



NASTT's *Trenchless Today*

Educate - Train - Research - Publish



FALL 2012

ISSUE NO. 3

INSIDE:
2012 NASTT
Membership
Directory

NASTT's Agenda

- 2013 No-Dig Show
- Onsite Training Courses
- NASTT Website
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USA: POWERFUL PREMIERE OF THE VSM TECHNOLOGY OF HERRENKNECHT.

Successful premiere of a Vertical Shaft Sinking Machine (VSM) from Herrenknecht in the USA: As part of the "Ballard Siphon Project" in Seattle, where a 77-year-old wooden sewer is being replaced and an additional sewer pipeline is being installed, the VSM 10000 is showing its strengths. The VSM created a 45 meter deep launch shaft with a diameter of 9 meters for the Herrenknecht EPB Shield, which will create approximately 600 meters of the new sewer tunnel.

By using the VSM technique the caisson was sunk safely and with a very high vertical accuracy. Even under water, the construction crew from Fowler was able to successfully sink the launch shaft in just 4 weeks.

Herrenknecht VSM technology has proved its advantages in comparison to conventional shaft construction. The parallel, low-noise sinking and lining of shafts, as well as the modular machine design guarantee rapid construction progress even on inner-city construction sites with restricted space. As personnel no longer have to work in the shaft during the excavation process, operational safety has increased significantly.

This major project is well on course so that the EPB machine from Herrenknecht can start operations as planned.

SEATTLE | USA

PROJECT DATA



VSM 10000, Vertical Shaft Sinking Machine
Diameter: 9,000mm
Max. torque: 80kNm
Shaft depth: 45m
Geology: sand, gravel, clay

CONTRACTOR

J.W. Fowler



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Compiled by *NTT* Staff

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Compiled by *NTT* Staff

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Message from the Executive Director



NASTT Wraps Up Successful 2012

Summer is a time for relaxing, family, travel and getting away from it all. Even so, we've been diligently working to prepare for a busy fall and the much anticipated return to the West Coast for NASTT's 2013 No-Dig Show.

I am delighted to share with you a few exciting developments that came out of the NASTT No-Dig Program Committee meeting and the NASTT Board of Directors meeting held in Sacramento, Calif. — home of NASTT's 2013 No-Dig Show. Plans and preparations for next year are well under way as work started immediately following the success of this year's show in Nashville, Tenn. Our Program Committee is building on this fantastic momentum, so mark your calendars: for March 3-7, 2013 at the Sacramento Convention Center.

The 2013 No-Dig Program Committee is developing another record-setting technical program. Chaired by Dr. Kim Staheli of Staheli Trenchless Consultants, the committee reviewed an overwhelming number of high-quality abstracts. Tough decisions were made to choose the best of the best for presentation in Sacramento and I have full confidence that the five-track technical program will be enthusiastically received.

After a six-year hiatus, Sacramento is the perfect location for the NASTT No-Dig Show to return to the West Coast. The Sacramento area has been home to a tremendous amount of trenchless work over the years including extensive municipal programs. The Sacramento Convention Center and the two adjacent hotels will offer our attendees and exhibitors a fantastic venue right in the heart of downtown.

One of the most highly anticipated events at the 2013 show, and surely future No-Dig shows, is the formal induction of NASTT's 2013 Hall of Fame inductee class. Still fresh from the first induction in Nashville, this is already my favorite event of our No-Dig Show experience.

NASTT's Hall of Fame was created to ensure that the trenchless industry's most outstanding and praiseworthy members receive due recognition of their achievements. It is the intent of NASTT to preserve the extraordinary accomplishments of these exceptional individuals and to honor their contributions to the advancement of the trenchless industry and NASTT. The Hall of Fame was a long overdue step for our Society, and I am proud to be a part of this effort.

The members of NASTT's 2013 Hall of Fame inductee class are: Insituform founder and inventor of the CIPP process, the late Eric Wood; trenchless author and engineering expert, Dr. David Bennett of Bennett Trenchless Engineers; and Ditch Witch founder and machinery developer, Ed Malzahn. What a superb group this is! You will be learning more about these incredible industry icons as the 2013 No-Dig Show nears.

The first Hall of Fame class was inducted at NASTT's 2012 No-Dig Show and the acceptance speeches by Frank Canon, Bernie Krzys and Mary Andringa for her father, the late Gary Vermeer, proved to be an emotional tribute to their years of service to the trenchless industry — their speeches moved me beyond words. I have no doubt our second Hall of Fame Class will pack the same type of emotional punch. Please join us in Sacramento to honor these trenchless professionals who will be inducted into NASTT's Hall of Fame during the Tuesday evening Gala Awards Dinner on March 5.

I also have more great news — the location of NASTT's 2015 No-Dig Show! After much discussion and review, the Board of Directors unanimously selected the City of Denver to host our annual event at the Colorado Convention Center. Dates for the show are March 16-18, 2015.

My final bit of news involves our high-quality educational programs. We kicked off our first-ever webinar series in June and the response was more than we could have hoped for. More than 500 attendees logged into the first session of the four-part "Introduction to Trenchless Technology" webinar series, which focuses on rehabilitation and new installation methods. I hosted the first session, which was expertly instructed by NASTT Vice Chair Derek Potvin. This is an entirely new educational vehicle for NASTT to reach a large trenchless audience — no cost to attendees who don't even need leave their office to partake. Sincere thanks our Communications & Training Manager, Michelle Hill, for her major role in making this webinar program a reality.

This publication marks the final issue of NASTT's *Trenchless Today* for 2012. So many good things have happened in the trenchless industry and at NASTT this year, and we have been happy to bring them to you in the Society's official magazine. Your input is always welcome — this is your magazine and your ideas make a real difference. Thoughts and comments from our members are always welcomed.

Sincerely,

Michael Willmets
NASTT Executive Director



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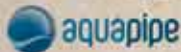
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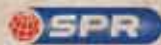
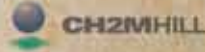


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Education, No-Dig at the Forefront of NASTT's Achievements

This is the final issue of *NASTT's Trenchless Today* for 2012, and therefore as my term comes to an end in December, the last time I will have the chance to talk directly to you as NASTT Chair. It seems like just yesterday when I took the reins of this incredible organization. We have done a lot of good work during my two years as Chair and I want to start this final message by thanking everyone — members, Board of Directors and staff — for their support, effort, ideas and time. Words cannot express how grateful I am for your partnership and unfailing support.

As 2012 draws to an end, I also want to use this space to reflect on the progress that NASTT has achieved during my time as Chair. Working as a team, we have made tremendous progress in making NASTT such a strong and vital organization. Everything we have done has been for the betterment of our organization, our membership and the trenchless industry.

Keeping the Books

Financially, NASTT is in a positive place but our record-keeping and accounting procedures needed an upgrade at the start of my term. When I became Chair, one of my goals was to continue to take a fresh eye at how NASTT does business. It is critical that non-profit organizations such as NASTT have accurate and reliable financial records. With the Board's approval, it was decided that a complete audit of NASTT's financial books was necessary to ensure that we are in full compliance of all federal regulations. The only word to describe our audit is "grueling," but the work our staff put into this endeavor was well worth it. To date, audits for NASTT's financial records for 2008-2011 have been completed. The time that went into this process will make future audits much faster and less stressful. Other changes we've made to our finances include modifying our accounting procedures to an accrual system, which includes implementation of appropriate check and balances — always important — and an automated billing process done through the internet. The NASTT No-Dig Show accounting has also been reformatted to synchronize it with the new system. I am proud to say that the overhaul of our finances has brought NASTT into the 21st century! These changes were necessary and critical to the financial stability and security of our organization.

One of my other goals during my chairship has been to increase our membership, with a specific focus on municipal and utility owners. NASTT believes it is very important to reach this audience as the use and acceptance of trenchless technology continues to grow. Over the last two years, NASTT has developed strong working relationships with the American Public Works Association (APWA) and the American Gas Association (AGA), partnering in various training activities to the benefit of each of group. We tailored our training courses to meet the needs of these groups and are also participating in their conferences, allowing us to interact directly with their membership. These partnerships are critical to the future of NASTT and I am so pleased with the early results they have produced. Everyone involved in making these relationships seamless and successful deserves more thanks than I can offer in this space. I am looking forward to seeing these partnerships grow in the years to come.

Education

The Education and Training Program of NASTT is the cornerstone of our organization. NASTT prides itself on the ability to

teach, train and promote the trenchless technology industry in a non-commercial setting — giving members and potential members the best information available. To that end, during my two years as Chair, I have worked with the Board to enhance and expand our Education and Training Programs on several levels. Our Good Practices Program remains the foundation of our training and is carried out by our most qualified members. But we wanted our instructors to be even better. To do that, we initiated an Instructor Certification Program in order to maintain the highest level of training for our attendees. We are also working on an "Introduction to Trenchless Technology" Short Course publication and course expansion (from four to eight hours). A core group of members are also involved in writing CIPP Good Practices Guidelines for non-pressurized pipes, and we have begun a separate CIPP publication for positive pressure applications. I'm very proud of these program additions and am thankful for those involved in making them a reality.

The training courses offered by NASTT are more than an integral part of our association — they are the foundation of our message in the promotion of trenchless technology. Our regional classroom presentations are a popular choice for those seeking trenchless information, but given the financial times we live in, it is not always feasible for people to travel for training. In 2012, we answered that challenge by offering our first-ever virtual classroom through our new Webinar Training Program. We are so excited about this addition to our educational arsenal, which allows us to reach a wider audience and provide high-quality, non-commercial trenchless information at no cost to attendees — you don't even have to leave your office! In June, we held the first of a four-part webinar series that offers instruction in infrastructure rehabilitation and new installation trenchless methods. The response to our first webinar was phenomenal, with more than 500 attendees logging into the session! We plan to create more webinar opportunities in 2013 as we continue to combine our classroom sessions with our virtual ones.

On the educational front, I believe we need to do more to attract the interest of those studying to work in construction fields. Over the last two years, NASTT has upped its educational commitment to ensuring the trenchless industry will be in the hands of the best engineers and construction managers by creating a stellar program — the Michael E. Argent Scholarship Program, established in 2010. A College Graduate Certification Program in Trenchless Technology is also under evaluation and development. Work to establish the latter program began in earnest in 2011, with outstanding debate and discussion. Today, this work continues and NASTT hopes to have a pilot program ready soon. This will be an excellent program for college students interested in trenchless technology! Our Scholarship Program has been more than I could have asked for and the hope is that these recipients will become part of the trenchless community once they graduate. I am thrilled to tell you that since 2011, four of the five inaugural scholarship recipients have embarked on a professional career in trenchless technology! Now that is money well spent on our industry's future!



Another important project that is coming along nicely is NASTT's collaboration with NYSEARCH/Northeast Gas Association on a Trenchless Carbon Calculator. The benefit of a Carbon Calculator will reinforce the image of trenchless technology as a "green" alternative, bringing trenchless to a higher level of awareness and focus to a viable product that will have meaningful results for the long-term. We are pursuing training and publication opportunities with the Carbon Calculator, plus, hosting a web-based application as a benefit of NASTT membership.

Over the last two years, I have worked to make NASTT more accessible to our members and future members. We have created this magazine in this effort and we have also revitalized the NASTT website, giving it a major facelift by adding new member features, such as all the No-Dig Show conference technical papers from 1991-2012, and interactive capabilities.

I want to extend my thanks and appreciation to NASTT Communications and Training Manager Michelle Hill, who since coming aboard NASTT's team, has played an invaluable role in making many of these training, education and No-Dig Show programs come to fruition. I also want to thank NASTT Executive Director Mike Willmets for his support and partnership with all these initiatives – he and Michelle have been my right hand, making my years as NASTT Chair the success I believe it has been.

No-Dig: A Testament to Success

I can't discuss my years as Chair without talking about the No-Dig Show. I am beyond thrilled with the success and growth

of our marquee event. With each year, the No-Dig Show has achieved record numbers in terms of attendees, exhibitors, technical papers, sponsors and volunteers. We are now honoring our trenchless pioneers through the NASTT Hall of Fame – something long overdue. As NASTT Chair and the 2012 Program Committee Chair, I have participated at all levels of the No-Dig Show and have witnessed the hard work and passion our members have for this event and for the industry. I attribute the show's success to all their hard work and dedication. As we see the construction industry embrace trenchless technology, our No-Dig Show is at the forefront in education and promotion. I look forward to attending future No-Dig Shows and experiencing its continued success.

I wish I had the space to go on with everything we have done over the last two years. We have accomplished so much since 2011 and there's so much more that I wanted to do before my term ended, but there are only so many hours in the day. I have done my best in serving as your Chair and I have no doubt that the 2013 Chair Derek Potvin will prove to be a dedicated steward of NASTT's message. I want to thank all of you for your assistance in making my years as NASTT Chair such a joy and rewarding experience. It's been my honor and privilege to lead this organization. Rewardingly, I've gotten to know so many of you and am profoundly touched by your friendship and professionalism. NASTT has no shortage of incredible people.

George Ragula
NASTT Chair

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ERIC WOOD
(1935-1994)
Eric invented the Cured-In-Place Pipe process in the early 1970s. He was the founder of Insituform and the owner of 33 U.S. Patents.



DAVID BENNETT
David is the longest serving NASTT Board Member (12 years) and co-author of all current NASTT Good Practices manuals. He is the founder of Bennett Trenchless Engineers.



ED MALZAHN
Ed is the developer of numerous trenchless products and the inventor of the first "trencher". He is the founder of Ditch Witch/ Charles Machine Works, Inc.

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Q&A

Derek Potvin, President of Robinson Consultants, Inc., and Incoming NASTT Chair, Reflects on the Organization's Recent Success and Looks to the Future



NASTT's Trenchless Today (NTT): Could you tell our readers a little bit about yourself and how you got into the trenchless field?

Derek Potvin: I have been providing engineering services for over 20 years to municipalities and utilities, primarily in the fields of water supply and wastewater collection. In the early 1990s, our clients' approach to infrastructure rehabilitation was focused on open cut replacement. In 1995, I attended my first NASTT No-Dig Show. A few years later I was made aware of an infrastructure rehabilitation requirement for an existing large diameter watermain within our local municipality. I recalled a paper presented at that No-Dig Show that used a trenchless technology that I believed could fulfill the requirements of this watermain rehabilitation. Our firm partnered with the presenter of the paper and we went on to successfully rehabilitate the watermain. The project won several awards including a NASTT No-Dig Outstanding Paper Award and a Canadian Consulting Engineering Award of Merit. We have since collaborated on many projects as part of a long term relationship with the author of the paper, Ian Doherty.

NTT: How did you first get involved in NASTT?

Potvin: A colleague in our firm was an NASTT member and I would read his copies of *Trenchless Technology* magazine. I could see the amazing development of trenchless and recognized the opportunities for our industry. So I joined NASTT and a few years later, was asked to join the Board of our local NASTT Chapter (Great Lakes, St. Lawrence & Atlantic), for which I am currently the Treasurer.

I started to get involved as a course instructor with NASTT over 10 years ago and have volunteered at the No Dig Shows. I was then fortunate to be nominated to be on the NASTT Board of Directors and am the current Vice Chair. I continue to be amazed by the volunteerism at both the local chapter level and the NASTT Board level. The dedication and efforts of my NASTT and local Chapter colleagues is truly inspiring!

NTT: What are some of the key issues being faced in the North American market?

Potvin: Current economic challenges have had an impact on the entire industry, including the pipeline owners. One impact is the reduction in availability of training budgets. As a result, NASTT has had to continue to be creative in meeting its mandate to educate and train. We have started a targeted outreach program focused on the pipeline owners, ensuring that decision makers within their organizations continue to invest in trenchless technology training. NASTT has also started offering educational courses via webinars. The webinars have proven to be very popular in educating our members and other industry professionals.

NTT: As the incoming Chair of NASTT, how has the organization evolved over the years? What have been the strengths?

Potvin: NASTT was started by a small group of pioneers that understood and believed strongly in the benefits of trenchless technologies. The founding members, and those that followed in their footsteps, have developed this small volunteer organization into a much larger organization that has continued to build on its mandate to educate. The first big step in pursuing this education mandate was the inaugural NASTT No-Dig Show in 1991. The attendance at the first No-Dig was less than 400 people and it has now grown to nearly 2,000 attendees. NASTT has also broadened its educational focus by holding trenchless technology courses throughout North America by providing scholarships to students and offering webinars that are viewed by interested participants from North America and around the world.

NTT: How else do you think the trenchless community benefits from No-Dig?

Potvin: The hallmark of the NASTT No-Dig Show is the technical program. The peer reviewed papers are of such high quality that they attract leading presenters in the industry. NASTT

members learn a great deal from listening to and networking with these leaders. Peer reviewed papers started my career in the trenchless industry by making me aware of another range of solutions for the infrastructure industry. Even as a veteran in this industry, I am still impressed by the education I get every year at the show.

NTT: What will be some of your goals once you take over as Chair?

Potvin: Under the leadership of the current Chair, George Ragula, the Board has developed some excellent initiatives that I plan to continue to support, including the outreach program to municipalities and utilities, the Carbon Calculator and the outreach to the gas industry. In particular, I want to continue to engage municipalities/owners by informing them of the benefits to their operations/business and offering continuing education. For the benefit of society, I want to ensure that municipalities/utilities continue to consider trenchless technologies when making infrastructure construction or renewal decisions. To achieve this goal, I want to ensure that every possible communication tool is being used to reach our audience.

NTT: What outlook do you have for the future of NASTT and the trenchless industry as a whole?

Potvin: The trenchless industry looks positive for 2013. We have seen an increased interest in trenchless technologies, as owners are required to achieve more with fewer dollars. Many technologies are now considered mainstream components of the implementation of infrastructure renewal and new construction. We expect this to continue as the word spreads about the successful completion of trenchless projects across the continent. As for NASTT, I am very confident that the Board has set a very positive course for 2012. We have many constructive plans that we want to achieve with regard to Board operations and some very worthy goals for the benefit of the broader industry.

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Tuesday, June 26, 2012 Trenchless Rehabilitation Part 1

*Presenter: Derek Potvin,
Robinson Consultants, Inc.*

- Cured in Place Pipe (CIPP) Lining
- Lateral Lining
- Spray-on Systems
- Tight Fit Lining Systems

View archive at www.nastt.org/webinars

Wednesday, August 8, 2012 Trenchless Rehabilitation Part 2

*Presenters: Ian Doherty, Trenchless
Design and Jennifer Glynn, RMC Water
and Environment*

- Pipe Bursting
- Sliplining
- Spiral Liners
- Spot Repairs
- Grout in Place Lining Systems
- Manhole Rehabilitation

View archive at www.nastt.org/webinars

Wednesday, October 10, 2012 Trenchless New Installations Part 1

*Presenters: Sam Ariaratnam, Arizona State University
and Dave Bennett, Bennett Trenchless Engineers*

- Horizontal Directional Drilling (HDD)
- Microtunneling
- Open Shield Pipe Jacking

Register today at www.nastt.org/webinars

Tuesday, December 4, 2012 Trenchless New Installations Part 2

*Presenters: Don Del Nero, CH2M HILL and
Kim Stahell, Stahell Trenchless Consultants, Inc.*

- Auger Boring
- Pilot Tube
- Pipe Ramming
- Guided Boring
- Moling / Piercing

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NASTT's No-Dig Show Heads to Denver!

Thank you for helping NASTT complete its 5 year plan! You voted and the Board of Directors listened.

We are heading to Denver, Colorado for NASTT's 2015 No-Dig Show! The conference will be held at the **Colorado Convention Center on March 15-19.**

Mark your calendars for this great trenchless event!



NASTT Spreads the Trenchless Word in Anaheim

NASTT had a grand showing at the American Public Works Association's (APWA) Public Works Congress & Exposition on Aug. 26-29 in Anaheim, Calif. The NASTT staff, along with Board members George Ragula and Frank Firsching, met up with many municipal representatives during the three-day Expo and evening networking activities. To round off the week, NASTT volunteer instructors Derek Potvin and Jennifer Glynn presented a complementary Introduction to Trenchless Technology Short Course. This particular version of the Short Course was focused on rehabilitation techniques.

NASTT is already signed up to exhibit at next year's APWA Congress on Aug. 25-28 at McCormick Place in the heart of downtown Chicago. NASTT looks forward to attending this great event each year, so please let us know if you can join us in 2013!



NASTT's booth at the APWA show was filled with information on the organization and everything trenchless. From left: Communications & Training Manager Michelle Hill, outgoing Chair George Ragula and Executive Director Mike Willmets.



NASTT volunteer instructors Jennifer Glynn and Derek Potvin taught a complementary Introduction to Trenchless Technology Short Course on rehabilitation techniques.

Education Update



NASTT is My Name, and Training is My Game

In my eyes, training is the most important part of what we do here at NASTT. Maybe it's because I'm the Communications & Training Manager, or maybe it's because our mission statement has a huge focus on training. Certainly training is important because it's the most powerful way NASTT reaches out and connects with the trenchless industry. That being said, we have decided to add this education update to each issue of *NASTT's Trenchless Today* to keep the industry informed of what we are doing to spread the trenchless word.

NASTT is proud to offer a suite of Good Practice training courses for the trenchless industry, currently focusing on six different areas — Cured-in-Place Pipe (CIPP), Horizontal Directional Drilling (HDD), Laterals, New Installation Methods, Pipe Bursting and an Introduction to Trenchless Technology. These evolving courses have been taught all over North America for nearly a decade, allowing NASTT to reach out to thousands of attendees who will undoubtedly help grow our industry.

Back in June, NASTT started a new adventure hosting a trenchless webinar series. By adding webinars to our toolbox, we are giving trenchless professionals the opportunity to learn valuable techniques and skills with-

out leaving their office. The difference between NASTT webinars and other online events on the market today is that our webinars will never include commercial content. And the best part about our webinar series is that it's free!

Our four-part webinar series includes sessions on rehabilitation and new installations, so there is something for everyone. These webinars are designed as an introductory course for both newcomers to the industry and for anyone who is interested in seeking a refresher course on trenchless technologies. Be sure to visit www.nastt.org/webinars to learn more about the series and to register. The June 26 and August 8 webinar archives are available for download, and the October 10 and December 4 webinars are now open for registration. Over 500 people attended the webinar on June 26, so you don't miss out on this valuable training.

There is no question that NASTT provides many opportunities to learn more about trenchless technology. I hope you will join us at a training event soon!

Michelle Hill
NASTT Communications & Training Manager

FREE FOR MEMBERS!

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In the Trenches



By Andrew Farr

There seems to be a common understanding amongst NASTTT members that the organization – and the trenchless industry – has no shortage of incredibly talented individuals. In this issue of *NASTTT's Trenchless Today*, we introduce Jennifer Glynn, Keith Hanks and Casey Smith – three industry professionals whose hard work and dedication to their field continue to help make NASTTT a symbol of the collective drive in trenchless construction.

Jennifer Glynn

Jennifer Glynn has been involved with trenchless design and project management since the beginning of her career 17 years ago. After graduating with a bachelor's in civil engineering from the University of New Hampshire, she headed west to California. There, she began working in municipal infrastructure planning, permitting, design and construction management, focusing on pipeline design and the use of trenchless technology.



Glynn said trenchless technology initially sparked her interest early in her career because it involved work that utilized new technology and new ways of putting in pipe. She also said she gained a wealth of experience during some of her early years while working for the engineering and consulting firm, Brown and Caldwell for five years.

Today, Glynn is a senior project manager for RMC Water and Environment, working out of its office in Walnut Creek, Calif. She is responsible for the design of over 85 miles of pipeline ranging in size from 2 in. to 84 in. in diameter.

Since January 2010, she has served on the NASTTT Board of Directors, having served eight years on the No-Dig Show Program Committee.

"NASTTT membership has continued to grow and I think it's a huge asset to the trenchless industry," she said. "The No-Dig Show is the only place to get the whole package on all aspects of the

trenchless industry and it is a great place for networking. I actually think the number of women involved in the industry has gone up as more women are interested in the civil engineering."

Glynn is also a volunteer instructor for NASTT's "Pipe Bursting Good Practices Course" and an instructor for the "Introduction to Trenchless Technology" course. She has published and presented numerous papers on projects she designed using trenchless technology at No-Dig since 2000 and at other conferences across the United States.

Glynn is a founding member and past Chair of the Board for the Western Regional Chapter of NASTT.

"The regional chapters are great for NASTT because they provide a platform for education and involvement in NASTT for people who can't make it to national shows like No-Dig," she said. "My involvement in NASTT has been one of the highlights of my career."

Keith Hanks

Keith Hanks has accomplished quite a bit since he has been involved in trenchless construction. Having always been interested in design, Hanks originally wanted to get into drafting in college, but eventually decided that engineering was the route he wanted to take.

Shortly after graduating with a bachelor's and master's in civil engineering, he interviewed for a job with the City of Los Angeles, where he has now worked for 27 years in the city's Wastewater Program. He has worked in the design and construction of both the collection system and treatment plants.

Over the course of his career, Hanks has developed guidelines for approved methods and materials in the City of Los Angeles and has been a strong advocate for the trenchless industry. He currently supervises the Design Standards group, which is responsible for the approval of materials used in the collection system.

In 1994, Hanks was involved with the design of the East Central Interceptor Sewer in Los Angeles, one of the more prominent trenchless projects he said he has worked on. The project involved an 11-mile, 16-ft diameter tunnel with an 11-ft finished interior diameter. Since then, Hanks has been in charge of design and engineering for numerous pipe rehabilitation and microtunneling projects. He has been particularly involved with developing the city's ability to perform non-circular sliplining in non-circular sewers, of which Los Angeles has more than 60 miles.

Hanks has been a member of the NASTT since 2001 and has also served on the Board of Directors for two terms, and served as the Secretary, as well as Treasurer. He has been on the No-Dig Program Committee for several years and has made numerous presentations at various No-Dig shows.

"I think it's important to go out and see the things people are doing because people are doing some pretty remarkable work," he said. "And it's so important to meet people. You find stuff you didn't know you were looking for."

In 2010, he was honored as the *Trenchless Technology* Person of the Year. "That was very surprising but a lot of fun," he said. "For that part of the year, I would go somewhere and people would say, 'Hey you were that guy on the cover.' But that was very nice."



Hanks reflected on the current state of the trenchless industry and said the market outlook is optimistic, but noted that one critical improvement must be on informing upper level decision-makers on the benefits of using trenchless applications.

"I think it's important that we get elected officials to pay more attention to trenchless methods," he said. "Elected officials mostly don't know anything about it."

"We need to focus on selling trenchless as a greenhouse gas reducing method. I think as we get a better handle on our carbon footprint, these methods will continue to gain traction. And that's probably going to be the way we will get the attention of elected officials."

Casey Smith

Casey Smith said he got into the trenchless industry by luck. At first, he said it was just a matter of needing a job. But reflecting on his career now, Smith said he can't imagine working in a different industry.

Smith has 20 years of experience in trenchless construction, beginning his career in 1992 working as an engineer at Insituform. With a background in civil engineering, Smith was no stranger to the trenchless practice, having also worked as a sales engineer prior to then, becoming familiar with pipe design theory. In 1999, he began working as director of operations in Europe for Insituform Technologies, Inc., based in Paris. There, he gained experience working in the European market for trenchless technology, which he said is much different than that of the United States.

"Europe is a small place comparatively, and has a much smaller market for trenchless construction," he said. "Europe is more innovative in construction practices and can afford to be, because contracts are smaller."

Smith continued working in various roles for Insituform, after which he joined SAK Construction LLC in 2008. SAK Construction is a privately-owned pipeline rehabilitation and tunneling contractor based in St. Louis. Smith works out of SAK's Phoenix office, where he now focuses on business development. During his time with the company, he has also led design-build teams on multi-million dollar pipeline rehabilitation and tunneling projects.

"I've had the opportunity to do a lot of different kinds of work throughout my career, from technical work, to marketing, to business development," he said. "I can imagine only a handful of people out there have been able to touch all those areas."

Smith said he has been involved with NASTT ever since he got into the industry. He said it has allowed him to see the industry transform from more of a specialty to more of a commodity.

"NASTT is doing a wonderful job of educating the community," he said. "I think there is a lot of momentum and interest in the organization, even though people have their own career interests to worry about."

"I would have never imagined getting into this type of work, but I think it is something that provides real value to our infrastructure."



Andrew Farr is the assistant editor of *NASTT's Trenchless Today*.



2012 NASTT Membership Directory

The North American Society for Trenchless Technology is pleased to provide you with its 2012 NASTT membership directory. Founded in 1990, NASTT is a not-for-profit educational and technical society dedicated to promoting the benefits of trenchless technology.

The directory pages are divided into three categories: individual, corporate and municipal. Individuals are listed with their company affiliation. Members and contact information are listed for each corporate and municipal listing. The membership directory printed in this issue was current as of Sept. 1, 2012.

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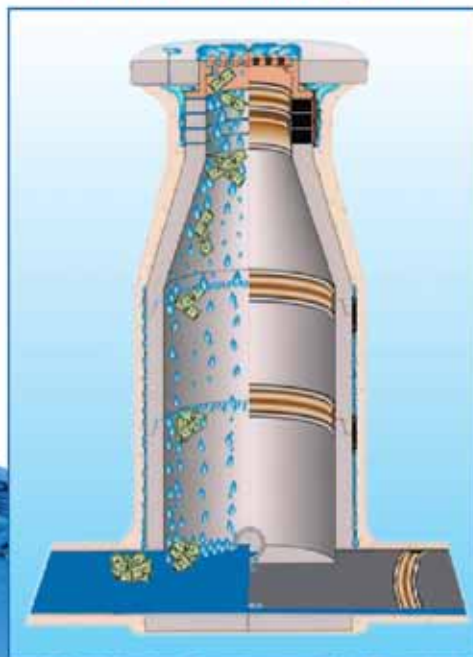


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NASTT Chapter News

Regional Chapter News

British Columbia

The British Columbia Chapter of NASTT is enjoying a successful 2012 and looks forward to an exciting fall and an eventful 2013.

Great Lakes St. Lawrence & Atlantic

The Great Lakes St. Lawrence and Atlantic (GLSLA) Chapter was pleased to support the Trenchless Technology Road Show held in Niagara Falls, Canada in June and would like to congratulate the planning committee on a very successful show. The Chapter is looking forward to a busy fall and winter with the release of its 2012-2013 magazine and planning for upcoming education seminars to be held in the fall or early 2013 (dates still to be confirmed). The GLSLA Chapter will once again be promoting Trenchless Technology at the ACWWA to be held Oct. 14-16, 2012 in Charlottetown, Prince Edward Island. For more information on GLSLA, future events or to obtain a PDF copy of the latest issue of the GLSLA magazine, please visit www.glsla.ca.

Mid Atlantic

The Mid Atlantic Chapter has a "Trenchless Technology, SSES and Buried Asset Management" two-day seminar tentatively planned for Oct. 17-18 in Pittsburgh Pa., and another one tentatively planned for Atlantic City, N.J. on Dec. 19-20.

Midwest

The Midwest Chapter is tentatively planning a "Trenchless Technology, SSES and Buried Asset Management" two day seminar for Sept. 12-13, 2012 in Detroit, Mich., and another one in Kansas City, Mo. in early 2013.

Pacific Northwest

The Pacific Northwest Chapter had a Board meeting in June to discuss upcoming events. Kim Staheli of the PNW Chapter was recently part of a trenchless forum put on by the City of Portland. The Chapter has also requested abstracts for its next PNW Trenchless Review, which are due by the end of August with the magazine itself coming out in December. The Chapter is also currently working on the logistics for its bi-annual Pacific Northwest Trenchless Symposium, which is tentatively scheduled for mid-January 2013 before the No-Dig Show. The Chapter is currently working on determining a venue and looking at possible topics for the symposium. As part of the trenchless symposium, members will be looking for additional volunteers to get involved with the PNW Chapter of NAS-

TT and will be holding its bi-annual elections for Board positions. Finally, the Chapter is also in the beginning stages of researching the possibility of forming a scholarship fund to assist with sending public agency owners to the national No-Dig Show.

Northwest

In January, the Northwest Chapter hosted NASTT's New Installations short course in Winnipeg, where 36 attendees enjoyed learning more about trenchless technology. The Chapter has organized a trenchless track for the 2012 Western Canada Water conference in Winnipeg this September, and is evaluating options to host a NASTT short course in Regina later this year or early next year.

Make sure to mark your calendars for the 2012 Northwest Trenchless Conference coming Nov. 14-15 to the Fantasyland Hotel in Edmonton. The conference organizing committee is actively looking for technical presentations. Anyone interested is encouraged to submit an abstract online at www.nastt-nw.com.

Rocky Mountain

NASTT's Rocky Mountain Chapter (RMC) will hold its 3rd annual No-Dig Conference and Exhibition Nov. 7-8 2012 at the DoubleTree Hotel in Westminster, Colo. On Wednesday, Nov. 7, the conference will feature a HDD Consortium Horizontal Directional Drilling Good Practices Course. The course, developed by NASTT, is aimed at providing contractors, engineers and owners with a set of guidelines that will assist and allow personnel to have successful HDD installations by training operators and supervisory personnel.

On Thursday, Nov. 8, the conference will feature technical presentations and a vendor exhibit area on a wide variety of topics related to the trenchless industry, including: recent regional trenchless construction projects; new design and installation methods and techniques; rehabilitation and repair; products and material; condition assessment; asset management for buried infrastructure; and tunneling and trenchless methods.

The RMC is also proud to announce that it will be hosting the 2015 NASTT No-Dig Show in Denver! The Chapter is looking forward to the opportunity to showcase the trenchless technology expertise of its members.

Southeast

The Southeast Chapter held a successful "Trenchless Technology, SSES and Buried Asset Management" two-day seminar at the Sheraton Tampa Riverwalk Hotel in Tampa, Fla., on June 20-21. The first day guest presenter was Cassidy Barrett, project engineer with the City of Tampa Wastewater Department, who gave a presentation on "Tampa's Trenchless Technology Program." The second-day presenters were Richard Cummings, group manager for Field Maintenance Services and Jim Demay, general manager of operations for the Hillsborough County Public Utility Department, who presented on "Hillsborough County's Trenchless Technology Program."

The Southeast Chapter also has tentatively planned a "Trenchless Technology, SSES and Buried Asset Management" two-day seminar in Greensboro N.C. on Nov. 28-29, 2012.

Western

The Western Chapter of NASTT is hosting its 8th annual Western Regional No-Dig Conference and Exhibition on Monday, Oct. 29 at the Ayres Hotel and Suites in Ontario, Calif.

Registration includes an informative one-day technical program and product exhibit area devoted entirely to trenchless technology, including new installation, rehabilitation and condition assessment. The conference is useful to public officials, engineers, utility company personnel, designers and contractors alike who are involved with designing, constructing, rehabilitating and managing underground infrastructure. The Western Chapter is committed to promoting trenchless technology education in the public sector and is therefore offering a significant discount for public employees. For registration rates and more information, please visit www.WESTT.org.

In addition, the Western Chapter is also offering two NASTT Good Practices Courses on Tuesday Oct. 30: Pipe Bursting and New Installation Methods. These two optional courses offer content that is thoroughly peer-reviewed for consensus-based information and non-commercialism. Participation in these courses will earn valuable Continuing Education Units (CEUs). An additional fee is required to attend the courses. For more information on the courses, go to www.NASTT.org/training. For more information or to exhibit at the conference, go to www.WESTT.org, or contact Matthew Wallin at 916.294.0095 or Jason Lueke at 480.247.0834.

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Back by popular demand, Vermeer will once again sponsor a vacation raffle. The winner of this raffle will receive a dream vacation to the Caribbean! Raffle tickets are \$25 each or five for \$100 and can be purchased online at www.nastt.org/auction.

Following on the 2012 western theme, the committee challenges you to revisit your 60's flower child days with bell bottom pants, tie-dye shirts and don't forget your peace symbols! Cash prize for the best groovy gal or guy. Can anyone top Dolly Parton's appearance in 2012?




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Michels' Robert Westphal Retires



Industry leader Robert Westphal retired on July 1 after a decorated career at Michels Corp. and in the utility construction industry.

Westphal started with Michels as a laborer in 1965 when he was directly hired by company founder Dale Michels. He worked his way through the ranks as operator, foreman, project superintendent, general superintendent, vice president and finally, senior vice president of construction operations.

After retirement, Westphal will continue to play an integral role with the Brownsville, Wis.-based utility construction company. He will transition into a role of senior strategic advisor by continuing to help Michels maintain and develop customer relationships, and to provide his keenly acquired knowledge and business acumen to Michels' future and growth.

Providing positive leadership has been a hallmark of Westphal's career. In 1980, future Michels president Pat Michels came to work for Westphal on a water project he was leading in South Dakota. The two developed a friendship and respect for one another which continues to thrive today. Both remain committed to respecting the company roots while keeping a keen eye trained on future growth.

"Bob has been critically important to my family and Michels Corporation for more than 47 years," said Pat Michels. "He has seen a tremendous amount of growth at Michels and has been an integral part in helping to evolve the company into the success it is today."

Westphal was heavily involved in the telecommunications boom of the 1980s and from that arena, helped found and shepherd Michels' now globally renowned directional drilling operation. He was also instrumental with guiding the company through the resurgence of its mainline pipeline operations.

Spending his career at Michels was an easy decision for Westphal. "I always had the sense that there would be continuous opportunity for growth, not only from the company's standpoint but for myself, and that has continued throughout my career," Westphal said. "I have had opportunities to work with many incredibly talented people throughout the organization during the course of my time here."

Horizontal directional drilling, microtunneling, pipeline construction and pipe rehabilitation encapsulates the diverse fields of underground utility construction for which Westphal has earned himself a highly regarded reputation.

Westphal has remained actively involved in many related associations which have played an in-valuable role in helping him stay in tune with rapidly changing technology, industries and markets. He has been an active member of the North American Society for Trenchless Technology (*Trenchless Technology* Person of the Year in 2011) and Pipe Line Contractors Association, for which he served 13 years on the Board of Directors, including president from 2005 to 2006. He is currently a trustee on the Labors National Pension Fund and a member of the Canadian PLCA, Interstate Natural Gas Association of America and International Pipeline and Off-shore Contractors Association.



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On the Trenchless Trail with Mortimer

Mortimer the Sewer Rat, the famed prize of NASTT's No-Dig Show Education Auction, has gotten around quite a bit over the last five years. To NASTT members and other trenchless professionals, Mortimer is more than just a stuffed sewer rodent. Well, maybe not. But nevertheless, he has become a recognizable face amongst No-Dig attendees and a symbol of the many trench-



less companies that share a passion for educating the industry. This month, *NASTT's Trenchless Today* took a closer look at Mortimer's travels since making his trenchless debut.

The story goes that in 2007, during the Western Society for Trenchless Technology's No-Dig Annual Conference, Dr. Sam Ariaratnam, WESTT Chair at the time, organized a Jeopardy game for exhibitors during the conference reception in which exhibitors created questions and the participant with the most points won a prize. Jan Gould of the City of Reno, Nev., purchased Mortimer at a Halloween store, created his safety vest and presented him to the Jeopardy game champion Glenn Boyce of Jacobs Associates, Seattle.

After a year-long visit with Boyce and the folks at Jacobs Associates, Mortimer was purchased by Pacific Boring during the education auction at No-Dig in 2008. Since then, Mortimer has become a staple of the education auction as companies bid on him each year, with the proceeds going to NASTT's education fund. In 2009, after Akkerman Inc. won the sewer rat from the auction, Ariaratnam suggested Akkerman give him a name, eventually choosing "Mortimer."

When No-Dig was in Chicago in 2010, Mortimer was purchased by Dan Liotti of Midwest Mole and Ray Post of Michels Corp. He was shared between the two companies throughout the year until 2011 when Michels assumed full custody. This March in Nashville, Mor-

timer was bought by John Milligan of Vermeer Corp. Since then, Mortimer has followed Milligan around various jobsites to check out Vermeer's AXIS Guided Boring System in action.

NASTT continues to push the value of education on the trenchless industry, offering a number of training courses and a new webinar series (see Education Update, pg. 13 for details). As Mortimer's reputation continues

to grow, he has been a reminder of NASTT's education effort and a representative to those companies that have contributed to spreading trenchless knowledge. Mortimer will once again be up for auction at NASTT's 2013 No-Dig Show in Sacramento, Calif., the education auction being Monday, March 4, at 5:30 p.m.

-Compiled by NTT staff

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An Overview of Technologies for Service Lateral Rehabilitation Using Cured-In-Place Pipe

Larry W. Kiest, Jr. — *President/CEO, LMK Technologies, Ottawa, Ill.*

Cured-in-place lateral lining is one of the most challenging rehabilitation methods in the trenchless technology industry. With many variable pipe configurations, pipe diameter changes, pipe access issues and site differences, the cured-in-place pipe system and the operator must be flexible and able to adapt to different scenarios in order to consistently offer the best solution. As an increasing amount of contractors and municipalities accept trenchless lateral renewal as a safe and cost-effective product for sewer rehabilitation, it is of the utmost importance that they appreciate the various materials and methods of installation. This paper serves to identify all of the various technologies available for service lateral pipe rehabilitation using a cured-in-place pipe. Four methods of lateral lining are discussed, along with three methods of lateral sectional repair and three methods of connection sealing and main/lateral lining. The positive and negative attributes of each method are discussed and elaborated upon for the benefit of specifying engineers, the owner and the contractor.

INTRODUCTION

Most of the lateral pipes that are being renewed today were constructed 40 or more years ago; some dating back to the turn of the nineteenth century. There are several characteristics found in the construction of a service lateral that pose distinct problems for trenchless technology applications. These characteristics include changes in line direction or bends in the lateral pipe; varying pipe diameters within

the same lateral pipe; and access points to the lateral pipe.

Lateral pipes may include a change in line direction or a bend in the pipe, such as a 45- or 90-degree bend made by use of a pipe fitting. However, it is not uncommon to see crooked pipe joints shifting the direction of the pipe. The practice of failing to install clean joints so that the pipe retains a uniform interior and consistent direction may cause a separation between the two adjoining pipes. This separation generally leaves one side of the bell and spigot open, allowing tree roots and water to enter the lateral pipe. This practice is referred to as “cheating the pipe joint,” and may result in difficult installations of cured-in-place lateral lining.

Varying diameters within the same pipe is another unique characteristic found in the construction of a service lateral. In the past, pipe reducing fittings were used, but it was common for a contractor to simply insert the smaller pipe into the larger pipe and seal the connection by placing mortar around the area where the two pipes interface. Most of these transitions form an eccentric connection with the smaller pipe setting on the invert of the larger pipe. The irregular shape of the resulting pipe interior may present issues for installations of cured-in-place lateral lining.

The access point to the pipe is a unique characteristic of service lateral pipes, and provides both unique opportunities and challenges for trenchless rehabilitation. Lateral pipes can be renewed by inserting a resin-impregnated tube through a cleanout access.

The diameter, location and length of the cleanout access are all important factors to determine when rehabilitating a service lateral pipe. However, in many areas, an outside cleanout was not included in the original construction, often resulting in no exterior lateral access. In such a case, a lateral access point is made for carrying out rehabilitation works. Therefore, access to a service lateral pipe is an important issue to recognize and plan for during a lateral rehabilitation project.

Many of the aforementioned characteristics are the product of poor planning and coordination of infrastructure efforts. Any plumber, drain cleaner or underground contractor can tell stories about the unique characteristics found in the construction of a service lateral. They are witnesses to a legacy of a process that lacked proper coordination and oversight, as most lateral pipes were installed by private contractors without coordination with the custodian of the sewer mains. Furthermore, the pipe laying works found outside of buildings were often performed without engineering, plans, or inspection. The poor construction methods combined with the simple fact that some of these pipes are old and decaying, results in a staggering number of defective laterals in our nation today. The aggregate cost of completely replacing defective service laterals is staggering for most economists. Therefore, we cannot afford to make the same mistake twice. Cured-in-place lateral lining provides an opportunity to repair many of the missteps made while building the nation's infrastructure in a coordinated fashion,

allowing the risks and rewards of each project to be taken into consideration.

DISCUSSION

This paper serves to identify all of the various technologies available for service lateral pipe rehabilitation using a cured-in-place pipe. In this section, four methods of lateral lining are discussed, along with three methods of lateral sectional repair and two methods of connection sealing/main-lateral lining. The positive and negative attributes of each method are discussed and elaborated upon for the benefit of specifying engineers, the owner and the contractor. After the methods are described, additional practical considerations relating to material usage are briefly discussed.

First, one must distinguish between lateral repair, lateral lining, connection sealing and main/lateral lining achieved by use of a resin-impregnated liner.

- Lateral repair addresses the repair of a localized defect in a lateral pipe.
- Lateral lining addresses the renewal of a service lateral pipe through a lateral access point. No type of seal to the main pipe or main pipe-liner is achieved.
- Connection sealing addresses sealing of the junction between the lateral and the main pipe. The insertion of the resin-impregnated liner is always performed remotely from within the main pipe.
- Main/lateral lining simultaneously seals the junction of the main and lateral pipe and renews the lateral to the ROW or near the building foundation by the insertion and curing of a resin-impregnated liner.

Lateral Access Point – A lateral access point can be one of the following:

- A cleanout located inside of the building
- A cleanout located outside of the building

- A manhole that connects to a lateral pipe
- An excavation that exposes the lateral and removing a section of pipe
- The mouth of the lateral pipe remotely accessed from the main pipe

Those skilled in the art of lateral rehabilitation, which is flexible and able to adapt to each different scenario, will consistently offer the right solution. This paper discusses each method of cured-in-place pipe lining used to repair or renew a sewer service lateral pipe.

LATERAL LINING METHODS

Lateral lining involves rehabilitating the lateral pipe from the lateral access point continuously to a specified point, which is typically near the



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sewer main. Lateral lining can be categorized by four different installation methods, each possessing a different degree of positive and negative attributes.

Method 1: Double inversion method

Method 2: Single inversion method

Method 3: Cleanout inversion method

Method 4: Pull-in-place method

Double Inversion Method

This is the most basic form of lateral lining where the process utilizes direct pipe access. The lateral pipe is always accessed by making an excavation and removing a section of pipe. A lateral tube of sufficient diameter and length is impregnated with an appropriate thermo-set resin and inverted using air-pressure into a first pipe section until the liner is positioned in the pipe where the end of the liner is open releasing the air-pressure. With the liner extending from the pipe opening to a location adjacent the mainline pipe, an inflation bladder is inverted into the liner tube pressing the tube tightly against the pipe wall until the resin is cured. This same process applies to renewing a lateral pipe that connects to a manhole; where the lateral liner extends from a manhole to a lateral access point excluding any excavation.

Single Inversion Method

This method also requires excavation and removing a section of pipe making an access point. A lateral tube of sufficient diameter and length is prepared by inserting the liner into a translucent bladder forming a "liner/bladder assembly." The liner tube at each end may be outfitted with swelling compression gaskets. The liner tube is then impregnated with an appropriate thermo-set resin. The liner/bladder assembly is inverted into a first pipe section pressing the liner against the pipe wall; the line extending from the pipe opening to a location adjacent the mainline pipe. The bladder maintains inflated until the resin is cured. Once the liner

is cured, the bladder is reverted and removed from the liner. This same process applies to renewing a lateral pipe that connects to a manhole; where the liner extends from a manhole to the lateral access point excluding any excavation.

Cleanout Inversion Method

Method 3 is 100 percent trenchless where the liner is inserted through a cleanout either located inside or outside of the building. A lateral tube of sufficient diameter and length is prepared by inserting the liner into a translucent bladder forming a "liner/bladder assembly" where the liner is frangibly attached to the bladder. The liner tube at each end may be outfitted with swelling compression gaskets. The liner/bladder assembly is inverted through a cleanout, with the liner remotely positioned in the lateral pipe, so as not to block the cleanout opening with the liner. As the liner/bladder inverts through the pipe, the bladder presses the liner against the pipe wall; the liner extending from the pipe opening to a location adjacent the mainline pipe. An inspection camera is inserted into the bladder under pressure before the liner is cured providing video documentation that the liner has been fully deployed and the liner has been properly positioned in the pipe before curing. The bladder maintains inflated until the resin is cured. Then, the bladder is reverted and removed from the liner. This same process applies to a section of lateral pipe; where the liner extends from an outside cleanout, in the upstream direction adjacent the building foundation.

Pull-in-Place Method

In method 4, the pull-in-place method, the liner can be inserted through a cleanout either located inside or outside of the building. A lateral tube of sufficient diameter and length is saturated with resin and positioned on a pneumatic rubber plug having a secondary skin made of no-stick material. A pull line is strung from a manhole through the main pipe and up ex-

tending up the lateral pipe to the cleanout. The plug/liner assembly is pulled through the cleanout, with the liner positioned only in the lateral pipe so as not to block the cleanout opening with the liner. A CCTV camera is positioned in the main pipe adjacent the main/lateral connection providing video documentation that the liner has been properly positioned being adjacent the main pipe. The plug is inflated until the resin has cured. Then, the plug is deflated and removed peeling the secondary skin from the cured liner.

LATERAL SECTIONAL REPAIR METHODS

There are cases where only a localized section of lateral pipe needs repair. Sectional repairs in a lateral pipe can be categorized by installation methods in a three tiered level, each possessing a different degree of positive and negative attributes.

- Pull-in-place method
- Push-in-place method
- Invert-in-place method

Pull-in-Place Method

The pull-in-place method includes a short resin saturated liner positioned on a pneumatic plug. The plug/liner assembly is inserted through a cleanout, from a pipe opening made by an excavation or from a manhole that connects to a lateral pipe. Once positioned the plug is inflated pressing the liner against the pipe wall until the resin is cured. The plug is deflated and removed leaving the cured sectional repair in-place.

Push-in-Place Method

The push-in-place method includes a short resin saturated liner positioned on a pneumatic plug and pushed into a lateral pipe from a clean-out by use of fiberglass pushrod.

Invert-in-Place Method

The invert-in-place method includes a short resin saturated liner

that is outfitted with a swelling compression gasket attached at each end of the liner tube. The liner is frangibly attached to an inversion bladder. The inverting bladder carries the liner through a cleanout and into the pipe to the remote point of repair.

CONNECTION SEALING AND LATERAL LINING

A common defect in sanitary sewer systems is the connection of the lateral and the sewer main pipe. This connection is often structurally inadequate due to cracking or an open joint. It also is a key contributor to infiltration since it is an unsealed area of cured-in-place sewer main rehabilitation. All cured-in-place connection sealing takes place from within the sewer main. There are three methods of installation, and two types of liner construction used for repairing the connection and a short section of the lateral pipe each possessing a different degree of positive and negative attributes.


- Pull-in-place method
- Inversion method
- Push-in-place method

Pull-in-Place Method (Structural and Non-Structural)

The pull-in-place method involves forming a liner assembly comprising of a lateral liner tube and a main liner portion and mounting the assembly on a tee-shaped inflatable rubber plug. The main liner portion may be a brim that is glued to the main pipe; or the main liner portion may be structural resisting hydrostatic loads by renewing the full circumference of the sewer main around the opening of the lateral. The main pipe has typically been renewed by lining. The liner assembly is inserted into a manhole and pulled through the mainline and continuing up the lateral until the main liner portion is aligned with the main/lateral interface. A connection seal with a short lateral liner section (12-36 in.) can be accomplished by pulling the liner from a clean-out without the need to excavate. The lateral liner tube may be longer extending to the ROW or to a point near the building foundation.

Inversion Method (Structural and Non-Structural)

The inversion method involves a liner assembly comprising of a lateral liner tube and a main liner portion and loading the liner inside of a translucent bladder forming a liner/bladder assembly. The main liner portion may be a brim that is glued to the main pipe; or the main liner portion may be structural resisting hydrostatic loads by renewing the full circumference of the sewer main around the opening of the lateral. The main pipe has typically been renewed by lining. The liner assembly is inserted into a manhole and pulled through the mainline until the main liner portion is aligned with the lateral interface, the main portion is inflated and the lateral tube is inverted extending a short distance (6-36 in.) up into the



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service lateral forming a connection seal, or the lateral liner may extend to the ROW line or near the building foundation. A main/lateral liner of virtually any length can be constructed by using a single one-piece liner assembly, or by using a two-piece liner assembly i.e. a connection seal is installed and followed by a lateral liner that overlaps the connection seal.

Push-in-Place Method (Structural and Non-Structural)

The push-in-place method involves forming a liner assembly comprising of a lateral liner tube and a main liner portion and mounting the assembly on a tee-shaped inflatable rubber plug. The main liner portion may be a brim that is glued to the main pipe; or the main liner portion may be structural resisting hydrostatic loads by renewing the full circumference of the sewer main around the lateral opening. The main pipe has typically been renewed by lining. The liner assembly is inserted into a manhole and "pushed" through the mainline until the lateral tube springs 8 in. into the lateral pipe. The plug is inflated, pressing the liner against the pipe walls until the resin is cured. The plugs are deflated and removed from the main pipe.

SERVICE LATERAL REHABILITATION

Along with the aforementioned positive and negative attributes, practical considerations of the materials used for each technology and method should be taken into account.

The first consideration is the intricacies of the resin systems. Each method of CIPP lining can be accomplished using an approved resin system. The most common resin systems used for lateral lining are polyester or epoxy. However, vinyl ester or silicate resin systems are also suitable. These resin systems can be cured at ambient temperatures or heat cured using hot water or steam. Ambient curing under air-pressure is the most common used curing method for lateral re-

habilitation with reduced equipment footprint and cost. However, ambient cure times can range from 2-12 hours. Steam curing proves to be the most efficient for production and effective for obtaining high levels of crosslinking the polymer resin. With steam curing, liners can be cured in as fast as 30 minutes. Water curing in laterals is not suggested, as lateral pipes may have a significant change in elevation causing the inflation pressure to increase at lower elevations. This increased pressure can result in reduced liner thickness at the deepest portion of the lateral pipe. In cases where the main pipe is deep, the lateral may connect at 12 o'clock with a riser pipe that turns at either a 45- or 90-degree bend. The use of water in this instance may cause the liner to be pulled down away from the crown of the pipe bend fitting (90-degree) due to the weight of the water. An additional issue that can arise with hot water curing in lateral pipes, is reversion of an inflation bladder that is filled with water.

The second consideration is the characteristics of the lining tube, including both the stretch factor and the mechanical properties. Lining tubes have advanced with the development of elastic tubes that invert easily through small diameter piping, negotiate bends and conform nicely to the host lateral pipe. Stretch in lateral tubes has long been an issue and the issue has increased with the introduction of these elastic lining tubes. These elastic tubes not only stretch in circumference, but also in length. Length stretch makes it nearly impossible to position the end of the liner at an exact location. The more elastic the tube, the less inversion pressure is required to invert the liner. This is key in lateral lining because the more pressure that is applied to the tube, the more resin is milked out of the tube. This milking of resin produces a resin slug that moves in front of the inverting face. The result is a slug of liquid resin being discharged into the main pipe, or when a liner is inverted upstream towards the building a solid slug

of resin is formed at the upstream end of a lateral liner. Lower inversion pressures greatly reduce resin slugging and the resin stays in the liner and penetrates open joints and fractures. New technology utilizing glass or other reinforcing fibers in the elastic liner tube has proven to solve the stretching issue for use in lateral rehabilitation. A unique reinforcing construction prevents the elastic liner tube from stretching in length, yet allows adequate stretching in circumference. In addition to controlling the length stretch, the glass enhances the flexural modulus and flexural strength while reducing the wall thickness.

CONCLUSION

The various technologies available for service lateral pipe rehabilitation using a cured-in-place pipe have been described, including lateral lining, lateral sectional repair and connection sealing/main-lateral lining. The positive and negative attributes associated with the various methods were discussed and elaborated upon for the benefit of specifying engineers, property owners and contractors. No two projects are ever the same, but cured-in-place methods pose risks during the installation process that are far outweighed by the benefits conferred to the property owners. The object of this paper is to arm contractors and specify engineers with the knowledge and flexibility to adapt to different scenarios commonly found, that increase the risk of installation, including variable pipe configurations, pipe diameter changes, pipe access issues, and site differences in order to consistently offer the best solution for renewing and sealing a sewer service lateral. Once these methods are fully understood by all interested parties, cured-in-place technology provides an opportunity to repair the nation's aging infrastructure in a manner that provides consistency and quality.

To view the complete version of Paper F-4-03, please visit www.nastt.org.

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