPP LINING FOR THE FIRST TIME

BY MICHAEL A. HOFFMASTER

S

ometimes you have to step out of your comfort zone in order to solve a problem. That is exactly what officials with Washington Dulles International Airport did when they needed to repair faulty pipe lines that are used to transport glycol runoff.

Situated in Loudoun County, Va., on more than 11,830 acres is Washington Dulles International Airport, serving the Washington, D.C.-metropolitan area since 1962. Currently, 5,000 acres are being used for aircraft operation. The airport has undergone numerous expansions and updates in its 52-year existence.

Airport construction projects are never routine and are often highly complex and challenging.

Glycol — technically referred to as ethylene or propylene glycol — is typically a component used in the deicing process on aircraft. According to Ray Mizener, P.E., and resident engineer with Airport Design Consultants Inc. (ADCI), “For many years, the airport has been unable to reuse the glycol run-off from the western apron and taxiway, due to faulty pipe lines.”

Therefore, ADCI was contracted by Washington Dulles International Airport to evaluate the extent of repairs needed on its glycol collection system, as well as the lining of three collection lines. The undertaking necessitated extensive planning and coordination as the work would be taking place within the Airport Operation Area (AOA), which means active airfield. Considering airport activity occurs around the clock with nearly 22 million passengers passing through the gates last year, this would be no easy feat.

The Matthews Group Inc. (TMG), a Virginia-based company, was selected as the general contractor to perform the necessary repairs and enhancements. Brandon Eiker, AIC-AC, EIT, with TMG stated that the majority of the pipe lining companies consulted were hesitant to offer a two-year warranty on their liner products, due to its exposure to glycol and potentially jet fuel.

Maryland-based Pleasants Construction Inc., a certified installer of the Alphaliner product for the Mid-Atlantic region of the United States, was one the subcontractors under consideration by TMG.

Alphaliner is a fiberglass reinforced pipe liner that is cured-in-place (CIP), utilizing ultra violet light. Reline America Inc., located in Saltville, Va., is the manufacturer of Alphaliner and the company readily agreed to Pleasants Construction’s two-year warranty requirements. As a result, TMG awarded the pipe lining portion of the Washington Dulles International Airport project to Pleasants Construction Inc. and Reline America Inc.

Not surprisingly, security was a top priority in regards to this endeavor. All necessary vehicles had unique identifica-
tion markers, enabling the control tower to easily spot them on the taxiway. Each day, all vehicles were escorted to and from the jobsite after passing through a security checkpoint, where they were inspected.

Rain creates obstacles when using cured-in-place pipe (CIPP) liner. When working with 5,000 acres of non-pervious surface, like concrete, even a small rain event can impact the drainage system. During Pleasants Construction's pre-construction site visit, there was no water running through the pipes. The weekend before the lining was to begin, there was a 30-minute, heavy rain occurrence at the airport. Drainage lines required pumping down using vac-trucks so work could proceed. By-pass pumping was not an option as aircraft was moving in proximity to the work zone.

As Alphaliner is cured using ultra violet (UV) light, equipment requirements are reduced on the jobsite and pumping or removal of the curing medium is unnecessary. Pumping and disposal of water was not a significant issue. Turn-around time for the vac-trucks to drain the lines was approximately 45 to 60 minutes per truck.

According to Tim Cook, construction manager for Pleasants Construction, “With the ability to simply wench the Alphaliner into place and just having the curing truck sitting out on the taxiway was a huge advantage on this project.”

Three separate 12-in. diameter pipes were successfully lined for a total of 1,208 lf on this project. According to Mizener, this was the first project at Dulles Airport utilizing the UV CIPP liner with fiberglass reinforcement.

“The UV technology was a much smoother process and less invasive than other CIPP methods we have used. We were able to put utilities back in service much quicker and restore service to the airport. Environmentally, we did not have to worry with recapturing the water or steam — which is a huge ordeal in an airport setting since the tanker trucks all have to exit through the active taxiways to dump. We will be utilizing this technology on a lot of future projects,” said Mizener.

Proper planning, site coordination and use of fiberglass reinforced Alphaliner, which can withstand exposure to glycol, allowed for the project’s success.

Michael A. Hoffmaster is business development manager with Pleasants Construction Inc.
The City of Rock Springs, Wyo., discovered a problem with a culvert in an upscale neighborhood. Then, the problem turned dire. The culvert—a roughly 700-ft long arched corrugated metal pipe—had a maximum height of 48 in. and a maximum width of 72 in. The initial problem? A residential backyard fell into a sinkhole, swallowing a large brick fireplace and a three-season deck. It was the latest sinkhole in a community where coal mines built underneath the town have collapsed due to neglect and some environmental factors. It’s called subsidence, and it’s happening in older mining towns all over the West, according to an NPR story in July 2013 by Amanda LeClaire. Crews stabilized the fireplace and deck, using a crane to hold them in place for weeks while workers performed emergency repairs. The culvert ran through many backyards that were closely spaced, and workers had relatively good access through manholes located at either end of the line. To stop further collapses, crews jacked up sections of the pipe and placed sections of new pipe inside the old.

After the emergency repairs, city officials let a contract for the full run of pipe, releasing older videos for contractors to review. What they saw was disturbing.

REVEALING THE REAL DAMAGE

The pipes had not been fully cleaned during earlier inspections, so the extent of the damage was unknown. The pipe’s invert was initially filled with dirt and trash, obscuring the real damage. Only after cleaning operations began could workers determine:

- The majority of the invert had been completely corroded away.
- Nearly 18 in. of the underlying soil had eroded along the full length of the culvert.
- In multiple areas, 4 x 4 wooden beams supported the pipe.
- Separations stretching more than 6 in. were found in many joints.
- The crown had caved over a 10-ft section of the structure running directly under the road.

Suddenly, things had turned from bad to worse.

A GRADE OF “D”

Decaying infrastructure has become a growing problem nationwide, and wastewater, in particular, faces a stiff challenge. The American Society of Civil Engineers (ASCE) 2013 report on America’s infrastructure gives the wastewater category a grade of “D,” estimating that nearly $300 billion will be needed over the next 20 years. “Pipes represent the largest capital need, comprising three quarters of total needs,” according to the report. “Fixing and expanding the pipes will address sanitary sewer overflows, combined sewer overflows and other pipe-related issues. In recent years, capital needs for the treatment plants comprise about 15 percent to 20 percent of total needs but will likely increase due to new regulatory requirements.”

The report underscores many potential health issues. If toxins or contaminants leak from those pipes, they could pollute neighboring soil or water. But digging up the pipes and replacing them could create other environmental and economic issues. It would disturb local environments near the piping. It would be a heavy burden for taxpayers. And disrupting the existing piping could create additional contamination of soil and groundwater.

The problem needed a new type of solution.

TRENCHLESS REPAIRS

City engineers decided a trenchless repair method would be the most economical solution for several reasons. It would minimize disruption to the neighborhood, save existing backyards and reduce the time needed to complete the project.

Some trenchless technologies, however, have raised questions about their potential effect on the environment. Cure-in-place pipe (CIPP), for instance, uses styrene-containing resin systems to create a new pipe inside the old, but critics claim it can leach contaminates into the water systems. And standard concrete or
cement techniques that use high levels of Portland cement create large quantities of greenhouse gases — both in their production and their use.

For its trenchless technology, the City of Rock Springs chose a revolutionary geopolymer mortar material that’s becoming more popular.

ENVIRONMENTAL, ECONOMIC BENEFITS

It’s called GeoSpray and it’s a styrene-free, easy-to-install material that essentially creates a new pipe within the old pipe. Regardless of the condition of the original storm or sewer pipe, GeoSpray allows contractors to reconstruct a new structural pipe onsite using a patented spray technology that improves the pipe’s strength and flow characteristics.

Since GeoSpray’s introduction in 2010, private and public asset owners in 20 states and countries have used the technology on more than 150 structures, repairing a total of more than 50,000 ft of decaying infrastructure. Among the advantages for contractors and asset owners:

- Use of more than 50 percent post-industrial waste materials that would otherwise be landfilled.
- Substantial reduction in environmental disruption from the use of a trenchless technology.
- Reduced CO2 emissions — as much as 80 or 90 percent — when compared to standard cement materials.
- Replacement of styrene-based resin alternative CIPP solutions.
- A single-step solution that does not rely on combining aluminosilicates with a solution of sodium or potassium silicates that have been dissolved in water.
- Easy pumpability up to 500 ft within a pipe that can still be centrifugally cast without clogging or damaging nozzle performance. Traditional cement or geopolymer foundations would require much higher water ratios that would degrade their ultimate strength and require a thicker final product during installation to meet the flexural strength requirements of the rehabilitation.

And compared to CIPP, GeoSpray and its method of just-add-water installation can reduce costs by as much as 30 percent. The City of Rock Springs decided to give it a try.

BETTER THAN NEW

Before repairing the culvert, it needed to be cleaned. Workers excavated sand and rocks that filled up to a third of the pipe. Afterward, the pressure washing began, but it quickly showed the pipe’s entire invert had corroded/eroded away.

Crews kept the previous timber bracing in place while reinforcing the crown. They replaced the missing soil with standard Portland cement fill, and they filled the offset joints.

After establishing the pipe’s basic shape, personnel from Inland Pipe Rehabilitation (IPR) applied Milliken GeoSpray in two passes to the culvert, returning the system’s structural integrity. IPR hand-sprayed the first pass to reinforce the width of the pipe, and then achieved the final thickness of 1.5 in. using its proprietary EcoCast Advanced Geopolymer Relining System. Crews also used GeoSpray liner on the culvert’s inlet and outlet to create a monolithic structure.

A professional engineer certified the liner design as a structural rehabilitation. In less than two weeks, the storm culvert that had seemed dire now looked better-than-new. And it should extend the lifetime of the infrastructure by more than 50 years.

John Hepfinger is global marketing manager-geopolymers at Milliken Infrastructure Solutions.

www.trenchlessonline.com
One thing’s for certain: While our infrastructure may be out of sight and out of mind, new trenchless technologies are not. The recent clamor for more and better information for technologies aimed at rehabilitating pressure pipes is getting louder and louder.

While pressure pipes have been around for a long time, assessment and rehabilitation technology is finally catching up. At NASSCO’s 2014 Annual Conference in San Diego in February, the most highly attended committee meeting was the Pressure Pipe Committee, in which NASSCO members gathered to learn more about recent advances in technologies designed specifically for force mains and other pressure pipe applications.

Force mains are pipelines that convey wastewater under pressure from the discharge side of a pump or pneumatic ejector to a discharge point. Pumps or compressors located in a lift station provide the energy for wastewater conveyance in force mains. Constructed from various materials and available in a wide range of diameters, force mains are often used to convey water from a lower to a higher elevation.

“Cities are looking for guidance to assess and rehabilitate pressure pipes,” said John Schroeder, associate engineer at CDM Smith Inc., and also co-chairperson of NASSCO’s Pressure Pipe Committee. “We are finally starting to see reasonable costs for assessment, instead of waiting for the system to fail. Until now, the cost to assess and rehabilitate was in some cases comparable to replacement, and with some pipes 80-plus years old, replacement was historically the economical choice over finding and fixing the problem.”

NASSCO’s Pressure Pipe Committee was formed to ensure standards are met in the assessment and rehabilitation of water and sewer force mains. Pressure pipelines are not as easy to inspect and rehabilitate as gravity lines are, primarily because of the lack of access, as well as the inability to take the pressure pipes out of service for any period of time. NASSCO’s Pressure Pipe Committee is working to develop reliable technical information, guidelines, and other references for: capabilities, limitations and costs of force main assessment and rehabilitation technologies, which will help owners and engineers with rehabilitation of pressure pipes. Some of the Committee’s recent activity includes:

- Development of an assessment pressure pipe technology matrix that combines professional experience with industry standards to populate information. The matrix is available in the Specifications area of nassco.org.
- Summarization of various technologies used across the world for pres-
sure pipe rehabilitation, including limitations, location and other important data. Brown and Caldwell senior associate Kelly Derr is instrumental in preparing this documentation, which will be completed later in fall 2014.

- Partnership with WEF to prepare content for a three-part WEF webcast titled, “Force Main Condition Assessment Series.” These webcasts focus on available technologies, case studies and lessons learned through panel discussion. Information is available at wef.org/CSForceMainSeries.
- Development of case studies from utilities across the United States, documenting force main condition assessment and rehabilitation, which will be from the viewpoint of the end user (utility), outlining the project drivers, planning, execution, overall success and cost.
- Presentation of pressure pipe assessment and rehabilitation tracks at the 2015 Underground Construction Technology International Conference and Exhibition.

“Now that we have better assessment information,” continued Schroeder, “we can start making solid recommendations on rehabilitation. Felt liner and resin manufacturers have begun offering products that can handle these pressures and internal tensile forces with design modifications.”

Two of the liner manufacturing companies that have stepped up to meet this growing market demand are Applied Felts Inc., and Insituform Technologies, an Aegion Co.

“The market is changing at a rapid pace,” said Applied Felts president Alex Johnson. “System owners are always looking for solutions that help flow move more quickly and easily. Pressure pipes have traditionally been a great solution, particularly where the elevation of the source is not sufficient for gravity flow and/or the use of gravity conveyance will result in excessive excavation depths and high construction costs. But like traditional gravity lines, force mains are not immune to cracks or leaks, either. Up until now CIPP technology has not been able to adequately address the growing need for pressure pipe rehabilitation, so Applied Felts has been working diligently to develop the best possible liner for these types of applications. After years of extensive research and development, we recently introduced AquaCure PS, which combines glass reinforcement with traditional felt for maximum performance in force mains. We will soon launch AquaCure PW, the Applied Felts solution specifically designed for potable water applications.”

While AquaCure PS is constructed specifically for municipal sewer applications, such as force mains, it can also be used for industrial purposes, including fire water lines and more. Its fiberglass reinforcement provides static, self-supporting properties and can be engineered to have the pressure resistance of a stand-alone AWWA Class IV Pipe. Size and design criteria determine maximum pressure, with pressures exceeding 150 psi typically accommodated.

“We know that every job is different,” continued Johnson, “so we work with our customers to understand custom design calculations before manufacturing their liners. This helps us deliver the best possible product and ensure our customers’ installations are successful.”

Another leading manufacturer of innovative liners for pressure pipe applications is Insituform Technologies, an Aegion Co. Senior applications manager (engineer) Lynn Osborn said, “We are seeing more work in the sewer force main market than ever before. About six years ago, we went through an R&D phase for our InsituMain product, which is glass reinforced and can be used for either sewer force mains or drinking water.”

Originally designed for pipelines up to 36 in. in diameter, the technical envelope now includes larger pipes. The InsituMain system can negotiate bends up to 45 degrees and is pressure-rated up to 150-plus psi depending on pipe diameter. It is suitable for rehabilitation in a variety of host pipes, including cast iron, ductile iron, steel, asbestos cement, reinforced concrete pipe and PVC. The InsituMain system is designed to meet the Class IV structural classification of the Manual of Water Supply Practices M-28 issued by AWWA and meets NSF/ANSI Standard 61 as certified by IAPMO R&T Laboratories.

“The apple of the eye in this market has historically been solutions for drinking water,” concluded Osborn. “For us that market has not taken off the way renewing sewer force mains has, but I do believe that at some point soon the acceptance of products for water applications will be evident by a growing demand.”

For more information on NASSCO’s Pressure Pipe Committee, visit nassco.org.

Sheila Joy is president of New Phase Marketing.
MIPP Technology Reduces Invasive Burdens on Municipal Communities

BY KENT WEISENBERG

As evidenced by a major rupture of a high pressure waterline near the campus of UCLA in Los Angeles, over the decades of development, much of America’s aging and deteriorating pipelines that serve our cities are under or near high value infrastructure, whether transportation, commercial, institutional or residential.

This elevated risk, combined with ever-increasing demands on shrinking resources, raises to paramount importance the need for versatile rehabilitation technologies that maximizes restoration of critical pipeline assets and minimizes all burdens and impact of construction.

One such innovative technology that can satisfy the demands of municipal and industrial engineers — as well as the universal goal of communities to minimize capital outlays and the disruptive impact of construction upon business and residents — is manufactured-in-place pipe (MIPP). This novel technology originated as a rehabilitation pipeline solution for the energy and power industries, noted for their high value infrastructure and pipelines with variable geometries. This technology has now migrated successfully into public works. Created to rehabilitate partial or fully deteriorated straight pipelines, as well as those with acute bends, concentric deviations and elevations changes, MIPP is a robotically installed construct of a fast-set high-build polymer liner. A key feature is that the liner thickness is engineered to meet the host pipelines specific internal pressure and/or external loading design requirements, resulting in a monolithic custom fit, structural polymer pipe, which is installable into pipelines ranging from 6-in. to greater than 144-in. diameters. Environmentally friendly, chemical- and abrasion-resistant properties of the liner, which have formulations NSF61 approved, make it highly suitable to either potable water or sewer force main.

TECHNOLOGY DEBUTED

The MIPP technology debuted into the municipal setting with a project completed in partnership with the City of Tacoma, Wash., during spring 2013. This water project was the rehabilitation of a 2,168-ft section of a 58-in. deteriorated carbon steel water transmission pipeline installed in 1936. The construction of the manufactured-in-place pipe represented the first successful robotic lining of a large-diameter water transmission pipeline in North America.

Without the guidance of an established standard for high build polymers, Tacoma Water's engineers worked with the contractor to design loading calculations and the subsequent installation specification. The requirement of which was deliver a liner designed for a minimum 50-year lifespan that would retain ring stiffness and circumferential integrity of the liner through a depressurized state to a surge pressure of 150 psi. This pioneer municipal lining project required two 10-ft x15-ft excavations for a new manway and valve installations. The lining of the final 500-ft section of pipe took advantage of an existing 20-in. vault located at the intersection of two four-lane thoroughfares to facilitate robotic communications.

The highlighted lesson learned from this action was the lining of major municipal pipelines was, in fact, feasible without impactful disruption of traffic flow and reconstruction of roadbeds when vault access was present.

This realization of true trenchless rehabilitation fostered research and design of a modularized large-diameter lining robot to support insertion and assembly/disassembly in pipe through a standard manhole.

High interest in MIPP was present in many of America’s utilities. City of Tacoma officials were excited to see its pilot MIPP performance results, as they view MIPP technology an important technology to use on large transmission pipeline rehabilitation, with identified projects pending pipeline condition assessments. Tacoma reopened pipe for the first year inspection of the installed liner in May 2014, the findings of which were unremarkable. — meaning no change in standard or condition.

MANWAY ENTRY MANAGEMENT SYSTEM TRIAL PROVES PROCESS

During the interim between installation and inspection, a January 2014 trial of the new robot design was shifted to the...
rehabilitation of a 96-in. carbon steel recirculation pipeline at a Texas power plant, in which the large diameter lining apparatus was inserted via an 18-in. manway. The new design proved that the robot could be successfully disassembled, inserted into the pipe and reassembled in approximately 45 minutes. While proven valuable to cooling water operators in reduced manpower and time burdens to make excavation entry, pump removal and reconnects, this capability in the municipal environment has much broader reaching returns to pipeline owners and to the public.

In many urban municipal environments, the manhole access points are close enough that the relining of large diameter pipelines over distance using MIPP methodology is executable through vault access with minimal surface construction. Moreover, with reduced demand on the serviced jurisdiction for safety monitoring and traffic control. The greatly minimized disruption of traffic flows and need for physical construction, including presence of ancillary equipment and larger work crews, reduces burden on commerce. Direct and indirect benefits take multiple forms. Among which is retained access to those businesses along the rehabilitation route, and retention of affected area commercial productivity that would otherwise experience reductions by delays of both customers and worker arrival.

Benefits of the MIPP technology extend far beyond the effect of reducing excavations and inconvenience to the public and trade. The improvement to the safety of the workers completing the installation and the reduction of environmental impacts are significant. The other big safety improvement is the dramatic reduction of confined space entry.

**ROBOTS IN A PIPE VS. PEOPLE CREATE A SAFER ENVIRONMENT.**

The first municipal application of the modular robot is planned for a city in Florida in the fourth quarter of this year — less a more opportune municipal project with vault access presents itself. Quest Inspar, as it works with a local general contractor is looking forward to a successful completion of a city project with little or no excavations and executing sequenced service to the robots through manhole access.

Kent Weisenberg is founder and CTO of Quest Inspar LLC and the inventor of MIPP technology. Manufactured-in-Place Pipe is a pending service trademark of Quest Inspar LLC.
Emerging CIPP Market: Asbestos Cement Water Mains

BY MICHAEL DAVISON

Asbestos has come to be one of the most feared words and materials in the world. Yet, in the 1940s, 1950s and 1960s, more than 600,000 miles of asbestos cement — also called transite and used for its light weight, corrosion resistance, rigidity, ease of handling and installation — was installed to handle water throughout the United States. Applications included potable water mains, storm drains and sanitary sewers.

Projected to have a 50- to 70-year life expectancy, decaying AC pipes today are a major source of asbestos in drinking water and pose even greater threats when they are removed or repaired. It is the 12 to 15 percent of chrysotile asbestos fibers added to the Portland cement for strength and corrosion resistance that causes the health hazards. So what are municipalities and public works entities to do?

Most states do not require public or private utilities or municipalities to remove and replace AC pipe. But, the increasing incidence of decaying pipes in residential areas that should be considered for removal or rehabilitated by pipe bursting or pipe reaming are subject to strict and costly EPA and/or other supervisory bodies regulations. Major downsides to this are both the high costs and, naturally, safety concerns.

Health hazards associated with asbestos cement pipes, when asbestos fibers are inhaled, can be caused by breaking, cutting, drilling, filing, scraping, surface cleaning, sanding or even dismantling. Thus, the reasons for national agencies to step in when using the above ways to replace or repair this type of pipe.

There is good news that solutions exist today — and that is cured-in-place pipe lining (CIPP), a trenchless rehabilitation process that can and does present a low-cost solution in situations where AC pipe can be rehabilitated. To date, several projects, among them one in Alaska and numerous new ones pending across the United States, have demonstrated that CIPP is a viable alternative to other methods, and, as compared to structurally relining cast iron piping, offers even greater savings. Best of all, this is without the attendant costs, strictures and safeguards imposed by the EPA.

ARE THERE ANY OPTIONS?

Alternative solutions to rehabilitate asbestos cement pipe to control dust and fiber release require wet methods. These include water with surfactants, thickened substances, wet sponges, material softening agents, liquid adhesives or wet wiping, plus the proper handling of nearby water, piping and soil.

To accomplish this safely and cost-effectively, current CIPP processes renovate water mains by lining the walls of existing water mains with a hardened synthetic polymer tube and cured using hot water. It has been successfully applied to thousands of miles of cast iron and other metal water mains with a 99.99 percent degree of success. Recently, there has been a growing number of projects and interest concerning rehabilitation of AC pipes. Such interest is especially prompted by the fact that it presents a huge solution, as well as a major cost saver.

Prior to initial work in the Carolinas and Alaska, and now with a growing number of projects in the works across the United States, structural CIPP relining is being viewed as an optimum “interim” solution. I say this facetiously in that by saying interim, this CIPP process can extend the life of the water main by 50 years or more. Obvious drawbacks of other removal or rehabilitation methods, other than huge potential costs, include meeting regulatory requirements.

Ongoing studies have shown that the possible health risks in AC drinking water pipes are technically difficult to measure. These studies have concluded, however, that there might be potential exposure to asbestos in the water through inhalation of aerosol fibers that might become trapped on clothes when washed and then emitted into the atmosphere.

Here is the bottom line why there is great potential for rehabilitating the 600,000 miles of AC water mains: The Aqua-Pipe CIPP process exposes into the environment far less asbestos than...
legislation requires. For instance, the EPA requires that no more than 260 ft or 60 sq ft or 35 cu ft of asbestos cement can be exposed or removed. In terms of CIPP, this means as much as 8,000 ft of AC pipe can be relined in any given location. Explained in other terms, since small pits and no trenches have to be dug at each end of the section to be repaired, in a single rehabilitation project, as many as 40 pits or shafts can be dug without deep regulatory involvement or costs. While regulatory bodies have to be notified, the CIPP process can be accomplished without incurring huge costs and conforming to strict constraints.

By scoring the AC pipes rather than cutting them, and thus causing minimal, if any, asbestos emission, one such differentiation of dealing with AC vs. cast iron pipes, both the small amount of water or piping and soil around the pipes possibly having asbestos is carefully removed, filtered and disposed of according to regulatory guidelines. Personnel from one or more trenchless technology firms are currently engaged with laboratories conducting airborne fiber testing to determine what, if any, additional steps or procedures need to be taken to ensure the safety of asbestos cement water main pipe rehabilitation and repair.

REASONS FOR THE NEED OR DESIRE TO PROCRASTINATE MAY BE OVER

Thus, it is no longer necessary for municipalities or utilities to avoid or prolong rehabilitating AC pipes, but rather to embrace current technology successfully being applied to cast iron pipes to restore residual breaks and leaks and renewing structural capacity. As noted previously, costs as compared other methods are far less; trenchless technologies offer faster and less disruptive solutions (the time factor from start to finish may be as little as five weeks); post-lining reinstatements of service connections are all done from within the pipe; and the linings not only give an additional 50-plus years of life to the water mains, but are also certified by NSF to NSF/ANSI Standard 61.

Regulatory bodies strongly encourage customers of municipal and private water companies to learn more about their drinking water, and when they do — for instance, the EPA requires all community water systems to deliver an annual water quality report to their customers on or before July 1 of each year. But, prior to inevitable growing ranks of citizen complaints or further regulatory constraints or strictures, it would be advisable for those responsible for drinking water installations and repair to not only take steps to repair or rehabilitate deteriorating AC piping, but look into proven technologies now being successfully and cost-effectively applied to cast iron pipes.

At the risk of being redundant, miles and miles of asbestos cement pipe either has or will reach the end of their useful lives. Most repair or replacement techniques are not a truly option, and those responsible should not only be aware of the situation, but also act to resolve it.

Michael Davison is product director at Sanexen Aqua-Pipe, Brossard, Quebec, Canada.
Inflow and infiltration (I/I) is one of the largest issues facing North America’s sewer and water infrastructure and one of the ways to combat this problem is through pipe relining.

One of the most important pieces of equipment when working on a relining project is the lateral reinstatement cutter. Without it, those connected to the pipe would not be able to enjoy its newly relined status.

Most lateral cutters are robotic and work in conjunction with CCTV camera units, and they have evolved into one of the most sophisticated pieces of equipment on a relining project. Depending on the style, the lateral reinstatement cutter also proves to be a versatile tool used both before and after the relining process.

“It can be used to clean the pipe, to prep it for relining and afterward to reinstate the laterals to the mainline pipe. For reinstatement, the machine is positioned at the lateral connection. Then, the cutting head of the machine is advanced so that the lining material can be removed from the covered lateral connection,” says Jessica Bowman, general manager of Bowman Tool Co. & Systems.

“When the ‘coupon’ of liner is removed, the cutter finishes the reinstatement process by cleaning the cut so that the connection is completely free of sharp edges or mismatched pipe.”

The option — and it is not really much of an option when discussing trenchless projects — is digging up each lateral connection and manually reinstating the service. To get a better idea of how contractors use the equipment, a simple YouTube search for lateral cutters returns a bevy of results.

In the early days, cutters were skid-mounted and pulled in place along with the CCTV camera explains Pipeline Renewal Technologies business unit manager Pete Kurz.

The pull designs, still in use today, face competition from self-propelled units with integrated cameras. Europe, as with many aspects of the pipe relining industry, is leading the design of these units that typically accommodate 6- to 28-in. pipes. Small push-in cutters are common for smaller 2- to 6-in. diameter pipes.

“The first cutters were very big, heavy, and complicated with numerous internal parts. Over the years, advances in materials and machining...
processes have allowed the machines to become more streamlined and more operator-friendly," Bowman says. "Focus, too, has been on making them fit into more of a variety of pipe sizes."

Bowman Tool, of East Berlin, Pa., manufactures the Dominator line of cutters designed with efficiency in mind. One example Bowman mentions is the internal parts. The Dominator line has eight compared to some on the market that have more than 50 internal moving parts.

In some instances, like the IST PC200 distributed by Pipeline Renewal Technologies, robotic cutters use CAN-Bus controls, which Kurz likens to a car's on-board diagnostics system. More specifically, in addition to controlling the cutter, an IST PC200 operator can read real-time position on all cutting axes and monitor system pressure, temperature, humidity, and inclination of the robot.

Pipeline Renewal Technologies also distributes the IMS Micro and Micro Premium self-positioning cutters, as well as the IMS Micro Drive self-propelled cutter.

One company bucking the robotic trend is Picote Cutter Systems. The Finland-based company markets several mechanical cutters, powered by handheld drills or a Picote milling system and geared to smaller pipe diameters. Making the Picote cutters standout is the ability to cut from the lateral to the relined pipe.

Katja Lindy-Wilkinson, managing director for Picote, says that the compact design and flexibility of the Picote cutters allows pipe-relining projects to take place inside of buildings, as well as underground.

"The cutter is a crucial part in a lateral lining project. To be able to line in-house (2- to 4-in. drains), a small cutter had to be created before it was possible," Wilkinson says when discussing the Picote cutters. "There were no other cutters available for 2-in. and 3-in. drains with bends at the time."

The Picote Smart Cutter, for cast iron and clay pipes, debuted in 2009 and international marketing began in 2012, the same year that it received the International Society for Trenchless Technology (ISTT) Product of the Year award. The Twister design, for plastic pipes, came shortly thereafter. HammerHead Trenchless Equipment, LMK Technologies and Perma-Liner Industries distribute the Picote lines in North America.

As with any purchase, Bowman says that when looking for a cutter it is important that a contractor does their due diligence and looks beyond price alone.

"What contractors need to look at when deciding which cutter to purchase: warranties, projected maintenance costs for a year, how quickly the cutter can be serviced in the field, and lastly the initial purchase price," Bowman says. "Many contractors fixate on the price, but the other factors should outweigh. The best way to get the answers on the other factors is by talking to other contractors about their experiences. They are the ones with the tried and true facts on the various machines on the market."

Of the cutters on the market, is there preferred design or material? Not really, say Bowman and Kurz.

"The first part of deciding which cutter to purchase or rent depends on the task, Kurz explained. Different cutters are used for felt CIPP and fiberglass CIPP liners then there are mainline cutters and lateral entry cutters, as well.

From there, Kurz points out, designs vary by propulsion winch-in (towing), self-propelled, push-in or inch worm; powered by air, water or electric; with an integrated, external (tow), front and or rear view cameras; and then pipe size small (2- to 6-in.), medium (6- to 10-in.) and large (8- to 28-in.) pipe diameters.

"From a manufacturing and customer service viewpoint, the cutter that is the most durable, operator-friendly and cost-effective is the 'best design' for all involved," Bowman says.

As for getting the most out of the cutter, the answer is simple.

"All lateral cutters are susceptible to the wear and tear of the working environment, particularly from water damage," Bowman says. "Therefore, proper care of the tool is critical to extending its life. Common sense in operation and scheduled maintenance is key."

Mike Kezdi is assistant editor for Trenchless Technology.
Locally owned and operated, the Mobile Regional Airport is located in southern Alabama and is the second airport in the United States to have a federalized screening workforce. The airport is also home to the U.S. Coast Guard Aviation Training Center, where advanced training is provided to U.S. Coast Guard pilots and aircrew.

In February 2013, the Mobile Airport Authority filed an application with the Federal Aviation Administration to garner a small stipend intended for continued development and rehabilitation for the airport. Part of that involved the rehabilitation of a single 1,740-ft long, 132-in. diameter culvert that ran under Runway 14/32. The project took place in March 2014.

**PROJECT SOLUTION**

Given the location of the existing culvert, replacement was completely out of the question. The airport did not want to have to completely shut down daily operations while construction was underway. Ultimately, airport officials turned to a 120-in. nominal diameter DuroMaxx steel-reinforced polyethylene (SRPE) liner pipe manufactured by Contech Engineered Solutions to slipline into the existing culvert. The fact that Contech has been involved in relining drainage structures, supplying both products and engineering consultative services, since the 1930s provided additional confidence in this sliplining solution. Contech’s product portfolio includes storm water quality management, wastewater treatment, bridges, drainage, retaining walls, erosion control and soil stabilization solutions.

Rehabilitation and relining a drainage structure is complicated and requires a site specific analysis process. As a result, there were several elements that had to be considered during the structural and hydraulic design for the reline project at the airport. First, the structural design for the SRPE liner pipe had to omit the load carrying capabilities of the host pipe completely. Contech supplied calculations as outlined by the project that also met the requirements of the AASHTO LRFD Bridge Design...
The sliplining process varies from product to product and shape to shape. For this particular project, the contractor, Indiana Reline Inc., created a unique system that allowed them to pull multiple pipe segments (trains) through the existing culvert utilizing a large heavy-duty winch that was set up near the upstream end of the culvert.

**Specifications, 7th Edition - Section 12.** Another important component in this part of the design was the varying heights of cover (some areas carrying almost 35 ft of cover).

Secondly, maintaining or exceeding the existing hydraulic flow capacity had to be taken into consideration. In certain circumstances, it is possible to increase the overall capacity of a culvert or sewer when sliplining, due to the cross sectional area being reduced. Even though there was a reduction in the inner diameter (I.D.) when sliplining the host pipe with the SRPE liner pipe (132-in. nominal diameter vs. the 118-in. I.D. of the SRPE liner pipe), the smooth interior profile of the DuroMaxx SRPE liner pipe provided a Manning’s ‘n’ of 0.012. This profile allowed for an increase in hydraulic capacity by 186 percent, based on outlet control conditions. The design also incorporated an existing junction box with a grade change of 0.2 percent to 1.04 percent. The entire installed length was 1,740 lf — the reline segments totaled 1,500 lf while an additional 240 lf were directly buried.

**Sliplining**

The sliplining process varies from product to product and shape to shape. For this particular project, the contractor, Indiana Reline Inc., created a unique system that allowed them to pull multiple pipe segments (trains) through the existing culvert utilizing a large heavy-duty winch that was set up near the upstream end of the culvert. They created an exceptional pulling system that enabled them to avoid overloading the joints during the push. The initial push was a preassembled train of 540 lf of thirteen 40-ft length pipes and a standard 20-ft length pipe, which was pulled the entire way through the pipe. The initial train was grouted first before additional trains were placed into the existing culvert.

Next, several smaller trains were created and pulled into place. Each train was...
fused together using welded, internal coupling bands to form a watertight joint and ensure the hydraulic flow remained at optimal levels. As a part of this slippining process, a leveled timber rail system was created on the floor of the existing culvert and in some places on the ceiling to guide the liner pipe through the host pipe helping to ease the installation process. Additional blocking was used to aid in the grouting process.

A lightweight cellular grout was used in multiple lifts through tubes at the headwall, as well as grout ports in the pipe. The tubes varied in lengths of 2-in. diameter PVC located primarily in the 10 o’clock, 12 o’clock and 2 o’clock position. This allowed the contractor to grout at multiple locations to accelerate the grouting process. An internal bracing system was also utilized to prevent flotation and displacement during the grouting process.

Indiana Reline Inc. owner Chris Wisc- hart stated, “Our company has installed a wide variety of both small and large...
diameter liner pipe products over the years. This was our first time installing DuroMaxx steel reinforced polyethylene pipe for large diameter pipeline rehabilitation and we were pleased with the pipe’s performance and ease of handling. DuroMaxx was strong enough to maintain its shape against flotation forces, while also providing necessary buckling resistance to the grouting operation. The special 40-ft lengths reduced the number of pieces we had to handle and minimized the amount of joint welding we had to perform.

Hugh Mickel, P.E., is vice president of reline technologies at Contech Engineered Solutions.

THE ENTIRE INSTALLED LENGTH WAS 1,740 LF — THE RELINE SEGMENTS TOTALED 1,500 LF WHILE AN ADDITIONAL 240 LF WERE DIRECTLY BURIED.

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Commitment to Quality Is Key to Long-Term Success in CIPP Marketplace

BY JIM KALISHMAN

The key to unlocking the door to long-term success at today’s modern CIPP company is the same one used by the industry founders more than 40 years ago — quality. While cost control is important for understandable reasons, only by consistently delivering a quality solution can a company achieve enduring success.

By focusing on quality at all stages of a CIPP project — from planning to building a team and through post-installation — a CIPP provider can increase the probability of delivering a great rehabilitation solution AND achieving profit goals (or better).

Ford Motor Co. founder Henry Ford once said, “Quality means doing it right when no one is looking.” That can be interpreted to mean that the act of incorporating quality into a job is so ingrained in a person or company that it’s done without thinking. In the CIPP world, there are opportunities throughout the lifecycle of a project when integrating quality can make a big difference in the outcome. The most impactful areas are in the planning process, internal and external communications and team building.

The planning stage of a CIPP job is the starting point for ensuring that quality is deeply rooted in the project. Planning, in its most basic form, is the conversion of strategic goals and objectives into tactical goals and objectives. It describes milestones, conditions for success and explains how a strategic plan will be put into operation during a given operational period, or in the case of construction, for a specific project. The operational plan is then the basis for and justification of, a project budget. Consequently, assuring quality procedures are followed every step of the way as a project is brought to completion has a direct bearing on the profit earned.

Factoring quality, not just cost, into CIPP project planning drives decision-making across the board. For example, the performance of the materials and vendors you select can have a big impact on success. Resins, felt, liner — every product selected for a job — must have standards set by the company that meet or exceed the job requirements. Standardizing on a quality material or vendor, while not always possible, is a great way to proceed. Sometimes a material may not be the lowest cost option available, but using it affords confidence and peace-of-mind that its quality is uniform and that it should perform as expected. Losing a liner during an install because of a deviation from a standard specification is simply not worth the risk. It’s in this way that committing to quality can have a direct impact on the profit of a CIPP job.

There’s an old adage from the late Margaret Thatcher, a former Prime Minister of Great Britain, to “Plan your work for today, then work your plan” and that advice applies well to the CIPP process. Selecting the materials during planning is just the first step in ensuring quality because these materials must ultimately be installed correctly. So it follows that part of the planning process needs to be directed to creating clear instructions, guidelines and documentation for material usage and installation. Everyone,
from the estimators to field personnel, needs to understand best practices for every type of material used.

Planning a CIPP job also relies on coordination and efficiency to maximize profitability by reducing setup and mobilization costs. Embedding quality into a process that is focused on speed is challenging. However, the key is to recognize constraints, such as extended cure times, and plan for them or else they will have a ripple effect on the schedule and, ultimately, on profitability. Certainly, it doesn’t make sense for a CIPP crew to shorten recommended cure times in order to meet an overall project schedule. If everyone is thinking about quality first, these sub-optimal decisions won’t be made. Making sure that specified installation guidelines are ALWAYS followed is part of quality and should ALWAYS take precedence over haste. Again, proper planning will invariably help installation crews avoid problematic situations.

All the planning in the world does little to influence a job without proper communication. CIPP projects truly require a contractor to practice 360 degrees of communication. As the quarterback of the team, a contractor must have continuous two-way communication with customers, vendors, field employees, the engineering firm and other internal resources. Communicating an expectation of quality at all times will make sure that everyone is on board to make the best decision and, therefore, open to input from others.

Updating and reporting to customers is critical to effective communication. Transparent and consistent updating and reporting at every stage of planning and construction leads to sound decision-making. Central to this effort is the accessibility of internal resources to external partners. Superintendents, project managers, executive leadership and all key members of a project team need to be accessible so that information is never more than a phone call or e-mail away. In this day and age, it doesn’t make sense for anyone to not reach out when making decisions.

Finally, infusing a commitment to quality into a CIPP team by effective training, knowledge transfer and empowerment to make field-level decisions can produce results that are both professionally and economically rewarding. Training creates a consistent level of quality throughout the organization and makes sure that best practices extend to the field. For example, engineers most familiar with the technical aspects of an inversion understand the best pressure or curing temperature for a certain type of liner. As they learn from experience about new optimal levels for these measures, a corporate focus on quality would immediately lead them to develop plans for field-training or incorporating the new information into their future estimates. It’s a mindset that information is for sharing.

If a company commits to training, the knowledge transferred among employees leads people to feel prepared and empowered to make decisions. Empowerment leads to better performance when CIPP teams are in the field and forced to make critical, split-second decisions. While CIPP projects follow a similar process, there is often a crucial nuance that requires a crew to make an on-the-job decision — far, far away from corporate headquarters — that could make or break a successful installation.

When an organization is focused first and foremost on quality, the profits will follow. Aristotle, the ancient philosopher, stated that “Quality is not an act, it is a habit.” That concept is as applicable today as it was more than 2,000 years ago. If you can incorporate quality throughout the CIPP process, you have a great opportunity to provide a great rehabilitation solution AND achieve your profit goals.

Jim Kalishman is chief information officer at SAK Construction, O’Fallon, Mo.
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www.conteches.com/rehab

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www.cosmic.com

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www.danbyrehab.com

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www.easy-liner.com

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www.ferratex.com

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www.fibrwrap.com

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www.formadrain.com

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www.globalpipelinesystems.com

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www.gpswestern.com

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www.hancor.com

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www.hosesolutions.com

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www.irsi.net

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