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for Municipalities, Engineers and Contractors

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Lateral Rehabilitation: The Final Frontier?

2009 marks the 40th anniversary of one of the most influential events of the environmentalism movement — the infamous Cuyahoga River fire in Cleveland, Ohio. On June 22, 1969, a combination of oily wastes and accumulated debris on the surface of the river burst into flames and burned for 20 to 30 minutes before firefighters extinguished it. Interestingly, it was not the first time the river caught fire — similar incidents were reported in 1868, 1883, 1887, 1912, 1922, 1936, 1941, 1948 and 1952, according to *ohiohistorycentral.org* — nor was Cleveland the only major city to have a river catch fire.

This one, however, grabbed the attention of a nation, albeit not overnight. Perhaps it was the depiction in *Time* magazine of a river that "oozes rather than flows," that helped lodge the event into the American psyche. Whatever the reason, the environmental movement that led to the creation of the Environmental Protection Agency and the passage of the Clean Water Act in 1972 had begun.

In the early days under the Clean Water Act, the major focus was on building and expanding treatment plant capacity. Work then moved toward adding capacity through the construction of new sewers. With the advent and increased acceptance of trenchless renewal methods, fixing mainlines became the next big push, yet sewer system operators — while seeing improving water quality overall — still were not as successful as they had hoped in reducing I/I and stopping overflows.

"In the development of the CMOM and SSO policies, the focus was on addressing the large diameter mains," said EPA's Steve Allbee, director of the Gap Analysis. "But we found out that dealing with the large diameter mains didn't address the problems in their entirety. It was discovered that as much as 40 to 60 percent of all I/I is attributable to laterals, whether they are deteriorating or infested with roots. Fixing the laterals is a legitimate concern that will have to be dealt with."

But dealing with laterals is another issue in itself. Because they are privately owned, the issue of paying for them falls on the homeowners. The smaller diameters, bends and sometimes difficult to access locations further complicate matters. But in any event, the laterals must be dealt with to achieve a leak-free system that reduces stoppages and overflows — and helps achieve the goal of clean water that began with the environmental movement.

In this supplement to *Trenchless Technology*, we examine the problems associated with repairing laterals, the available techniques, case histories of cities that are tackling the problem and companies involved in this sector. Some of the techniques you will read about are lowering the cost and allowing repairs to be done that previously were not possible. No doubt the technology will continue to improve as we conquer the final frontier in sewer rehabilitation.

Regards,

Jim Rush
Editor, *Trenchless Technology*

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Editorial & Advertising Offices
1770 Main St., P.O. Box 190
Peninsula, OH 44264 USA
(330) 467-7588 • Fax: (330) 468-2289
www.trenchlessonline.com
e-mail: *info@benjaminmedia.com*

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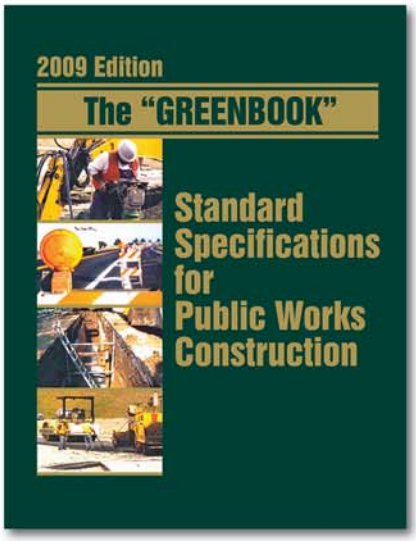

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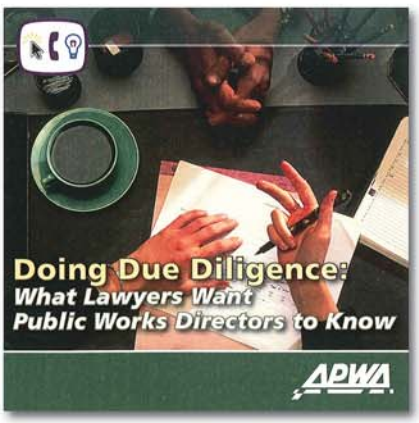

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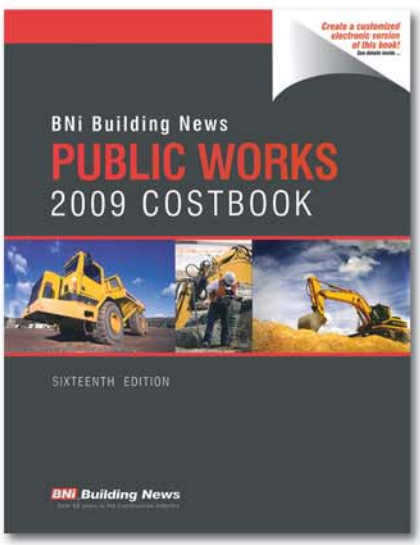

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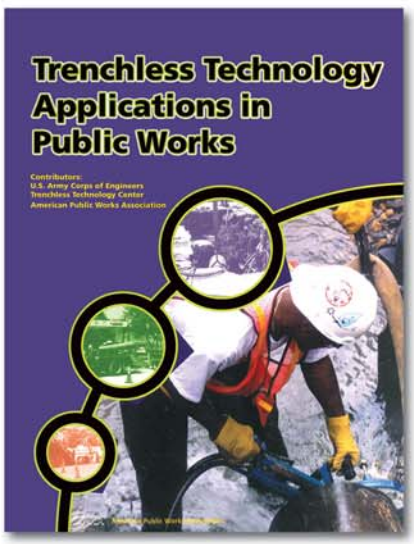

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Sidestepping the Lateral Market

Are Municipal Sewer Rehab Efforts Being Undermined by Leaky Laterals?

By Sharon M. Bueno

The definition of a sanitary sewer lateral is pretty simple: It's the pipe that connects individual properties to the public sewer system. With millions of sewer laterals running throughout the United States, they are as vital to the value of a community's sewer system as the mainline itself.

However, the condition of these sewer conduits would tell a different story. Much has been written about the state of approximately 1 million miles of sewer lines across the United States: They are aged, deteriorated and in dire need of rehabilitation. As the laterals were installed at roughly the same time as the mainline pipe, those same words can be used to describe their condition as well.

The general condition of laterals begs several questions: Just how did the laterals get that way? Are cities taking their condition seriously? What are some of the obstacles cities face to ensure that these critical assets are rehabbed? How much do leaking laterals contribute to inflow and infiltration? What role does trenchless technology play in the rehabilitation of the sewer laterals?

These are some of the questions posed to trenchless professionals who deal with sewer laterals on a daily basis and have years of experience in rehabilitating them. Everyone agrees that municipalities need to take a more proactive approach to the aging laterals — some of which are between 70 and 100 years old — but getting them to do it is another story.

Lateral replacement can be a nightmare for homeowners when trenchless methods aren't utilized to minimize disruption.

Lateral Conditions

Many of the older laterals buried in the United States are made of clay, concrete or ductile iron pipe and are the primary ones that are the cause for concern. They are deteriorated, cracked, taken on roots, have grease buildup, inflow and infiltration, disintegrated materials, bad connections, poor slope of the pipe and in some of the most severe cases, there are pieces of pipe missing — and that's being kind.

"[U.S. laterals] are past their lifespan," says Jerry D'Hulster, president and CEO of Perma-Liner, a leading provider of drain lateral lining and main line sec-

tional point repair products. "I would say approximately 80 percent of the laterals in the United States are past their lifespan, which is about 50 years and before PVC. They need to be inspected and reviewed for some type of rehabilitation whether it's [lateral] bursting or lining."

Over the last 20 years, the rise in popularity and acceptance of pipe rehabilitation, specifically employing trenchless methods, has been seen in U.S. cities — whether voluntarily addressing the sad state of their mainlines or required to via a consent order through the U.S. EPA. However, in taking care of the leaks, cracks and poor condition of the mainlines, the same consideration to the laterals was not included.

Don Barnhart has been involved in the trenchless industry for more than 20 years, with experience in reviewing sewer video, flow monitoring and lateral renovation.

"As cities started to build and grow, of course water and sewer infrastructure assets were installed," says Barnhart, who is general manager of The Janssen Process LLC, which specifically renovates the lateral connection where it meets the mainline. "In the older sections of American cities, the quality of those [lateral] installations was highly dependent on the skills and the quality of the contractors. Did they use good techniques and practices? Did they take care and time in putting the laterals in? What was the backfill used and was it applied properly? Were the lateral installations properly inspected afterward?

"All of these things ultimately have an impact on what [municipal] managers find today when they approach repairing the lateral."

Larry Kiest is president and CEO of LMK Enterprises, a leading provider of lateral renewal systems and structural connection sealings, and is also a master licensed plumber. He concurs with Barnhart's assessment. "Take all that and compare it to the main pipe," he says. "That main pipe was engineered and typically has onsite inspectors. For the most part it is straight, has access at both the upstream and downstream manholes and pipe diameters only change at the manholes. So as you can see, there's a huge difference between the main and the laterals. Laterals on the other hand do not have manholes for access, have bends up to 90 degrees and pipe diameter changes are common in lateral pipes. Because of all that, the laterals are in worse shape and much more challenging to repair than the main pipe."

Problems Attributed to Laterals

The problems that come with bad laterals can cost cities millions of dollars each year through infiltration, not to mention temporary fixes and repair costs. "In many cities, laterals are a significant contributor to operational problems, primarily infiltration and roots," Barnhart says. "Many of those lateral connections have deteriorated as cements that were used to attach the laterals to the mainline have degraded. In some cases, there may not have been cement used at all — they took a ball-peen hammer and knocked a hole in the mainline and stuck the lateral into the hole created."

U.S. laterals are past their lifespan and trenchless professionals say they are a leading contributor to infiltration.

Another problem associated with laterals are the Ys and Ts that are connected to the lateral, as they can degrade over time as well and become another opening for water, roots and debris to enter the system, experts say.

But it's the older neighborhoods where the laterals need the attention. "Overall in many older sections of our cities, some engineers estimate that as much as 40 to 50 percent of the total infiltration coming into that neighborhood can be attributed to leaky laterals," Barnhart says.

"With sewer systems, the emphasis is on the word system… when you'll see the biggest bang for your buck is when you address all of the sewer system components: mainline, manhole and laterals," says George Kurz, P.E., DEE, with Barge Waggoner Sumner & Cannon Inc., based in Nashville, Tenn., which recently completed more than 320 miles of sewer rehabilitation (mostly trenchless) that included 10,000 rehabbed laterals. "You'll get better results if you do it as a system approach, which is not just treating your mainlines."

The strategy Kurz talks of was pursued in Nashville based on results from its 1991 Oak Valley project, which showed an additional 20 percent I/I reduction from lateral rehabilitation — for an additional 10 percent cost on the contract.

But it is the mainlines that garner the most attention in city rehab programs with the belief that will fix the I/I problem. "[Municipal] managers understood that laterals leaked from day one but the approach was 'Let's do our mainline and let's do our manholes and we're going to see significant reductions in I/I.' And in some cases

Experts say that taking care of the laterals will be less costly for cities in the end.

they did," Barnhart says. "But in many cases after all of this mainline and manhole rehabilitation not as much I/I is removed as they hoped. That helped refocus attention back to the laterals."

Because, as our panel points out — water migrates. Fixing the leak in one area will just cause the water to move along until it finds another crack or opening and when that leak is fixed, the water continues to the next one and so on, they say.

All agree that there has been a steady increase by municipalities in discussing rehabbing the laterals, as well as actually doing the rehab work, beginning in the late 1990s and early 2000s with the onset of more options to treat the laterals — specifically trenchless methods such as lateral lining, top hats, lateral bursting, etc. Trenchless technologies have allowed cities to explore rehabbing their laterals with minimum disruption to homes and businesses.

"People are starting to think about how mainlines aren't the whole story," Kurz says. "They should be doing more. People are talking about [laterals] more but talk is cheap. Now we have to get out and do it."

"We are in the early stages of the maturation of the lateral market," Barnhart says. "As this market continues to mature, there are two challenges. One is for the industry, operations managers and engineers to understand what technologies are available and their pros and cons. The second is to figure out how to prioritize the laterals for repair. The money is always going to be an issue so they need to decide where to get the biggest bang for their buck."

Funding is an issue in any type of the infrastructure repair but with laterals comes another: lateral ownership. If the problematic lateral is on private property, many municipal ordinances require the property owner to take care of it; municipalities won't pay for it.

Kiest notes that when he first started rehabbing lat-

LACP Training

In recent years, NASSCO has impacted the trenchless industry with the creation of two assessment and coding programs for pipelines and manholes, which provide standardization for the way sewers and manholes are evaluated, coded and managed.

Today, NASSCO is developing a similar program for laterals, called Lateral Assessment and Certification Program (LACP). The program is based on the defect codes within Pipeline Assessment and Certification Program. While many of the defects found in laterals are similar or even identical to those found in mains, some variations do exist. It's vital that the industry has a complete understanding and consistent method for identifying and coding defects in all three areas of the collection system. According to NASSCO, with regard to laterals, the industry must understand the following:

Regardless of the lateral size (typically 4- or 6-in. diameter) the defects found in them are the same found in mains. Cracks, fractures, broken, root intrusion, infiltration, etc. are still coded as they are in PACP. Several codes that are specific to laterals have been added. The new codes deal with fittings such as Ys, bends, clean-outs and more. Typical LACP applications may include: Condition Assessment of High Consequence Areas (Critical Laterals); Condition-based Preventive Maintenance and Re-inspection; Pipeline Deterioration Analysis; Pipeline Condition Mapping; Population of Other Application Databases; and Ability to retrofit existing data.

Larry Kiest, CEO of LMK Enterprises, heads the NASSCO Lateral Committee and has been involved in developing the LACP program. He says, "It's the contractors and municipalities alike that the LACP program is targeting so we are all speaking the same defect code language when it comes to laterals."

Kiest says the committee has just released the LACP program and more information can be found by contacting NASSCO or an approved LACP vendor.

erals in 1993, he didn't get the reaction he hoped for. "[Municipalities] pretty much ignored the need to renew laterals," he recalls. "Even today there are a lot of municipalities that tell the homeowner that [they] are responsible for the lateral pipe all the way to the main. In my opinion that just ignores the issue at hand and attempts to pass responsibility onto the homeowner and I feel this is a disservice to the taxpayers, specifically the portion of the lateral in the public right of way under paved streets."

Kurz agrees. "The real story is that the benefit is not to the homeowner individually but it's to the community. If your lateral is leaking like crazy with I/I and your neighbors' laterals are leaking, then all the I/I coming into your system is stealing the capacity of the lines in the street that eventually convey the sewage to the treatment plant. Eventually you would have a case where all of you (homeowners) would have to pay for an upsizing of that main line or increase capacity at the plant. Whereas by taking care of the lateral situation in a thorough way, you may be able to avoid completely a major increase in your rates. It would be for the community's good."

The Future for Laterals

While lateral professionals are seeing a steady interest by municipalities to address the condition of their laterals, much work to bring continued awareness must be done they say. As they become more educated as to what's available to them, the lateral rehab market will continue to grow because it can't be ignored.

"The lateral market is still growing. We are just scratching the surface now," D'Hulster says. "There is a lot of education and awareness that needs to be done through municipalities, engineers and homeowners. There are a lot more companies out there doing work in residential areas that need to be educated and made aware of these types of applications to save the costly expense of excavating people's yards, digging up and possibly causing more disruption to existing infrastructure, such as water, electric and gas lines."

Companies such as Perma-Liner and LMK are doing their part to educate the masses on lateral rehabilitation through seminars they conduct around the country. "There's really no place to educate but through [manufacturers] like us who are in the industry and doing our best to go out and educate municipalities and specifying engineers on proper methods and materials for renewing laterals," Kiest says.

Sharon M. Bueno is managing editor of *Trenchless Technology*.

Methods for Rehabilitation of Sewer Laterals

By Jadranka Simicevic

Different methods are available to agencies to effectively rehabilitate sewer laterals. Most widely used trenchless methods in the United States are pipe bursting and cured-in-place (CIP) relining. Chemical grouting is well established and the least expensive, whereas flood grouting and robotic repairs are still innovative. Each method has certain advantages and limitations.

Lateral CIP liners

Based on the shape and location of installed liner, four types of lateral CIP systems can be distinguished.

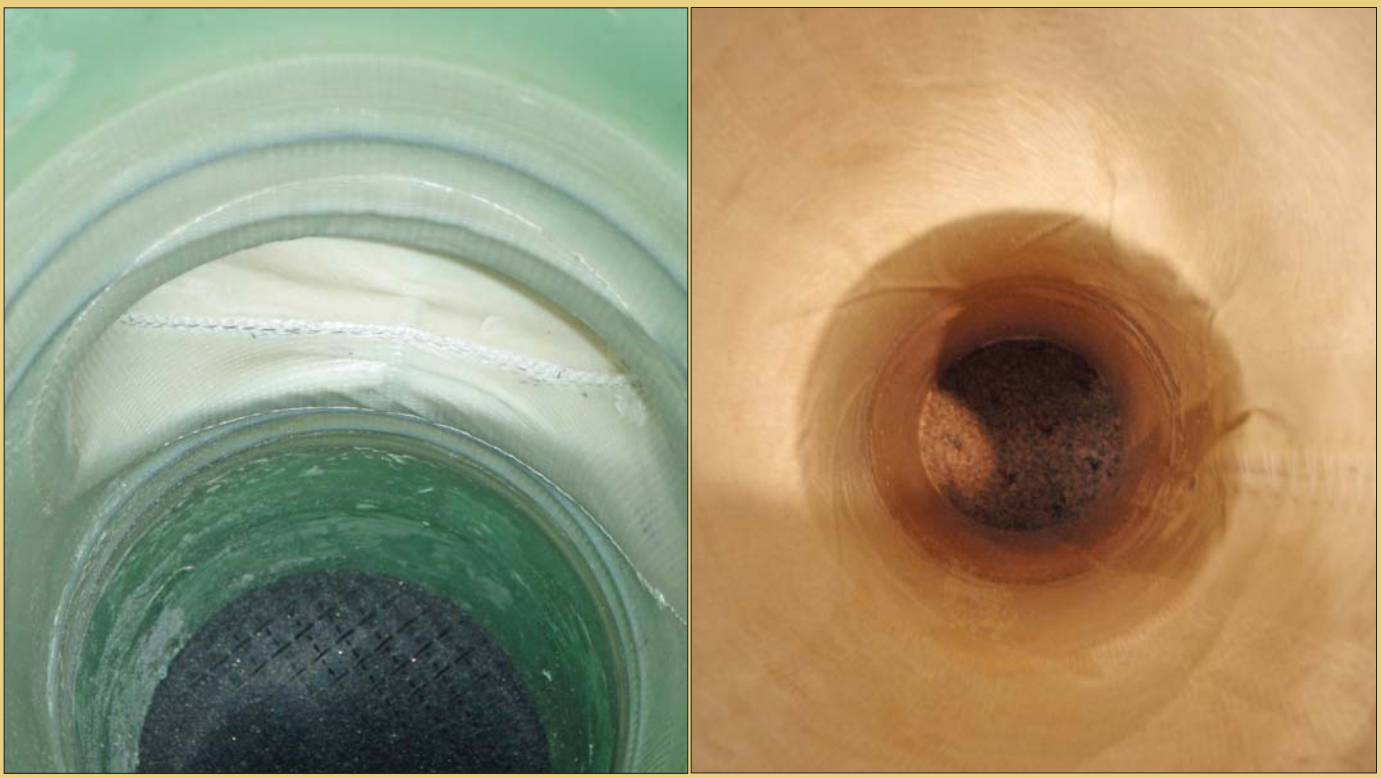
Standard liners are shaped as simple tubes and are used to reline the entire length of the lateral or only a part of it (usually the upper lateral or the lower lateral is relined, i.e. a portion between the house and the property line, or between the property line and the mainline, respectively).

Short connection liners are shaped as top hats and are used to reline a connection between the lateral and mainline, which is often a "weak link" that allows infiltration into the sewer collection system. These products create a brim around the lateral opening (approximately 3 in. wide) in the mainline and extend for a short distance into the lateral (about 6 to 12 in.).

Long connection liners are also anchored in the mainline with a brim created around the lateral opening but they extend much farther into the lateral (e.g. 25 or 30 ft). T-liners have a full circle mainline seal (about 12 to 16 in. long) that is stitched and fused onto the standard CIP liner.

Standard liners are typically installed through cleanouts or small pits requiring little excavation if any (mainly if cleanouts are missing). Connection liners and T-liners are installed remotely from the mainline eliminating the need for excavation completely.

The CIP liners can be installed in laterals that have active leaks. Most manufacturers, however, recom-



Cured-in-place (CIP) lateral lining is one of the most widely used lateral rehabilitation methods.

mend inverting PVC preliner prior to relining and applying chemical grouting if heavy leaks are present.

Duration of relining depends on preparation work and type of resin cure (steam or hot water accelerate the cure) but is overall relatively short, requiring a disruption of service to homeowners for about one or two partial days. Some systems can be installed very quickly, e.g. TOP HAT requires the lateral to be plugged for only about 15 minutes.

The method is suitable for repair of deeper laterals, however, not for pipes with severe offset joints, severe corrosion or mineral buildup that has badly reduced the hydraulic capacity. Many bends in the pipe can make the inversion difficult or impossible (relining usually goes smoothly through 45-degree bends, but 90-degree bends and Y fittings make installation more difficult). In sharp bends and diameter transition points, some wrinkling can be expected. More stretchable liners (knitted or woven tubes) may wrinkle less but exhibit change in thickness. Some systems offer for laterals with diameter transitions liners that are made of two parts, each matching exactly the diameter in which it would be installed.

The method does not eliminate a potential for root problems re-occurring in the future if there is any annular space left between the liner and the host lateral pipe after installation.

The longevity of lateral liners is expected to be 50 years or longer, however, this has not been confirmed in practice, as these liners started to be installed in early 1990s. A small percentage of defects (less than 5 percent) has been found in incidental reviews of lateral liners installed in early- and mid-1990s in Nashville, Tenn.

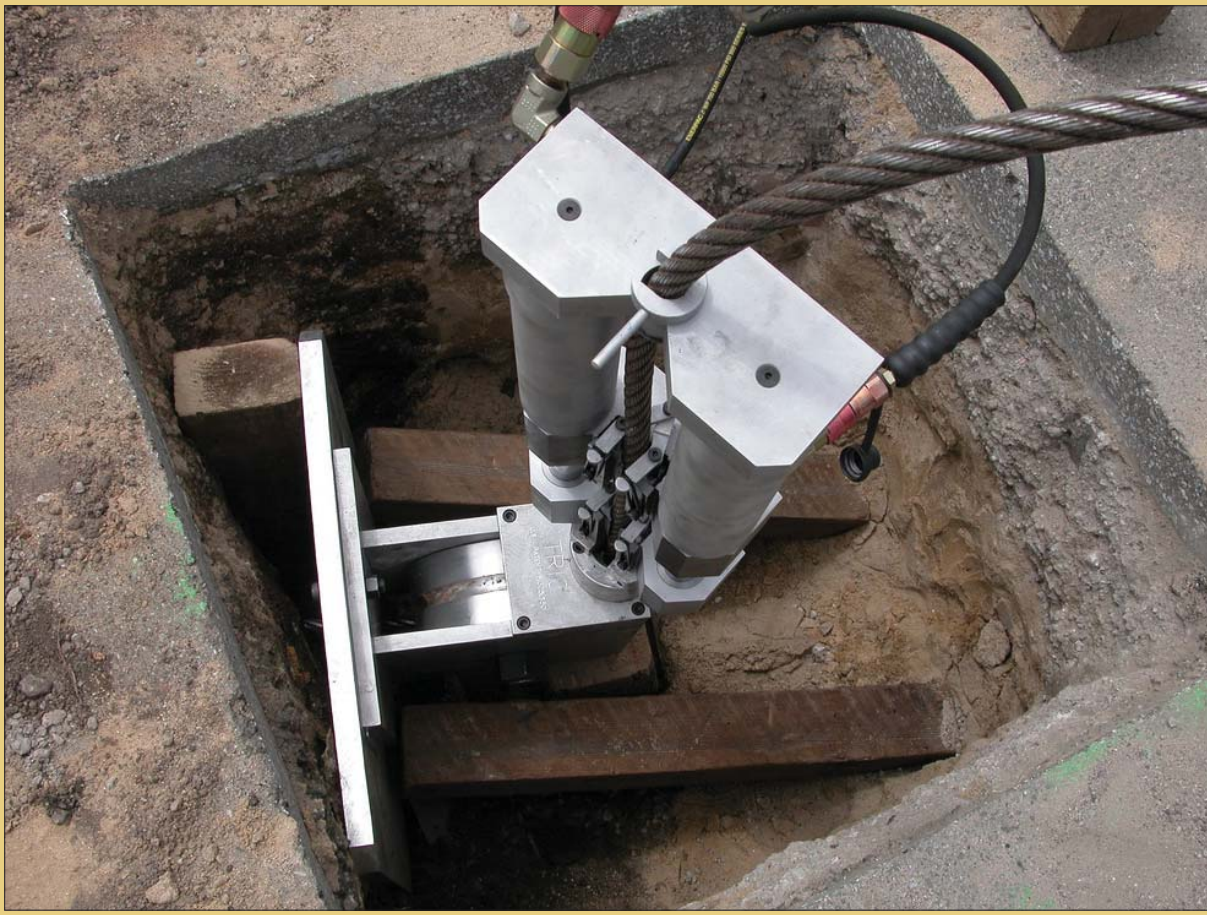
Pipe Bursting

Pipe bursting of laterals requires excavation of two small pits, e.g. 2 ft by 4 ft (the pit size depends on the pit depth). The length of lateral bursting is typically no less than 20 ft or else open-cut replacement is more suitable. The method is not suitable if there are many sharp bends in the pipe. Most systems in the market can pass through one or even two 90-degree bends (cutting through the soil and installing the replacement pipe with larger bending radius than it was originally), but with more bends separate bursting setups must be made.

The preferred replacement pipe is an HDPE pipe, which is typically supplied in 20 to 40 ft lengths and fused onsite to the desired length. Alternatively, the pipe can be supplied in long lengths coiled on reels and simply cut to size in the field. An increasing number of plumbing and building codes in the United States approve this pipe for lateral bursting, but other pipe types such as ductile iron

or PVC pipes can be used if necessary or preferred.

With lateral bursting, pipe cleaning/roots removal is not needed unless pulling the cable through the pipe is hindered and then it is only needed to a minimal extent. The method is suitable for structurally damaged laterals on the verge of collapse. In fact, "the worse the structural condition of the lateral, the easier to burst."



Lateral bursting is suitable for structurally damaged laterals on the verge of collapse.

Lateral bursting has an advantage of installing a brand new pipe, upsizing is possible (one pipe size typically) although the hydraulic capacity is usually not an issue with private sewer laterals, minor sags can be eliminated, no chemicals are used and roots are not be likely to be an issue in the future as the replacement pipe has no joints. Disruption of service to homeowners is relatively short (up to one day) but access to private property is required and may be an issue. With lateral bursting, more excavation is required compared to other trenchless rehabilitation methods and there is risk of damaging nearby objects and surface objects when bursting at shallow depths.

Lateral Chemical Grouting

Lateral chemical grouting is usually performed from the mainline to seal the lateral connection with mainline and the first 1 to 6 ft of the lateral although much longer bladders (up to 30 ft long) are available. Chemical grouting can also be performed along the entire length of lateral, in 3- or 5-ft increments starting from the cleanout. In either case, a test-and-seal procedure is applied. Different types of grouts may be used (e.g., Acrylamide, Acrylate, Acrylic resins, Urethane gels) but Acrylamide grouts are used the most widely in the United States. Optional additives to chemical grouts can add protection against freezing and drying out (Ethylene glycol), inhibit root growth (Dichlobenil), increase compressive and tensile strength of the grout (Latex emulsion/reinforcing agent), etc.

Chemical grouting is the least expensive of all lateral rehabilitation options. The method does not provide structural repair, although it fills voids on the outside of the pipe stabilizing the soil around the structures.

This is a truly trenchless method as it requires no excavation at all. Duration of repair is very short, causing a minimal disturbance to homeowners. The repair requires a two-hour setup time and thereafter only 15 to 30 minutes per lateral along the same mainline.

Agencies have reported different performance (longevity) of installed grouts. In some projects, grout failures occurred approximately four to five years after the installation. However, in other projects, the grout remains in good condition 10 years after the installation (e.g., South Fayette Township Municipal Authority, Pa., where chemical grouting, typically 8 ft into the lateral, has been utilized quite extensively since 1997).

Flood Grouting

Flood grouting is a geotechnical method of sealing manholes, mainlines and laterals simultaneously in one setup. Two proprietary chemical solutions are consecutively applied to "flood" an isolated section of

sewer and exfiltrate through defects in pipes and manholes into the soil, where they chemically react with each other. The cured grout with the soil aggregate creates a watertight, sandstone-like silicate envelope around the leaks.

The method does not claim to provide structural repair but improves the bedding and the soil around the pipes and manholes. The method eliminates infiltration and exfiltration and is the most suitable for rehabilitation of structurally sound sewer systems with sources of I/I "everywhere." Flood grouting has the advantage of stopping biogenic sulfur corrosion and preventing future root growth into the sewer. The chemicals used are environmentally friendly, and are reusable and storable.

With flood grouting, disturbance to homeowners is small. All work is performed in the street and entering private property is needed only for plugging the laterals (the cleanout is required on each lateral near the house and must be installed if missing). The laterals remain out of service for about eight hours.

Robotic Repairs

Robotic repairs provide a full structural repair of the damaged connection between the mainline and the lateral and form a sealing collar of material around the pipe thus stopping infiltration into the sewer system. The method stabilizes the soil envelope around the pipe thus eliminating any infiltration in the future. Different resins can be used, depending on the system (e.g., silica-based resin, epoxy resin).

Robotic repairs extend a short distance into the lateral (e.g., up to 24 in. for the system that uses a silica-based resin). A cutting robot positioned at the lateral opening in the mainline is used to remove a small portion of the lateral pipe (e.g., 2 in. of its entire circumference and any damaged portion of the lateral pipe wall) and a resin is injected under pressure to penetrate into the soil and voids behind the pipe and fill pipe cavity removed during cutting. Resin can be injected in the presence of high groundwater infiltration.

Robotic repairs do not require cleanouts, as access to the lateral connection is entirely through the mainline. The duration of repair is short (approximately 1.5 to two hours per lateral). Robotic repairs have been used quite a lot in Europe, Australia and the Far East but were not significantly pursued in the United States until recently. Consequently, a pool of qualified contractors in the United States is limited at this time.

Jadranka Simicevic is a research engineer at the Trenchless Technology Center at Louisiana Tech University, located in Ruston, La.

For more information visit *www.trenchlessonline.com/info*

Dual Lateral Lining Projects Successfully Rehab Tacoma Sewers

By Leanne Butkovic

Since the early 1990s, it's been no secret that the sewers in Tacoma, Wash., had some problems with inflow and infiltration (I/I).

"Throughout the city, we'd been doing a lot of metering, so we knew that we had some serious I/I issues that were affecting our capacity at the plant," says Rod Rossi, an environmental specialist with the City of Tacoma.

The City of Tacoma had been taking aggressive approaches to reducing I/I and overflows for years, including smoke testing, implementing a mainline rehabilitation program, roof drain redirecting and removing direct storm water connections in the right of way. Still, there was a problem. The City eventually pinpointed privately owned side sewers as the major contributor to its I/I issues.

Made of mostly concrete and dating back to the early 1900s, the pipe was clearly in bad shape. It was then when the City of Tacoma decided to replace the residential pipe laterals in two of the wettest city basins, the second larger than the first, to see if the I/I could be reduced. Both experiments were done with in-house crews so as to keep tabs on all project aspects. Tacoma decided on Perma-Liner and its air-inversion lining method, as the company would be able to assist them on their ventures.

Where was the logical starting point from there — securing city funding. The team had to rationalize funding the replacement of the side sewers on private property.

"We were able to do it on private property and not have it considered a public gift because we were doing it for informational reasons. We were trying to garner what kind of infiltration we could eliminate by doing this, so that's how we were able to justify the expense," recalls Rossi.

After funding was approved, the team lobbied to the residents their case of providing a free, necessary service in their mailboxes and front door handles. Astonishingly, a sizable amount of locals, it seemed, were not interested in the city's assistance.

"We were trying to give people a free side sewer, and we had probably 25 to 30 percent after numerous mailings, door hangers and everything else that we just never got a response from [on the second project], which was a little bit surprising," Rossi says. From the sample that did respond, some disputes arose with the coordination process, including getting people to sign a release form to work on private property and scheduling a convenient time for the homeowners since many wanted to be present for the job.

Once the technicalities were in order, the City began on their endeavors to claim control of I/I. The process for both projects was the same: Each began with pre-flow monitoring during one wet season, followed by a pre-inspection of the residential laterals via CCTV. The camera was used to identify the side sewers' horizontal and vertical location, any horizontal and vertical bends, the pipe

size and type and the condition. The inspection for Phases I and II took one month and two and a half months, respectively. At an average of lining two laterals a day, the projects had an efficient three-part team in place.

"We had one crew that would go out and do the prep work, as far as digging down to the lateral. We had a second crew that would actually do the lining, and a third crew that would install the cleanout and do the landscaping rehabilitation," Rossi explains.

The first task force would dig one small pit at the transition point, which was usually in the planting strip. After the pit excavation, the same crew would clean each side sewer and re-inspect the line to make sure that all the debris had been removed.

Next, the two-part resin of the liner was mixed and rolled up into an air-inversion machine. Once it was ready, the liner was inserted into the existing side sewer by lining up the air-inversion machine with the existing side sewer. The air-pressure was raised to 15 psi and the liner was released. The resin curing followed. A calibration tube was reeled into the air-inversion machine, the machine was again lined up with the liner and the calibration tube was inserted into the side sewer. The tube was clamped off from the air-inversion machine. A cap was placed on the end of the calibration tube and an air tank was hooked up with the pressure to 10 psi. The clamp was then released while making sure the calibration tube was holding pressure. Once the pressure was set, the crew moved on to the next site. After two to three hours, the crew would return to check the liner. If the liner was cured, they would remove the calibration tube and reconnected the side sewer. A cleanout was installed at the transition, and there was a final inspection through CCTV with no problems found.

Aside from two laterals curing too quickly in the sun on especially hot days, the crews faced few problems.

Though completed at different times and in different magnitudes, both projects yielded similar positive results. The first project rehabilitated 69 sewers out of a potential 159 homes for 2,600 lf of 4-in. lining installed and took three months. The second sampled a larger basin with 229 sewers fixed out of 518 investigated homes for 12,824 lf of the same 4-in. lining and took nine months. Phase I of the project ended in a 27 percent reduction of I/I, while final percentage effectiveness from Phase II is still being evaluated.

Currently, the City of Tacoma does not have an annual lateral rehabilitation program, but the type of work is becoming increasingly more popular with private companies in the area, Rossi says.

Leanne Butkovic is an editorial assistant for *Trenchless Technology*.

California Company Uses Clean Approach to Lateral Replacement

Lateral Bursting Saves Time and Money

By Greg Ehm

Lateral bursting is cleaner, eliminates open excavation and significantly reduces restoration costs.

Replacing lateral sewer lines can be a dirty job, involving a tremendous amount of restoration work for the contractor and home or business owner. This can become more challenging when you're dealing with homeowners who have invested tens of thousands of dollars to landscape their property.

That's what Bobby Williams with Williams Brothers Plumbing/Oak Drain Service deals with every day in Thousand Oaks, Calif. Thousand Oaks, incorporated in 1964 and known for being a planned community, is one of few cities that have actually stayed with the master plan. Located northwest of the Greater Los Angeles area, Thousand Oaks is home to about 117,000 residents and some of the most expensive homes in the region with a median home value of $565,771.

This makes William's job of replacing sewer laterals even more complicated.

"Out here, people will spend up to $100,000 landscaping their yard with trees, plants, rocks and concrete," says Williams. "These are exquisite landscaping jobs and you just can't go through there and tear up their landscaping using the traditional open-cut method — it would cost the homeowner a fortune to restore their landscape."

Thousand Oaks is known for its mature oak trees that are more than 50 years old on average. The trees are protected and monitored by the city and environmental groups. Therefore, contractors aren't allowed to dig underneath the tree canopy for fear of causing permanent damage to the root structure. While the trees are an asset to the community, root infestation is responsible for 90 percent of the sewer laterals Williams replaces.

That's why Williams turned to lateral sewer line bursting in 1998. The process is just cleaner, eliminates open excavation and significantly reduces restoration costs.

"Lateral bursting saves us time and money," Williams says. "We can replace a sewer lateral in half the time with half as many people on a crew. This significantly reduces our labor and workers' compensation insurance costs. Plus our employees are skilled plumbers and making more money per man compared to less skilled workers."

New Approach

Williams' company is one of the few in the area to adopt lateral bursting. A number of other companies are using the sock method. But when Williams looked into the sock method, he found a problem.

"Every time I watch a company use the slipline or sock method, they come up short by 4 or 5 in. and the sock doesn't cover the connection at the street," Williams says. "Ninety percent of the time the root infiltration occurs at the connection in the street where the main and lateral lines come together. Basically that homeowner will address sewer backup in their home again within 18 months."

While lateral bursting is a much less intrusive replacement process compared to open-cut replacement, Williams takes it one step further.

"We use a Vac-Con hydro-excavation vacuum truck to dig our pits at the main connection," says Williams. "The vacuum allows us to more efficiently dig our pits vs. using a compact excavator, plus we don't leave a pile of unsightly dirt in the street or the homeowner's yard."

Before Williams began using the hydro-excavation vacuum, his crew would arrive at the site with a compact excavator and excavate the pit in the street. The dirt would be piled in the street or on the lawn and the pit covered with a 4- by 8-ft steel plate. Today, the vacuum is used to create an 8-ft deep pit that measures 2.5 sq ft. The bottom of the pit flares out for easier placement of a HammerHead PB30 lateral bursting unit. The PB30 is powered directly from the vacuum truck hydraulics. With the extra hydraulic flow, the PB30 pulls pipe at about 9 ft per minute so if Williams is pulling 60 or 100 ft, the operating cost difference is negligible.

Once the pit has been excavated, the unit returns to the Williams yard and the dirt is poured out into a pit for drying. Dry dirt, pulled from a job two weeks earlier, is loaded into a truck and brought back to the site to backfill the pit once the project is completed.

The whole process takes about six hours from start to finish," says Williams. "Not to mention we don't have problems hitting utilities when using a vacuum."

Williams also stresses that the homeowner benefits by a lower cost to complete the project and in some cases it can be up to 50 percent cheaper than open-cut methods.

Attracting an Audience

According to Williams, lateral replacement work is pretty routine and he doesn't typically run into many unusual projects. However, one project required some innovation and negotiation with the city.

Williams was hired to replace a lateral in the Simi Valley, Calif. The only problem — the canopy of a 60-year-old oak tree covered the entire yard and part of the street.

"The city code states that we cannot excavate or even work under the drip line of a tree," says Williams. "In this case, the drip line stretched from the edge of the house to the middle of the street, causing us to rethink our plans. But we had no option other than going directly under the tree canopy."

Williams worked with the city and explained the lateral bursting method and asked for special permission to pull the line directly under the tree canopy. The city issued the permits and was on hand to oversee the process.

"The day of the replacement, four divisions of the city, as well as a number of environmentalists were on hand to make sure we did not harm the tree," says Williams. "I was pretty nervous and worried about the project stalling midway through the burst. But the project was completed with no problems and everyone seemed pleased."

Williams does everything he can to plan each lateral replacement, but unforeseen challenges present themselves on every job.

"We run an efficient operation and our HammerHead lateral bursting units are important to our success," Williams says. "The power and speed of the units is key especially when you have an expensive bunch of guys sitting around watching this thing pull. I know the HammerHead unit is pulling two or three times faster and we're saving time and generating more profit every day."

Greg Ehm is a technical writer, based in Des Moines, Iowa.

Lateral bursting is a much less intrusive replacement process compared to open-cut replacement.

Trenchless Lateral Rehabilitation with

Chemical Grouting:

Doing it Well, Doing it Right!

By Marc Anctil

Chemical grouting of sewers has been used to stop infiltration and exfiltration in collection systems for more than 50 years. As one of the first trenchless and few available technologies of the time, it was often considered as a "fix all" approach and thereby misunderstood by owners and specifiers.

Chemical grouting will not provide you with a new pipe but it will — in structurally sound pipe — stop infiltration of groundwater and fines into the system and exfiltration of sewage. Chemical grouting of lateral connections from the mainline made its debut in the early 1990s and has been growing in use ever since as the awareness of laterals contributing in great portions to the clear flow of water is being observed from this portion of the system.

Often misunderstood, chemical grouting is not used to fill the joint, but actually uses the defects of the pipe as a pathway for the grout to be pumped beyond this point and out into the surrounding soil or bedding forming a cohesive watertight collar around the structure. This is still misunderstood today as some people believe that the internal grout ring is the seal. This internal grout ring is actually residual material from the "grout mixing chamber." The external grout ring is the permanent seal.

Work is being done all across North America where lateral connection grouting is an integral part of grouting and lining projects. In many cases the bid documents call for "Lateral Grouting of the Connections" without referring to any or brief specifications, grouting distances, testing or grouting pressures, approved materials, mixing ratios or volumes, gel times vs. pumping rates vs. voids etc. This leaves little room for the contractors to understand what is requested of them and what the system owners are obtaining in return.

A Successful Chemical Grout Project

In order to increase the chances of obtaining a successful project the following points should be considered:

- Have good specifications and defined objectives (see ASTM & NASSCO).
- Have a knowledgeable operator and inspector
- Preparation work (well documented CCTV inspection reports) cleaning, root and grease removal, etc.
- Grout mix must take into consideration that the first few gallons of grout may be diluted by active infiltration.
- Grout gel times must be appropriate (depending on the volume of the void between the packer and the

pipe vs. the pumping rate) in order to exit the pipe defects. Premature gelling of the grout may plug up crevices and prevent the grout from exiting the pipe defects.

- Pump until refusal (refusal can be defined as a sudden spike in the void pressure under continuous pumping with the above conditions respected). Always monitor the void pressures (testing and grouting).
- Volumes of grout pumped should be paid as a separate item as no one can predict the actual amount of grout necessary to permanently seal the defects (the specifications should allow a certain volume of grout to be included in the bid tab and any supplemental volumes be paid at a predetermined rate). This serves as an incentive to pump enough grout to obtain a permanent seal without penalizing the contractor.
- A post-grouting air test and or visual confirmation of the sealed leak should be an integral part of the work being performed.
- Test and seal log must be handed in and be part of the job report.

Over the years it has become standard practice in many cities across North America to grout the lateral connections after lateral reinstatement (post-sewer relining). Some cities have adopted an even more proactive approach and request not only that the lateral connections be grouted but also the first 6 ft of the lateral.

Some grouting projects have pushed the envelope even further to seal laterals as far as 20 and 30 ft from the connection. These projects were well defined in their approach and have established bench marks for future projects.

No other rehab process is as versatile as chemical grouting, as it is not dependent upon mechanical bonds or pipe shapes, all it needs is a defect so that the grout may exit the pipe and seal it from the outside of the structure.

As the technology is beginning to be better understood by system owners and specifiers, more defined projects are hitting the streets. Recent ASTM standards are being used for more test-and-seal projects around the country and are gradually gaining acceptance within the engineering community .

A few years back, a group of grouting equipment manufacturers and grout providers saw the need to educate and train users. They decided to get together to form the "Grout Boot Camp" to educate and train operators, inspectors and municipal users on the different techniques and equipment to do it well and do it right and understanding the components of the system enabling them to troubleshoot and increase productivity. Attendees — more than 150 — have either been long-time users, rookies, municipal users, inspectors, business owners wanting to learn more about this proven technology and the equipment used in delivering the grouting materials.

Not one technology solves all the problems that can be encountered in the underground. There are different tools for different situations and when the tools are better understood, they can be used more effectively for a successful project.

Marc Anctil is president of Logiball Inc., which is headquartered in Jackman, Maine.

Lateral Lining Helps to Rehab Michigan City's System

By Kristina Kiest and Rick Gage

Many municipalities throughout the world possess an aged underground infrastructure that is more than 100 years old and in desperate need of repair. These conduits under the earth are also referred to as "buried assets."

Most of these assets are owned by municipal or private funded agencies; however, you, the homeowner, own many of these buried pipes. Failing pipes can and have caused sink holes, outbreaks of infection because the sewage was not effectively treated before re-entering our waterways and of course sanitary sewer overflows due to blockages caused by root intrusion, grease build up and soil collection through voids in the pipeline.

Cured-in-place-pipe (CIPP) was invented to address the rehabilitation and renewal of these buried assets without the means of conventional, costly and sometimes dangerous excavation. In turn, municipalities and the world have received technologies that can address the collection system in a safe manner and at a much faster rate, removing an agency's liability while simultaneously returning service back to normal sooner than technologies of the past.

Advancements in trenchless technologies has led to two major innovative systems: installation of an outside cleanout without conventional digging and man-entry; and CIPP main-to-lateral connection lining, which is being utilized worldwide to structurally rebuild the connection and seal off groundwater infiltration while simultaneously renewing the lateral pipe.

Young's Environmental Cleanup Inc., Flint, Mich., is a certified applicator of these two technologies, as well as the rest of the processes offered by the technology provider, LMK Enterprises Inc., Ottawa, Ill. Young's Environmental was able to incorporate these two technologies to successfully complete a trenchless renewal project in Waterford Township, located in Oakland County, Mich.

This government-funded project was managed by the Oakland County Drain Commissioner's Office, which specified the rehabilitation of laterals and mainline connections by using trenchless technology whenever possible. This particular subdivision's sewer system was probably not much different than most of the collection systems across the world, as they were impacted with roots that required extensive

cleaning and preparation before trenchless renewal could take place.

Young's Environmental has been a certified licensed installer of LMK's processes since 2007, using its CIPP main-to-lateral lining system, T-Liner, which is 100 percent compliant with the lateral standard, ASTM F2561. The installations of outside cleanouts were also specified, so Young's Environmental utilized another system offered by LMK called Vac-A-Tee, which allows for the installation of an outside cleanout without digging and man-entry. Hydroexcavation technology was used to expose the lateral pipes once located with a sewer camera and sonde. Once the pipe was exposed, the cleanout riser pipe was solvent welded to the PVC saddle, called Vac-A-Tee, then a specific adhesive was applied to the underside of the saddle and it was snapped over and adhered to the crown of the lateral pipe. After properly verifying a non-leaking connection, the crown of the lateral pipe was cored allowing for lateral access upstream towards the house and downstream toward the city mainline pipe.

Young's Environmental successfully and structurally renewed 143 main-to-lateral connections, as well as their laterals in the Huron Gardens subdivision. Oakland County project engineer Sid Lockhart said, "This area was chosen because Waterford Township sanitary sewer meter data reflected increased flows after rainfall."

These laterals were mainly chosen to reduce infiltration and inflow (I/I) while simultaneously restoring the structural integrity of the connections to the main and the lateral pipes.

Young's Environmental vice president Kris Thiel expressed his concerns on the job: "The system was old and the laterals were heavily impacted with roots and needed extensive cleaning and preparation for the acceptance of CIPP lining."

Young's Environmental proved to be successfully productive by averaging more than four CIPP main to lateral installations per day. The average lateral length was approximately 30 lf that consisted of bends and transitions. "The neighborhoods we were working in were smaller with tight confinements and short right of ways where the mainline sewer ran down the middle of the streets," said Thiel.

"The biggest concern was that this was Young's first major CIPP project using T-Liner and everyone questioned our experience and ability to perform. Past success and experience with the engineer and owner on other projects helped, and once we got rolling into this particular project, there were no issues or questions about our ability to complete the project successfully and on schedule. There were many laterals with transitions going from 6-in diameter to 4-in. diameter piping and sometimes those transitioned from clay to cast iron pipe," Thiel continued.

Young's Environmental successfully lined 53 transitional laterals. "Good lateral preparation and accurate liner measurements allowed for successful installations. It also helps that LMK manufactures transitional CIPP lining tubes that are also engineered to negotiate pipe bends," said Thiel.

Young's Environmental installed 132 cleanouts utilizing a Vac-A-Tee system, installing an average of five cleanouts per day. These cleanouts provide a key access point when it comes to lateral lining. Lateral access through an outside cleanout allows the construction crew to verify that the pipe is a candidate for lining, effectively clean the pipe, verify pipe measurements and identify pipe diameter changes. When it comes to lateral lining, the cleanout is used for proper line up of the main to lateral CIPP lining at the connection by use of a lateral push camera. This camera is also used to visually verify that lateral lining has been properly installed. Should there be excessive resin at the end of the lateral lining that did not get displaced into open joints and voids a vacuum is used to remove the resin while it's still in liquid form. Since the cleanout is a Tee, a lateral plug is inserted upstream to reduce risk and failure prior to lining by ensuring the homeowner isn't allowed to mistakenly flush water during liner insertion. The plug also plays an intricate role in the production process as steam mixed with air is used to effectively cure the thermoset resin. The lateral plug prevents this steam from going into the house and forces it to exhaust up the riser pipe. And lastly, should the homeowner phone the city that he/she have a drain issue, a technician can be deployed to inspect the lateral through the outside cleanout.

"The collective goal of the Oakland County Drain Commissioner's office, Waterford Township and Johnson & Anderson Inc. was to maximize the reduction of infiltration and inflow," said Lockhart. "This technology allows for a long-term structural solution and the reduction goals to be accomplished without major disruption or restoration. We have been very satisfied with the outcome of the project and with our contractor's performance. Residents had very few complaints and positive results are expected in our flow measurement analysis."

Good education is an excellent way for engineers and contractors to make the best decisions in regards to products and processes to use. Thiel's opinion as to why a municipality would or should consider CIPP main-to-lateral lining vs. dig-and-replace is this: "The obvious reason in most cases is the savings in cost to install a lateral liner vs. dig-and-replace. CIPP is a much more socio-economical process because there is minimal disruption and no restoration for the homeowners to complain about. Other buried utilities stay where they are without fear of disruption, which can be very risky business."

He noted that "Most municipalities are now identifying that mainline and manhole rehabilitation is not enough. So now it is up to us to educate them and specifying engineers in regards to which main-to-lateral renewal systems incorporate the most effective technologies, the longest term repair and the best value for the money spent."

Lockhart added, "I have often wondered why someone would open the door for potential complaints and problems by using open-cut methods when most laterals could be lined and the problems eliminated. There will always be a few laterals here and there that will need to be excavated. A major amount of the laterals on our project were lined around bends, in various depths and through transitions with good results. Of course we will monitor this project for years to come to make sure it is a long lasting solution, but for now our office is very satisfied with the results."

Kristina Kiest and Rick Gage are with LMK Enterprises.

Lateral Assurance for the Homeowner

LineSaver Program and Trenchless Technology: Helping Municipalities and Homeowners

Municipalities offer the LineSaver Program to help homeowners with expensive service line repairs.

Municipal water utilities throughout the United States are challenged to continually repair and upgrade their aging infrastructure to meet U.S. Environmental Protection Agency (EPA) requirements while maintaining their budgets.

They are also challenged with the fact that most residents don't realize they are responsible for water and sewer line repairs on their property and that homeowners' insurance usually doesn't cover this expense. Although advancements such as trenchless technology can lower restoration costs and impact to a customer's yard, when a problem (such as a leak, break or blockage) occurs, residents are upset, financially unprepared and challenged to find a qualified plumber. Some homeowners even delay the repair, which causes water loss to occur before the water is registered on the customer's meter, resulting in unrecoverable water and revenue loss to the municipality.

For these reasons and more, municipalities are offering their residents the LineSaver Service Line Protection Program administered by American Water Resources Inc., a subsidiary of the nation's largest water company, American Water.

LineSaver provides peace-of-mind coverage to homeowners before an emergency happens, while providing municipalities with a revenue opportunity that can be used for infrastructure improvements or other community enhancements.

How the Program Works

Homeowners can shield themselves from the high cost of covered repairs and receive professional service by local plumbers that meet state and local codes.

Michael Abram, contractor network supervisor for American Water Resources, believes the LineSaver Program is a win-win for municipalities and their residents.

"Before joining American Water Resources, I had 25 years of experience as a public works director in two different municipalities in the Midwest, and I wish we had this program," he says. "It's a real hardship for people to have to suddenly pay thousands of dollars for repairs, especially for something they didn't even know was their responsibility."

"Having LineSaver makes a huge difference for a family when faced with a water emergency. It is a tremendous relief to people when they have an incident and they hear us say, 'don't worry, it's covered,'" Abram said.

Using Trenchless Technology

Many customers are also relieved when they hear their service line repair can be made using trenchless technology. Abram is a major advocate for using this method whenever appropriate for pipe bursting and pipe and lateral lining, citing the tremendous customer benefits.

"Customers are happy when we're able to use trenchless technology because it enables us to only dig around the source of the problem instead of having to dig up their entire yard," he said. "Besides saving them from having to restore what could be large portions of their landscaping, gardens and even trees, it also saves them from the trauma of seeing their property torn up, especially at a time when they're already upset from the actual service line problem."

Abram also noted that using trenchless technology is both faster and more cost-effective.

The Benefits for Municipalities

Informing homeowners of their water and sewer line responsibilities may be perceived as presenting them with "bad news," but the alternative is much worse. Residents who are unaware of this responsibility usually learn about it during a water emergency, which can cause frustration, anxiety about being able to pay for the repairs and often prompts complaints to municipal officials.

"When municipalities take the proactive approach of educating their homeowners and businesses about their service line responsibilities, and then extend to them this valuable program as a low-cost, practical solution, it goes a long way toward maintaining a positive relationship with residents," says Sharon Cameron, president of American Water Resources.

At no cost to the municipality, the experts at American Water Resources fully manage LineSaver, and take care of all the requirements for developing and implementing the program — from establishing a local contractor network and managing 24/7/365 customer service and incident response, to educating the community about the service and performing all covered repairs. There are no new taxes, no capital investment or budget increases required by the municipality.

Since the inception of the Water Line Protection Program in 2000, the Sewer Line Protection Program in 2003 and the In-Home Plumbing Emergency Protection Program in 2005, American Water Resources now oversees more than 700,000 residential contracts across the country.

Cameron said, "American Water Resources is an experienced user of trenchless technology and we are uniquely qualified to meet the fiscal and operational needs of municipalities. Our customized programs yield high customer repair satisfaction ratings, so municipal officials can be assured that homeowners are pleased with the service."

* *In California (DBA as American Water Resources Insurance Services) and in Virginia, this program is insurance, which is provided by Virginia Surety Co. Inc.*

This article was submitted by American Water Inc., and edited by Trenchless Technology.

For more information visit *www.trenchlessonline.com/info*

Lateral Line Root Intrusions

Effects on Municipal Sewer Systems

By Adam Meisner

"Pipeline root intrusion is the single most destructive element involved in maintaining a wastewater collection system."
—U.S. Environmental Protection Agency

Roots intrude in the laterals, as well as sewer lines.

This quote by the United States Environmental Protection Agency (EPA) shows that sewer line root intrusion is the most destructive problem facing our municipal sewer systems today. But main sewer line root intrusion isn't the only factor causing problems for the municipal collection departments.

Lateral sewer line root intrusion can also have an effect on the main sewer line flow, causing problems for municipal collection crews. Whether your municipality is responsible for the right of way or not, municipal sewer departments are the first call a homeowner with a root blockage is going to make. These calls cost the municipality time and money to investigate.

Left untreated, roots will spread throughout the pipe. Material passing down the drain gets trapped in the roots, restricting the flow or even causing a complete blockage. Root intrusion can eventually destroy the pipe's structural integrity, costing cities hundreds of thousands or even millions of dollars to repair or replace.

The Cause

In fact, sewer lines offer nearly ideal conditions for root growth. They offer an unlimited water supply, an unlimited air supply and a constant temperature.

Roots follow vapor trails that are present in the loosely cultivated soils surrounding sewer lines. These vapor trails are created when the warmer flow in the sewer line produces condensation on the outside the pipe. This condensation evaporates through the surrounding soil, producing vapors that the growing roots follow back to the sewer pipe.

A related variable is the distance between trees and sewer lines. In rural communities, tree roots typically extend to just outside their drip line, which covers the soil around a tree directly under the tips of its outermost branches. The closer a tree is to a sewer line, the more likely the roots will enter the pipe. By the same token, pipes located farther away from trees are less vulnerable to root intrusion. This characteristic of trees is different for more urbanized areas. Historically the roots would find all of the nutrients they needed as rains were absorbed into surrounding soil. But construction of our streets, driveways and sidewalks has changed the amount of water that's directly absorbed by the soil. Now the nutrients aren't being replenished into the soils, so the roots are finding those nutrients within the sewer system.

The Effect

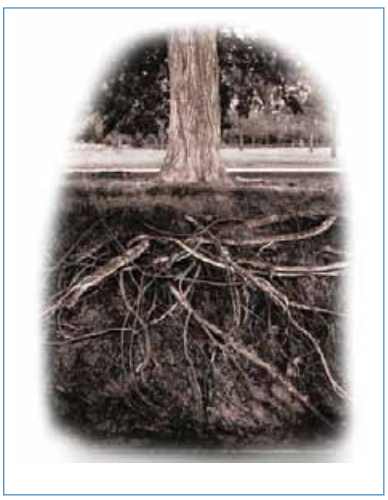
When roots grow into a service lateral, it takes a shorter amount of time for that line's flow to become interrupted. This interruption usually results in your municipal collection crews being called to survey the situation. This will result in the city spending time and money investigating the interruption, and possibly fixing it if it's deemed the cities responsibility.

Roots growing into a lateral line don't always stop when they reach their source of nutrients. Sometimes they will continue to grow down the sewer line and into the main sewer line. This growth into the main line provides an area for debris flowing down the sewers to get caught up, interrupt flow and eventually become a backup. This interruption can lead to an expensive overtime emergency call for your crews or overflows involving costly clean up.

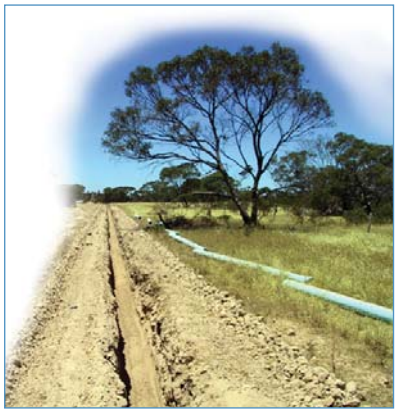
Now because roots grow by adding on a cell to their tip, they will penetrate the smallest of openings. Many times that means that they will grow into what you and I may consider a pin hole. Once they've entered a pipe they will continue to grow and expand, creating cracks and separations in the pipe. These roots will continue to grow and spread until action is taken to remove them from the line.

The Solution

There are a few different methods of root removal that can be used by your municipal collection crews or the homeowners responsible for the



Trees while pleasing to the eye above the ground, create havoc underneath it.

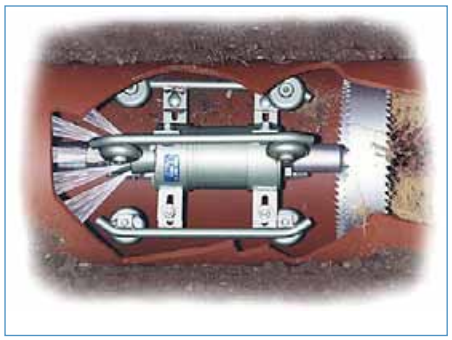


When roots grow into the service lateral, it takes a shorter amount of time for that line's flow to be interrupted.

lateral line. The first of these methods is mechanical root removal.

The best thing about mechanical cutting is that it cuts through the obstructing root mass, immediately restoring the natural flow of the sewer line. That's why it's the first choice used when there's a sewer line backup. The backup can be opened up right away, and the overflow can be stopped, or further overflow can be avoided.

However, even the best mechanical cutters can't remove 100 percent of all the roots in a sewer pipe. Worse yet, plants secrete a hormone called abscisic acid when they are cut back and damaged. This hormone causes the roots to grow back quicker and thickens the re-growth. It's because of this natural plant process that mechanical cutting must be done repeatedly with smaller intervals between future cuttings. Eventually, the continued growth and thicker root masses will create larger cracks and openings in the sewer pipe. Over time, this will damage the integrity of the line. Once the structural integrity is diminished enough, you'll have more access points for future root intrusion and a greater chance for problems like collapsed pipe, inflow and infiltration.



Mechanically removing the root from the lateral is one way to address the problem.

Because cut roots grow back so quickly, mechanical cutting is often combined with chemical root control. Mechanical cutting removes the immediate blockage, while chemical herbicides kill the remaining roots, helping to keep sewer pipes clear longer than with mechanical cutting alone.

Chemical herbicides kill roots by destroying the root tissue. They are non-selective, killing any roots they come in contact. Dead roots decay naturally and are carried away by the flow of the line. Some herbicides also prevent roots from growing back.

Because of the time and cost involved in inspecting lateral lines, there has been a change of thinking for those municipalities that are responsible for the right of way. Some cities have started installing cleanouts at the property line to better define homeowner and municipal responsibilities. This cleanout also serves as an easy access point for municipal collection crews to maintain the right of way. In doing that, they can cut out any main line blockages coming from the lateral line and chemically treat to those small lateral line sections to prevent further blockages.

So although roots growing into lateral sewer lines can cause interruptions in the flow of the main line sewer system, there are steps that can be taken to take lateral line root treatment from reactive work, to proactive preventative maintenance.

Adam Meisner is a root control specialist with RootX, which is based in Salem, Ore.

By Coliins Orton

Lateral Replacement in Santa Rosa, Calif.

The City of Santa Rosa, Calif., is facing the same problems that cities throughout the United States are facing: A deteriorating wastewater collection system and the need for more funds to be able to make needed repairs. The challenge at hand is how to upgrade and repair the system while remaining socially and fiscally responsible.

The City of Santa Rosa has been actively working to mitigate the effects of inflow and infiltration (I/I) for many years and has developed a significant lateral pipe bursting program to combat the problem.

Santa Rosa is the largest city north of San Francisco to the Oregon border and has strict regulations. All agencies are under scrutiny regarding sanitary sewer overflows and I/I and are working toward a solution. The City of Santa Rosa Utilities Department has been spending about $12 million a year on replacement and hopes to double that in the next five years.

The city, through an extensive main rehabilitation and replacement effort, replaces laterals in the public area from the city sewer main back to the property line. The City of Santa Rosa Utilities Department, city engineers and operations staff, have researched and applied numerous construction technologies, including trenchless technology, to facilitate the repair or replacements of aging pipe. The latest focus of their effort is sewer laterals and development of an in-house lateral bursting program to save time and money.

Inflow and infiltration is a two-tiered problem for many municipalities, including Santa Rosa, whose I/I crews operate two camera trucks every day and do smoke and dye testing. Inflow typically comes from a clean water source being illegally or improperly connected or flowing to the wastewater collection system. The city's inflow problems stem from a variety of conditions such as leaky manhole covers and uncovered cleanouts, private property rain downspouts or sump pumps and yard and foundation drains that are illegally connected to the sanitary sewer system.

Infiltration is primarily a seepage issue. Groundwater is the issue here, which infiltrates into the collection system through cracked, collapsed and just plain leaking pipes. This can be caused by any number of problems including age of pipe, pipe joint material, tree roots, cracked or deteriorating pipes or even seismic activity, which is partially to blame for some of the problems this city is having.

The wastewater collection system for Santa Rosa consists of more than 520 miles of pipe ranging in size from 4 to 66 in. in diameter. The older areas of Santa Rosa typically have sewer mains constructed of vitrified clay pipe (VCP) installed throughout the 1970s. Some VCP installed during that era is fairly brittle. That, combined with ground movement due to seismic activity, has promoted joint separation and cracks in the pipe. Root intrusion is also a problem, compromising the integrity of mains and laterals.

Lateral Replacement

The push to begin lateral replacement began long before the city actually purchased equipment and began bursting. The bursting program was being developed two years prior to equipment being purchased. Several lateral bursting machines were demonstrated before the bid was released. One of the other key items was local support from the bursting equipment manufacturer. After much review, the city ultimately purchased a lateral pipe bursting system and the program was put into place.

The city's asset management team incorporates a ranking system that looks at condition, performance and risk for each segment of its sewer system in order to develop a priority schedule for replacement. Once determined for replacement, the job is assigned to the field crews or the cured-in-place pipe (CIPP) team.

All of the city's operational staff is cross-trained to perform water and wastewater rehab and replacement. The city employs three general repair crews and two leak crews, as well as a weekend crew, since operations run seven days a week, nine hours a day, from 6:30 a.m. to 4 p.m. For lateral bursting, crews first identify launch and exit pits for the project. Pit sizes typically measure 5 ft by 5 ft. Once the pits are excavated, crews place the winch line through the existing lateral. At the launch pit side, the expander is connected to the first segment of new pipe, in this case high density polyethylene pipe (HDPE). The expander and pipe are then connected to the winch line.

At the exit pit, the winch line is connected to the hydraulic bursting unit. Once the hydraulic power pack connections are made, the bursting can begin. Crews can choose to fuse together the entire length of HDPE at once just prior to bursting operations, or fuse together segments during bursting operations. During the lateral bursting process, the expander, which is larger in diameter than the existing lateral, is pulled through the host pipe, breaking it apart and forcing the fragments into the surrounding soil. The new HDPE pipe is pulled into place simultaneously.

The property owner maintains laterals in Santa Rosa. But, at the city's discretion, and as a service to its customers, the city will repair or replace the portion of the lateral in the public right of way at no charge to the homeowner.

While the homeowners are ultimately responsible for the portion of the lateral that resides on their property, replacing the portion in the public right of way is helping mitigate the effects of I/I, while providing a customer service function. Being able to replace those laterals through trenchless pipe bursting saves time and money and lessens the impacts to the customers.

Collins Orton is a product specialist with TT Technologies.
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Dimple Marks the Spot

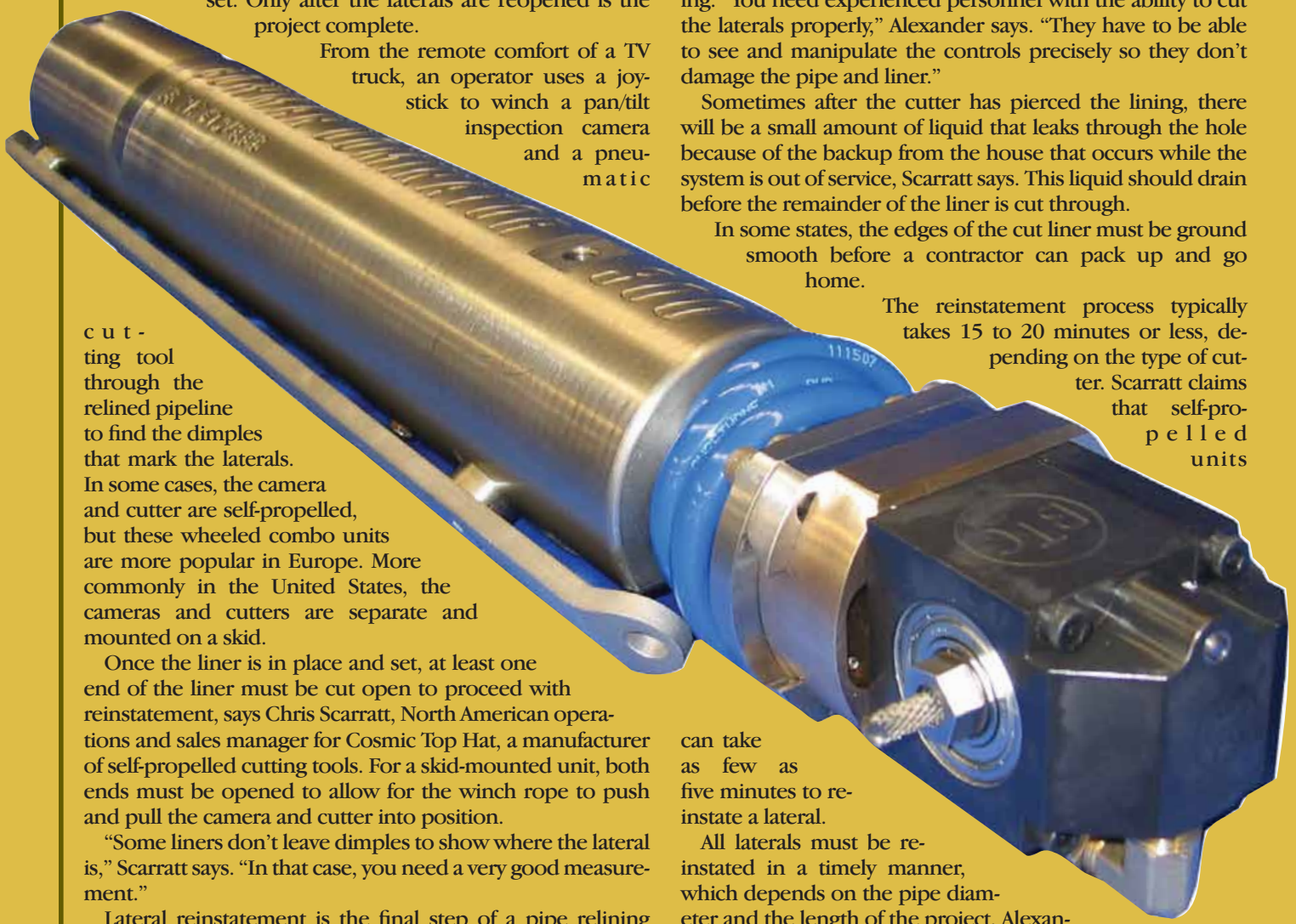
Lateral Cutters Complete Relining Projects

By Bradley Kramer

A water or sewer pipeline relining project isn't done until the customer can flush the toilet again.

During a pipeline rehabilitation project using cured-in-place pipe (CIPP) lining system, the service laterals are sealed as if they were just part of the pipe wall. The laterals create a dimple — or small depression — in the lining, which must be cut through once the lining has cooled and set. Only after the laterals are reopened is the project complete.

From the remote comfort of a TV truck, an operator uses a joystick to winch a pan/tilt inspection camera and a pneumatic cutting tool through the relined pipeline to find the dimples that mark the laterals. In some cases, the camera and cutter are self-propelled, but these wheeled combo units are more popular in Europe. More commonly in the United States, the cameras and cutters are separate and mounted on a skid.



Once the liner is in place and set, at least one end of the liner must be cut open to proceed with reinstatement, says Chris Scarratt, North American operations and sales manager for Cosmic Top Hat, a manufacturer of self-propelled cutting tools. For a skid-mounted unit, both ends must be opened to allow for the winch rope to push and pull the camera and cutter into position.

"Some liners don't leave dimples to show where the lateral is," Scarratt says. "In that case, you need a very good measurement."

Lateral reinstatement is the final step of a pipe relining project, but preparation for this last measure begins before the liner is ever put into the pipe, says Keith Alexander, president of Visu-Sewer Inc., a company that has been involved with pipe rehabilitation since 1988.

In the preparation stage, contractors should measure the distance to the laterals to ensure proper location in the event that the lining does not show the dimples where the laterals are. That way, the operator has two methods to locate the lateral: a visual method with the camera and a physical measurement.

Once the lateral location is determined, the operator pushes the cutter toward the dimple and grinds through the lining. "You need experienced personnel with the ability to cut the laterals properly," Alexander says. "They have to be able to see and manipulate the controls precisely so they don't damage the pipe and liner."

Sometimes after the cutter has pierced the lining, there will be a small amount of liquid that leaks through the hole because of the backup from the house that occurs while the system is out of service, Scarratt says. This liquid should drain before the remainder of the liner is cut through.

In some states, the edges of the cut liner must be ground smooth before a contractor can pack up and go home.

The reinstatement process typically takes 15 to 20 minutes or less, depending on the type of cutter. Scarratt claims that self-propelled units can take as few as five minutes to reinstate a lateral.

All laterals must be reinstated in a timely manner, which depends on the pipe diameter and the length of the project, Alexander says. In smaller diameter pipe, between 8 and 12 in., reinstatement should occur in about 12 hours from the time the service was halted for the project. For larger diameters, between 15 and 36 in., reinstatement will take from 24 to 36 hours.

Contractors should be diligent about communicating how long service will be out, Alexander says. And if the service will be out longer than estimated, the contractor will likely have to investigate service bypass options or housing for the customers affected.

In some cases when reinstating the lateral will take longer than 24 hours, Scarratt says "You can go poke a hole in the liner so at least the people have 50 to 60 percent drainage."

Regardless of these challenges, relining a pipeline tends to be less costly and more timely than dig-and-replace methods. A contractor can usually reline the pipe and reinstate eight to 10 laterals a day, compared to two to four laterals per day with open-cut projects.

Relining pipelines and reinstating the laterals costs between $50 and $150 per lateral, Scarratt says, compared to about $4,000 per lateral with dig-and-replace methods, which can cost as much as $10,000 per lateral, depending on the depth and type of soil involved.

With dig-and-replace methods, you have to consider the costs of locating the lateral, digging the hole, cutting up asphalt or concrete or landscaping, remove and replace the pipe, backfill the hole, compact the soil, level and restore the ground, not to mention the cost of diverting traffic and business lost.

Keeping it Clean

Lateral instatement tools — the cameras and cutters — operate in a harsh environment. Water and corrosive chemicals can damage the equipment and possibly delay a project. That's why it's important for contractors to perform regular maintenance on their equipment.

Contractors usually need to have a backup cutter and camera so that the laterals can be reinstated as soon as possible in case the equipment breaks.

The inspection and location cameras cost between $15,000 and $35,000. Alexander recommends that equipment owners make sure the camera batteries are charged and the unit is pressurized to keep water out.

Cutters cost between $25,000 and $45,000, and these units require the most care because of the task they perform. "The cutter takes a beating," Scarratt says. "They use a lot of bits and there's a lot of wear and tear."

Scarratt recommends that cutters be cleaned and lubricated regularly. The air motor fins and cutting bits should be inspected for wear. Make sure water is out of the unit to avoid corrosion or freezing in cold temperatures. If a part must be replaced, he suggests a full unit inspection to ensure that something else is not on the brink of breaking as well.

Bradley Kramer is a contributing editor to *Trenchless Technology*.

A Quick Guide to Maintaining a Healthy Cutter

By Jessica L. Bowman

Generally speaking, the level of maintenance required to keep your equipment in good working condition depends on the brand. The different lateral reinstatement cutters on the market require different maintenance schedules. For example, some cutters, such as the Dominator by the Bowman Tool Co., have fewer internal moving parts than others, which can reduce overall maintenance needs and limits the number of parts that may need to be replaced. However, all lateral cutters are susceptible to the wear and tear of the working environment, particularly from water damage.

The maintenance schedule that you should follow depends on the current conditions that the cutter has been working in. The most relevant question that needs to be asked is whether the cutter was submerged while during operation. The answer to that question determines whether a daily, mid-week or weekly maintenance schedule should be followed.

If the unit has been submerged during operation, a daily schedule is suggested. When the ram function of the cutter is advancing, an unavoidable suction occurs, which pulls an insignificant amount of water inside the unit. However, after a full day of operating in such conditions, water will have accumulated inside the unit. The daily maintenance schedule will prevent any unnecessary dilution of the lubricants on the internal running gears.

If the unit has not been submerged during operation, a mid-week or weekly maintenance schedule would be sufficient, depending on the unit's number of operation hours per day.

A maintenance schedule is also relative to which part of the cutter assembly one is maintaining. Varying schedules are required for the cutter's exterior, internal running gear, head slide and air motor. The exterior requires little to no maintenance. One should treat the skid fasteners with an anti-seizing lubricant to allow for future adjustment of the skid assembly. The internal running gear only requires that the gears be treated with marine-grade grease. The spline drive is best treated with bar and chain oil to allow for smooth motion of the gears along it. The head slide should also be treated with the same marine-grade grease as the internal gears. The air motor should be removed from the cutter and placed in diesel fuel or Mystery Air Tool Oil to displace any water that is inside of it, which will cause premature corrosion. Overall, the most frequent maintenance will be required by the air motors to ensure that they are cutting efficiently.

A maintenance schedule, which is relative to the conditions the units have been working in and the parts one is working on, is a judgment call. However, the more frequently and consistently the equipment is maintained, the longer the equipment will work properly and efficiently.

Jessica L. Bowman is general manager of Bowman Tool Company & Systems, a manufacturer of lateral reinstatement cutters.

Aries Industries

Aries Industries raises the industry standard again with the release of its new LETS. Aries LETS inspects lateral lines up to 150 ft from main line sewer lines. Aries' new Mini Pan & Tilt Camera not only provides full pan-and-tilt inspections of the mainline, but now offers capabilities in the service lines as small as 3 in. in diameter. The mini Pan & Tilt camera has a standard built-in 512 Hz Sonde for accurate line locating. Aries has also increased its customer's flexibility by offering adapters to operate its Mini Pan & Tilt Camera as a back-up mainline camera or skid mounted inspections in pipes 3 in. and larger. For more information, visit *www.trenchlessonline.com/info*.

Bowman Tool Co. & Systems

Bowman Tool Co. & Systems has a full line of cutters for every size of mainline construction, as well as support equipment, such as air motors and control systems. The Dominator 300 is for small, intermittent spot repair cutting in 4- to 6-in. pipe, and the Dominator 430 is for general, continuous cutting in 6- to 30-in. pipe. The Dominator J 8-36 is for large, heavy duty cutting in 8- to 36-in. pipe. Maintenance is easy with only eight internal moving parts and an isolated, water-tight motor chamber. The Dominator cutters' rotation and feed mechanisms are covered by a limited lifetime warranty. For more information, visit *www.trenchlessonline.com/info*.

Envirosight

The stainless steel SuperVision SAT lateral launch system crawls hundreds of feet down mainlines 6 in. and larger and then inserts its camera as far as 100 ft into laterals 3.5 in. and larger. Its auto-leveling color camera with shadowless illumination pans 360 degrees and tilts 90 degrees to view both sidewall detail and distant targets. SuperVision SAT's steerable six-wheel drive helps it maneuver to troublesome launch points. Auxiliary lamps and a backward-viewing camera enhance visibility in both directions. An integral sonde transmits at multiple frequencies, facilitating locating the camera from aboveground. Force-sensing rollers prevent damage to the push rod, ensuring maintenance-free operation.
For more information, visit *www.trenchlessonline.com/info*.

LMK Enterprises

LMK Enterprises now offers three main-to-lateral cured in-place-pipe (CIPP) solutions. For municipalities that are only concerned with the connections while maximizing the potential for infiltration and cannot access the private property, LMK offers Shorty, which is exactly the same as T-Liner. It extends up the lateral pipe to a distance of 3 ft and is installed with no cleanout. And for municipalities that are only concerned with the connections, LMK offers Stubby, which is also installed with no cleanout. It only extends up into the lateral pipe 6 in.
For more information, visit *www.trenchlessonline.com/info*.

Nu Flow America

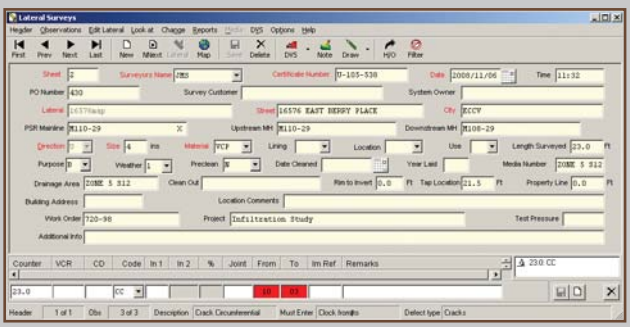
Nu Flex is a high-quality CIPP liner from the small diameter pipe rehabilitation experts at Nu Flow. Most trenchless technologies require some excavation — not true with Nu Flex. The Nu Flex product can be launched through an average 4-in. clean out with no excavation required. Nu Flex comes in a variety of diameters, from 1.5 to 8 in. Pull-in-place techniques allow certified Nu Flow installers to stop and start anywhere in the pipe. The same techniques are used to negotiate multiple 45- and 90-degree bends. No expensive equipment is required, and the versatile system can be used for multiple applications, including inside infrastructure. Nu Flow manufactures its own products, enforcing rigorous quality control. High standards and a skilled North American network of certified installers have established Nu Flow and Nu Flex as industry leaders. For more information, visit *www.trenchlessonline.com/info*.

Perma-Liner Industries

Perma-Liner Industries Inc. recently released two new products: the Super Mini Inverter and the Micro Mini Inverter. Perma-Liner have developed this cost-effective equipment to give the installer ease and simplicity when it comes to lining 10 ft up to 45 ft. Both products are made of a high-quality, lightweight aluminum and allow the installer flexibility when it comes to slabs, confined spaces, basements, etc. The Micro Mini Inverter will line up to 25 ft of 4-in., and the Super Mini Inverter will line up to 45 ft of 4-in or 6-in. For more information, visit *www.trenchlessonline.com/info*.

PipeLogix

LACP-certified by NASSCO, flexidata's standard lateral survey form is included with both Full Reporting and Lite Reporting versions when using PACP mode with no extra fees. The lateral survey form is available for use in the PACP, WRc or flexidata mode and works with push camera systems for inspections from a cleanout or with lateral launch equipment from a mainline survey run. When combined with flexidata's DVS license, each lateral inspection movie captured is a separate file, even when inspecting from a mainline. A free online demonstration of flexidata's lateral survey features and capabilities is available by request. For more information about this and the full range of infrastructure data collection, assessment and reporting tools available from PipeLogix, please visit www.flexi-data.com. For more information, visit *www.trenchlessonline.com/info*.



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TRIC Tools presents the HPLS-30, its most versatile tool for pipe bursting. Capable of replacing ¾-in. water lines to 6-in. sewer laterals, the HPLS-30 is ideal for both residential and commercial projects. Paired with TRIC's latest compact 18-HP hydraulic pump, the HPLS-30 can replace 100 ft of pipe in less than 30 minutes. Need to burst bigger pipe? Ask us how you can use the HPLS-30 to replace 8-in. lines. For more information, visit *www.trenchlessonline.com/info*.

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