MSTT

Midwest Society for Trenchless Technology

MIDWEST JOURNAL OF

TRENCHLESS TECHNOLOGY 2015

OFFICIAL PUBLICATION OF THE MIDWEST SOCIETY FOR TRENCHLESS TECHNOLOGY

2015 EDITION

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MESSAGE FROM THE PRESIDENT

ADVANCING THE SCIENCE AND PRACTICE OF TRENCHLESS TECHNOLOGY

Jeff Boschert, P.E., MSTT Chair

We are happy to be celebrating the third annual publication of the Midwest Journal of Trenchless Technology, because it is evidence of your continued support. The Midwest Society for Trenchless Technology (MSTT) is the oldest NASTT regional chapter in the United States. Our commitment to research, development and education supports the use of trenchless installation methods.

Get Involved. Your support is critical. We're proud to have earned that support for the growth of the trenchless industry and our part in it. We encourage you to join the NASTT/ MSTT and get involved. For more information on the annual No-Dig Show, see page 3. For NASTT Education and Training resources see pages 9 and 47.

Member Benefits: NASTT members receive complimentary access to over 2,000 technical papers presented and published at past No-Dig Shows, glossary of terms, plus access to the Trenchless Resource Center available on the ISTT website. http://www.istt.com/

No-Dig, 2016: The No-Dig Show represents an annual opportunity for education, professional development and industry engagement. I encourage you to attend the 2016 show, scheduled for March 20-24, 2016 at the Gaylord Texan in Dallas, Texas.

Municipal Scholarships Available. The No-Dig Show Municipal & Public Utility Scholarship Award Program was established in 2013 to provide education and training for approximately one hundred employees of North American municipalities, government agencies and utility owners who have limited or no training funds due to economic challenges. To apply see https://www.nastt.org/municipalscholarship

Thanks to our VIP: Our Executive Director, Leonard Ingram is an indispensable resource for both me and this organization. His ongoing dedication and commitment is much-needed and much-appreciated.

MSTT is your organization, and this is your publication, so please support us and let us hear what you think. To provide feedback, place an ad or submit an article in next year's publication please contact Leonard, me or one of our directors.

OUR PURPOSE:

Advancing the science and practice of Trenchless Technology for the public benefit, to promote and conduct education, training, study and research in said science and practice for the public benefit.

Sincerely,

Jeff Boschert, P.E.
President, MSTT
(314)229-3789
jboschert@ncpi.org

MSTT
Midwest Society for Trenchless Technology

MSTT SITE

GREETINGS FROM THE MSTT EXECUTIVE DIRECTOR

Leonard Ingram, Executive Director, MSTT

The Midwest Society for Trenchless Technology (MSTT) was established in 1998 as a Chapter of the North American Society for Trenchless Technology (NASTT). Since its foundation, MSTT has presented 27 two-day seminars in 15 cities throughout the Chapter's nine state Midwest region. Through this active education outreach, MSTT has reached over 1,000 classroom attendees. I want to thank all our exhibitors, food sponsors, presenters, guest presenters or ASCE co-sponsor members for their support. MSTT could not have had such an active successful program without them.

Special thanks goes to MSTT Vice President Chris Schuler of Miller Pipeline for stepping up with their brand new training venue to host the upcoming MSTT seminar, October 7th and 8th, 2015. I plan to have ASCE Metropolitan Indianapolis Branch as the co sponsor for the seminar and Citizens Energy Group, which is the Indianapolis Sewer and Water systems provider, as the Guest Presenter. There will be a lot of networking and learning at the seminar.

For the professionals responsible for design, installation and maintenance of infrastructure, certainty is critical and the greatest obstacle professionals face is fear of the new and the unknown. As "trenchless technologists," it is our charge to educate these professionals with case studies, experiences and demonstrations to help them overcome these fears. That is why MSTT and NASTT conducts seminars and trade shows.

We plan to use this third annual publication of the *Midwest Journal of Trenchless Technology 2015* to further those efforts. This magazine highlights some of the many trenchless projects performed in and around the Midwest. It shows our successes and the continued growth in demand for trenchless projects. Please help me thank the Board of Directors of MSTT and their companies for their support throughout the year and for making this journal a reality. The MSTT Board of Directors is listed on page 9 in this journal.

I am also the Executive Director of the Mid Atlantic (MASTT) and Southeast (SESTT) Chapters of the North American Society for Trenchless Technology (NASTT) and serve on the Board of Directors of the Buried Asset Management Institute – International (BAMI-I) as the Treasurer. Recently, BAMI-I conducted a four day Certification of Training in Asset Management (CTAM) course in Raleigh NC that was attended by many MASTT, MSTT and SESTT members and others, including State of North Carolina representatives. (see pg 19 in this magazine).

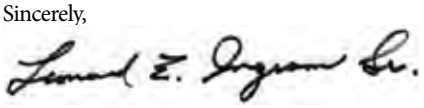
The four part CTAM course is a process that certifies Water Asset Managers as Associate or Professional Water Asset Managers (AWAM and PWAM). Upon proper completion and approval, it allows a person to have the designation of AWAM or PWAM after their signature denoting that they are Associates or Professionals in the water asset management profession. The course is also available on line at www.bami-i.com .

Dr. Tom Iseley, P.E., Professor at Louisiana Tech University, founder of their Trenchless Technology Center (TTC), Trenchless Technologist, and Chairman and co founder of BAMI-I was the originator of the CTAM process. This certification process is very important to protect our water resources through proper knowledge and correct implementation of all trenchless technology methods, equipment and techniques. Water Asset Managers who are CTAM certified will have great knowledge of the where, how, when, why and what to do with new and old water assets. This allows the designer, Engineer and/or financial people to have better understanding of new and existing water system problems and to correct them with the best and most affordable methods available.

Please contact me for additional information about attending any seminars or becoming more active in MSTT Chapter activities (leonard@engconco.com).

Thank you for your support!

Sincerely,



Leonard E. Ingram, Sr., AWAM
Executive Director, MSTT

Future Proposed Seminars:

MSTT October 7 - 8, 2015 Indianapolis IN
DATE SET

MASTT October 21 - 22, 2015 Virginia Beach VA
DATE MAY CHANGE

SESTT December 2 - 3, 2015 Shreveport LA
DATE MAY CHANGE

All MASTT, MSTT & SESTT 2016 seminars will be posted online in January 2016

MIDWEST SOCIETY FOR TRENCHLESS TECHNOLOGY
BOARD OF DIRECTORS 2015

Jeff Boschert - *President*

Jeff Boschert, P.E. is the President of the National Clay Pipe Institute (NCPI), a technical resource for sewer system managers and designers of gravity sanitary sewer lines. He holds a BSCE from Missouri University of Science and Technology. Jeff joined NCPI from Missouri DOT in 2004 to serve as the leader of NCPI's trenchless initiatives and has become a leading expert in the field of pilot tube guided boring. In 2012 he took on the added responsibility of conducting research and educational outreach and is now actively working with municipalities as they rediscover the benefits of vitrified clay pipe. In addition to his work with MSTT, he represents the industry on multiple ASCE and ASTM committees. In 2013 and 2014, Jeff presented papers at the NASTT No-Dig show and the ASCE Pipelines conference.

Chris Schuler – *Vice President*

Chris Schuler joined Miller Pipeline in 1984 as a laborer in Indianapolis, Indiana. Over the next few years he served the company in many capacities, assuming the role of equipment operator in 1989 and foreman the following year. In 1998 Chris stepped into the role of superintendent over Kansas City and Indianapolis until 2005 when he was promoted to project manager. In 2009 he assumed his current role as general manager of the Municipal Services Division where he oversees Miller Pipeline's water/wastewater trenchless rehabilitation operations.

Chris attended Indiana University from 1983-1986 focusing on Economics and Business. He graduated from the University of Missouri with a B.A. in Commercial Economics in 2001. Chris serves as the current Miller Pipeline Representative for the Indiana Chapter of NUCA. He is also a member of the NASTT Program Committee in addition to his role as Vice President of the MSTT Board of Directors.

Gary Smolinski – *Treasurer*

Gary is the construction manager at OHM Advisors (Orchard, Hiltz, and McCliment, Inc.), an integrated engineering, architecture and planning firm that is committed to advancing communities. As construction manager, Gary directs the construction engineering and management operations for OHM Advisors' Construction Department in Michigan, Ohio and Tennessee. He has over 25 years of experience working with multiple municipalities on best practices in the civil industry. While advancing in his career at OHM Advisors, he has excelled in his field construction experience utilizing trenchless technology on various municipal construction projects in the civil construction industry.

John Milligan – Secretary

John Milligan began his career with Vermeer in 1992 as a sales liaison with Latin America and eventually the Asia Pacific region, spending his first 15 years in various international and domestic sales-management positions. After leading the quality team within the trenchless and utility product segments at Vermeer, John took over as Business Manager for the Water & Sewer Segment, responsible for coordinating and executing the sales, engineering and manufacturing efforts related to the AXIS® guided boring system. He has been with the AXIS program since before its market launch in 2009. John was born and reared in São Paulo, Brazil, and earned a double major in Business Management and Business Marketing from Cedarville University in Ohio.

UPCOMING TRENCHLESS EVENTS

September 30, 2015
NASTT Pipe Bursting Good Practices Course
9:00 AM - 11:00 AM
Kentucky Exposition Center
Louisville, Kentucky
Information:
www.nastt.org/calendar

October 7-8, 2015
MSTT Trenchless Technology, SSES & Buried Asset Management Seminar
Miller Pipeline Facility
Indianapolis, Indiana
Information: Leonard Ingram,
mstt@engconco.com

October 7, 2015
NASTT Laterals Good Practices Course
1:00 PM – 5:00 PM
Atlanta, Georgia
Information:
www.nastt.org/calendar

October 16
NASTT Laterals Good Practices Course
8:00 AM – 5:00 PM
Hilton Niagara
Niagara Falls, Ontario
Information:
www.nastt.org/calendar

October 16
NASTT CIPP Good Practices Course
8:00 AM – 5:00 PM
Hilton Niagara
Niagara Falls, Ontario
Information:
www.nastt.org/calendar

October 21-22, 2015
MASTT Trenchless Technology, SSES & Buried Asset Management Seminar
Virginia Beach, Virginia
(Date may change)
Information: Leonard Ingram,
mastt@engconco.com

October 27
NASTT CIPP Good Practices Course
8:00 AM – 5:00 PM
The Declan Suites
San Diego, California
Information:
www.nastt.org/calendar

November 5
NASTT New Installation and Rehabilitation Good Practices Course
8:00 AM – 5:00 PM
The Inverness Hotel & Conference Center
Englewood, Colorado
Information:
www.nastt.org/calendar

November 10
NASTT Pipe Ramming Webinar
2:00 PM - 3:30 PM
Your Computer!
Information:
www.nastt.org/calendar

November 18
NASTT New Installation and Rehabilitation Good Practices Course
7:30 AM – 5:00 PM
Coast Plaza Hotel
Calgary, Alberta
Information:
www.nastt.org/calendar

December 2-3, 2015
SESTT Trenchless Technology, SSES & Buried Asset Management Seminar
Shreveport, Louisiana
(Date may change)
Information: Leonard Ingram,
sestt@engconco.com

March 20-24, 2016
NASTT 2016 No-Dig Show
Gaylord Texan Hotel & Convention Center
Dallas, Texas
Information:
www.nodigshow.com

MESSAGE FROM NASTT CHAIR

Dr. Kimberlie Staheli, PH.D, P.E., NASTT Chair

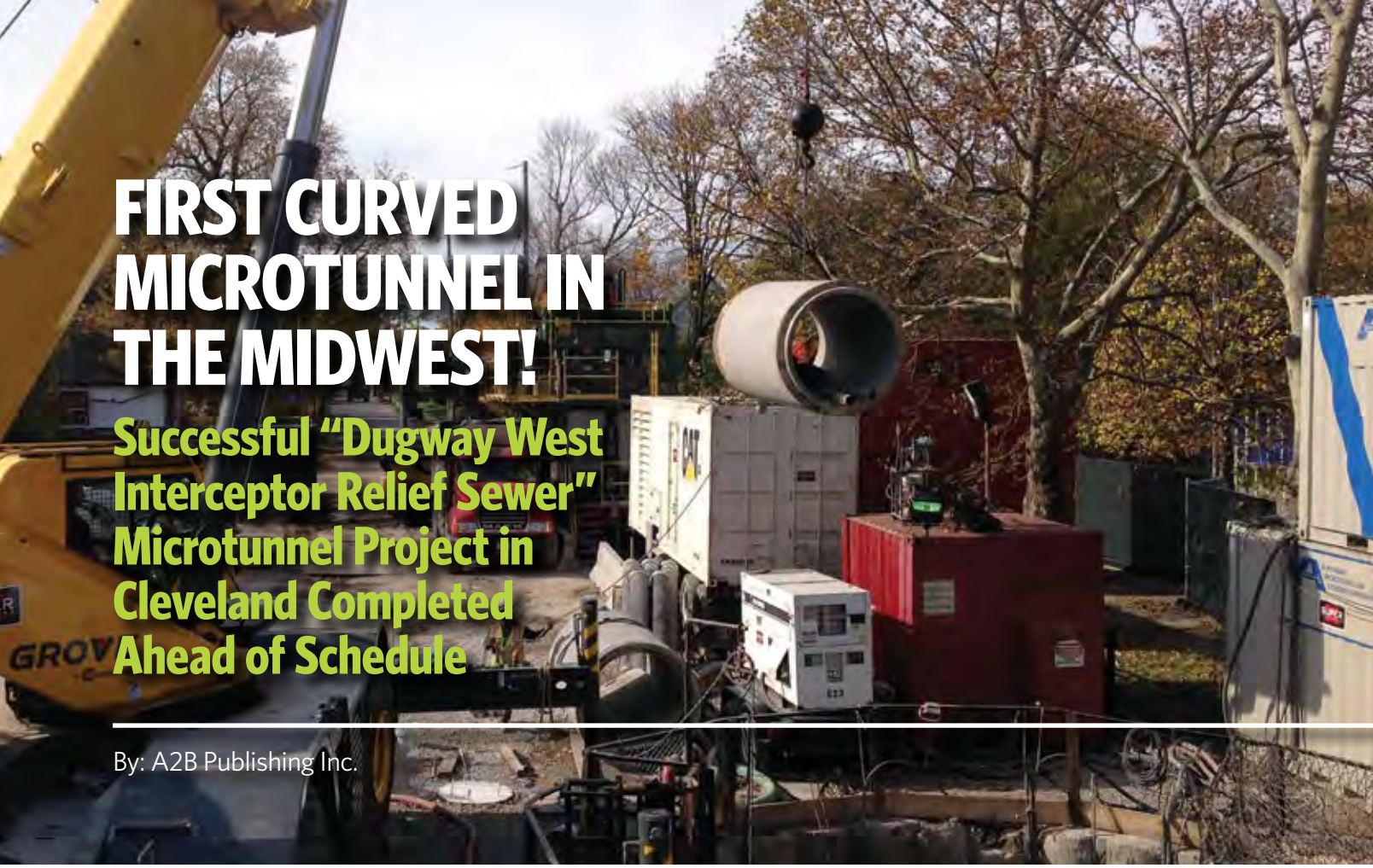
Greetings Midwest Chapter Members! NASTT is having a great year, and I'm excited for the future of our Society during my term as Chair of the Board of Directors and beyond. As you may be aware, NASTT's 2015 No-Dig Show in Denver, Colorado was a huge success as we broke attendance records and experienced a sold-out exhibit hall! Personally, I heard a number of excellent presentations and have read numerous quality papers since the show. It is clear that NASTT's No-Dig Show is a mecca for trenchless education, and without a doubt, our web site (www.nastt.org) houses the most comprehensive source of trenchless information.

NASTT would never be where we are today without the grass roots support of our volunteers and regional chapters. I would like to take this opportunity to thank the numerous Midwest Chapter Members that served on NASTT's 2015 No-Dig Show Program Committee: Alan Atalah, Glenn Duyvestyn, Jason Haas, Sahar Hassan, Larry Kiest, Dan Koo, Bernie Krzys, Johnathan Kunay, Marc Lehmann, John Milligan, Cathy Morley, Kevin Nagle, Ryan Otto, Jim Rankin, Jon Robinson, Jason Schiro, John Schroeder, Chris Schuler and Srini Vallabhaneni. I'd like to give a special thank you to Alan Atalah, Sahar Hasan, Dan Koo, Johnathan Kunay, Marc Lehmann, Cathy Morley, Jason Schiro and Srini Vallabhaneni who also served as Session Leaders this year. Serving on the Program Committee is a serious time commitment, hard work, and requires volunteer travel. Without these individuals who believe in the industry and the power of education, the NASTT No-Dig Show could not succeed. Thank you.

In addition to NASTT's No-Dig Show, NASTT provides many trenchless training courses. NASTT is focused on trenchless education and our instructors provide their expertise strictly on a volunteer basis. They take personal time to travel all over North America to provide top notch training about trenchless technologies. I would like to thank Dave Holcomb of TT Technologies who is training to teach our Introduction to Trenchless Technology – New Installations Course, Jason Schiro of Interplastic Corporation who teaches our CIPP Good Practices Course and Rick Melvin of TT Technologies who is presenting on our Pipe Ramming webinar on November 10. Visit www.nastt.org/webinars to sign up for this complementary training event. Thank you all for your dedication!

One of the goals that the Board of Directors identified through strategic planning is to engage a larger group of trenchless professionals to participate in the many volunteer opportunities provided by NASTT. NASTT has a very wide variety of volunteer openings that allow for satisfying and rewarding involvement at any level. If you are interested in more information, please visit our website at www.nastt.org/volunteer . There you can view our committees and learn more about NASTT's goals. Please consider becoming a volunteer – we would love to have you.

NASTT has a very promising future and your Midwest Chapter is stronger than ever. Thank you again for your continued support and dedication to NASTT and the trenchless technology industry.



FIRST CURVED MICROTUNNEL IN THE MIDWEST!

Successful "Dugway West Interceptor Relief Sewer" Microtunnel Project in Cleveland Completed Ahead of Schedule

By: A2B Publishing Inc.

Microtunneling setup at DWIRS launch shaft. The curved microtunnel eliminated the construction of two shafts, reducing impacts on the local community

Presented an opportunity to embark bravely into the next frontier of microtunneling by designing and completing a curved drive, trenchless contractor Super Excavators, Inc. (SEI) stepped up to the challenge, delivering excellent value to the project owner, while working to minimize surface disruption for residents in a busy east side Cleveland neighborhood.

At its own initiative, SEI submitted a Value Engineering Change Proposal (VECP) for design modifications to the Dugway West Interceptor Relief Sewer (DWIRS) microtunnel project, completed this August. The VECP introduced a 700 LF 72-inch tunnel curve in the alignment, replacing three shorter straight drives, and relocating one structure. Benefits from the design modifications in the VECP included reduced community impacts and maintenance costs from elimination of the construction of two shafts in a residential neighborhood. These changes also accelerated the overall project construction.

Overview

Project Clean Lake is the $3billion 25 year Northeast Ohio Regional Sewer District (NEORSD) program with the ultimate goal to ensure 98% of wet weather flows entering the combined sewer system receive treatment, thereby dramatically reducing raw discharges into Lake Erie and adjacent waterways. The NEORSD services over one million customers in all or part of 62 member communities in the greater Cleveland area, treating over 90 billion gallons of wastewater annually.

Under Project Clean Lake, the Dugway West Interceptor Relief Sewer (DWIRS) is a major component of the combined sewer overflow (CSO) control projects in the NEORSD Easterly service area, a system of conveyance and storage facilities under construction to drastically reduce overall CSO discharges. Part of the Euclid Creek and Dugway Storage Tunnel system, the DWIRS provides flow management to decrease the frequency and volume of CSO and flooding in the Dugway Brook West Branch watershed area, which encompasses the Glenville neighborhood - an older, predominantly residential area east of downtown Cleveland. The projected annual CSO capture for the DWIRS is 110 million gallons.

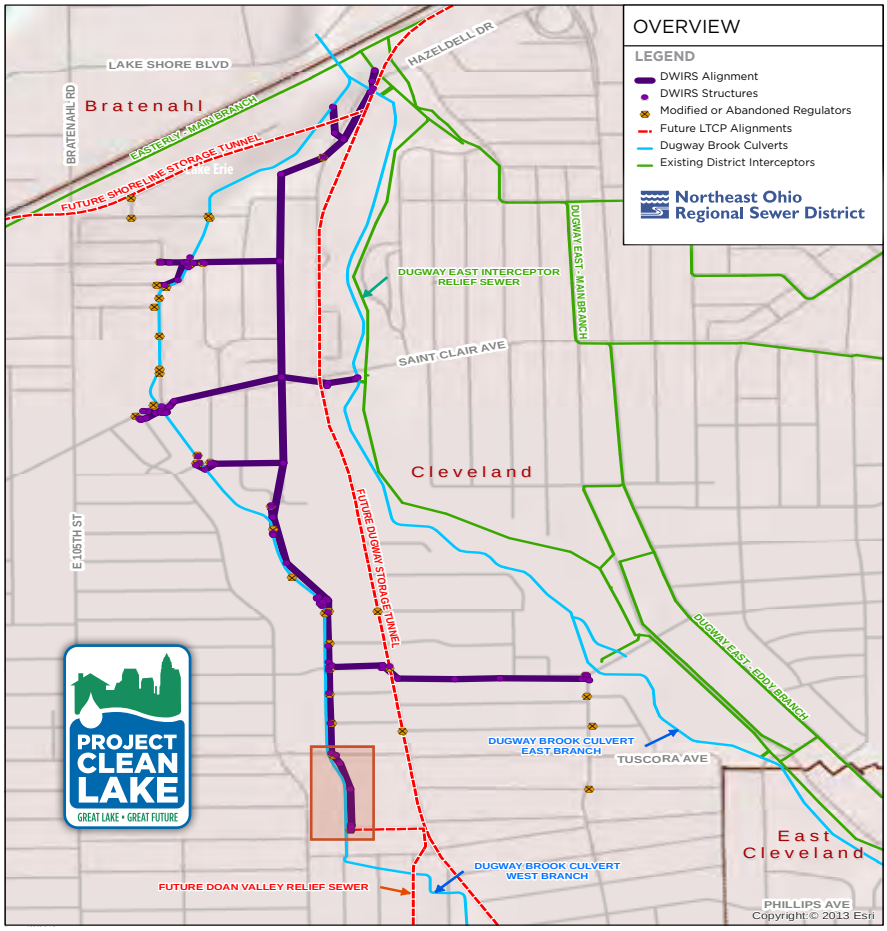
Essentially a 2 mile long conveyance tunnel, the DWIRS project design included construction of 10,600 LF of main line relief sewer, 4,000 LF of connecting sewers, demolition of 8 buildings and modification reconstruction or abandonment of 39 regulating structures. Due to location in a dense urban area with overhead and buried utilities, a minimum tunnel depth of 25 feet and high water table, the project design specified the use of microtunneling trenchless methods. In many tight urban settings such as east side Cleveland, trenchless construction is often now required because of the negative impacts on local communities from open-cut construction. These impacts can include general inconvenience, safety problems, environmental concerns, along with damage to roads, utilities, and other infrastructure already in place.

DWIRS Microtunnel Project

NEORSD awarded the $57 million contract for the DWIRS project in October 2013 to Joint Venture partners Walsh Construction and Super Excavators, Inc. (SEI) of Menomonee Falls Wisconsin. Walsh Construction was responsible for all the above ground work including the regulating structures, manholes, junction chambers and all tie in connections to the existing sewer system.

SEI focused on the microtunneling work, which consisted of 7,000 LF of 72-inch RCP relief sewer, mining through shale rock of approximately 915 LF, and trenchless construction of approximately 4,000 LF of 48-inch RCP sewer. In total there were 17 separate drives of varying lengths with the longest being 1079 LF. Depths ranged from 25 – 32 feet with the deepest drive at 42 feet. Nine launch shafts and 11 receiving pits were constructed – one launch shaft and one receiving pit were eliminated from the original project design through implementation of the VECP design modifications.

Before construction, subsurface conditions were evaluated along the planned DWIRS route, which runs along the gently sloping east side of the Cuyahoga River valley northwards to Lake Erie. Soils consist of fill, alluvium, glacial lacustrine deposits, and glacial till on shale bedrock. Nearly the entire alignment is covered in non-engineered fill consisting of sand with varying amounts of silt, clay and gravel intermixed with random debris. Much of this fill has the appearance of fine sandy dredge spoil from Lake Erie. Alluvial deposits are comprised of channel deposits and flood plain deposits, predominantly silty fine sand. Cobbles and boulders common in glacial tills throughout the Great Lakes region were also found. These ground conditions changed variously and frequently over short distances along the project alignment, reflecting the complex post glacial geology and rich settlement history of the region.



Project Clean Lake plan overview of DWIRS with location of curved microtunnel segment highlighted. Southern end runs close to existing culvert (courtesy NEORSD)

The water table is generally from 10 to 20 feet deep, several feet above the installed pipe. At the upper, southernmost end of the alignment, groundwater follows the elevation of Dugway Brook West Branch, which is almost entirely enclosed in a culvert, now a vital part of the current sewer system used for CSO discharges. The proximity of this culverted stream to the planned DWIRS alignment was an additional consideration in the original selection of microtunneling in the project design. Use of precision trenchless methods instead of open-cut construction greatly reduced risk of damage to the Dugway Brook Culvert.

Because of the project specific soil conditions and elevated water table, two Microtunnel Boring Machines (MTBMs) with capability to continuously pressurize the mining face were used. The first MTBM drive was launched in August 2014 from a 45-foot deep secant pile shaft with an Akkerman SL60 MTBM. The SL60 was used throughout the project for the 48-inch RCP sewer, including a 915 LF run through shale, while an Akkerman SL74 was deployed on all the 72-inch drives including the 700 LF of curved microtunnel. Both MTBMs were equipped with an increase kit so that the final bore diameter would accomodate the outer bore diameter of the jacked pipe. The machines performed very well in the various ground conditions encountered during tunneling operations.

Value Engineering Change Proposal

SEI initiated the VECP to consolidate three very short drives into one longer curved tunnel located at the southernmost upper end of the DWIRS project alignment along Linn Drive. The original NEORSD design used 3 shorter drives in order to work within the easement granted for the project, and to stay far enough away from the existing Dugway Brook Culvert. This initial design approach followed the curve of the culvert with short pieces of straight pipe.

Together, these three relatively short tunnel runs made up about 670 LF. SEI realized these three straight runs could be incorporated into one longer curved drive design which would greatly reduce the costs and time associated with shaft construction, setup/breakdown, and moving equipment and crews around. All of this could be

accomplished through elimination of one jacking shaft and one receiving shaft.

With the curved design approach, future maintenance costs incurred by NEORSD for these two structures (points of intersection) PM14 and PM15 were completely eliminated. The owner allowed SEI to relocate structure PM13 approximately 30 feet north which helped facilitate a "better fit" curve by making it 30 feet longer, and thus 700 LF in total.

Curved MTBM Drive

Once the idea of introducing a curved tunnel into the alignment was accepted by the owner, Scott Ludlow, S.J. Ludlow Consulting Engineers, Inc., of Indianapolis IN, was retained by SEI to complete the engineering design necessary to obtain final approval. Based on what he saw, Ludlow was optimistic about the prospects for success:

"Considering the project requirements, anticipated ground conditions, SEI's capability to perform the work, and the NEORSD's knowledge of tunneling, the concept of utilizing a curved microtunnel appeared to be viable."

In order to maintain proper safe distance from the Dugway Brook Culvert the curve in the VECP design mirrored the curve of the existing culvert and roughly followed the path of the original NEORSD design. The entire alignment was very close to the culvert – never more than 15-20 feet away. To facilitate the curved section, Hanson Pipe of Columbus Ohio provided shorter 8 foot 72-inch RCP segments, which were installed instead of the 10 foot RCP segments used on the rest of the job.

According to Ludlow: *"Design considerations for the tunnel section included: maintaining an alignment within the right-of-way; estimates of jacking forces and ground response; and structural adequacy/joint performance of the pipe."*

Working 24 hours/day it took 10 days to complete this historic drive, mining north to south, from PM13 to PM16 which at is the southern terminus of the DWIRS under the intersection of Ada Avenue and Linn Drive.

As SEI Project Manager Justin Kolster observed: *"The response of SEI to approach this section of the DWIRS with the curved design was strictly a matter of practicality in terms of schedule, neighborhood impact, cost, and overall project goals, all of which were successfully met and delivered by implementing the curve design."*

First MTBM launch August 15 2014 from a 45 foot deep secant pile shaft using an Akkerman with an MT860K jacking frame

CURVED MICROTUNNELS: DIRECT BENEFITS

Over the last few years, curved microtunnel alignments have been successfully completed on only a limited number of projects in North America. The majority of curved projects were bid as straight drive microtunnels, and later became curved drives through value engineering proposals from contractors.

Project owners have recently appreciated that incorporating curves into microtunnel alignments can lead to net savings both in terms of cost and schedule after risks have been addressed. As the infrastructure inevitably becomes denser, being able to reduce the number of shafts, reduce shaft depths, provide flexibility along the right of way or the alignment, and avoid obstacles, sensitive zones or utility crossings will lead to more significant direct and indirect cost savings.

Contractors are now more willing to bring forward change proposals on their own that incorporate curves and offer savings in terms of the impact to the public or in terms of saving time and money. The majority of curves have come from the contractors who have had to present proposals in a way to the owners that made sense in terms of the benefits. This has been a huge step for the industry - soon we will get to a point where owners are willing to have curved drives on their actual bid sets.

Now that they are seeing projects completed successfully in North America, owners are engaged in the discussion and eager to learn more. They are more receptive to seeing if it makes sense to do a curve. Recently there has been a major step forward in the projects contractors and owners are willing to do. However, this is just the beginning of where we will go.

In the future, the North American industry will see longer drives, sharper curves, curves in rock, and alignments with more spatial curves. This will be accomplished with more successful projects providing direct benefits to owners where risks are appropriately allocated to the party best able to manage them.

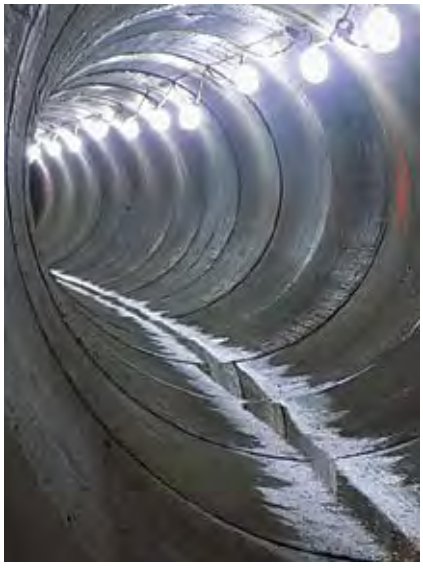
Rory Ball is a graduate of the University of Illinois and a Senior Project Manager with Hatch Mott MacDonald based in Cleveland OH. He has over twelve years of work experience in the tunneling industry on a wide variety of tunneling projects in four countries and over a dozen states. Rory is passionate about pressurized face tunneling and fostering advancements within the North America industry.

Guidance System

A crucial element in the successful completion of any microtunneling project is the guidance system used, and this was absolutely critical to the success of the curved tunnel segment.

Once design was approved for curve approach, SEI purchased a VMT navigation system to assist with the MTBM guidance. VMT was a big contributor to the success of the curved microtunnel, as they provided onsite survey support for the duration of construction. Said Kolster: *"VMT was critical in making this successful."*

Break out at PM 16 receiving pit celebrated by SEI crew after completion of curved tunnel drive with an Akkerman SL74 MTBM



Tunnel has curve radius of 915 feet. 8 Foot segments of 72-inch RCP were jacked in the curved section

Major Accomplishment

Joining an elite group of North American microtunneling contractors who have accomplished this feat, SEI completed the approximate 700 LF of 72-inch curved MTBM drive this summer. It is the first curved microtunnel completed in the Midwest region, and the 4th such milestone using conventional microtunneling equipment completed to date in the US. 100% the brainchild of SEI, the VECP further reduced community impacts from DWIRS construction in a densely populated Cleveland neighborhood, while reducing long term maintenance costs for project owner NEORSD.

The DWIRS project demonstrates how close ongoing cooperation between owner and contractor can deliver success. SEI worked together with NEORSD to ensure the most accurate, up-to-date information on the project was dispersed to local residents. The microtunnel curve facilitated an accelerated schedule as did the fact NEORSD allowed work to proceed on a 24 hour basis for much of the job. Microtunnel construction completed in August 2015, 60 days ahead of schedule.

As Kolster summed up: *"It doesn't get any better than this. It went perfect, and just as planned. SEI's team, S.J. Ludlow Consulting Engineers, Inc., the NEORSD, Hanson Pipe, VMT, and onsite crews all did a great job working together, and the results show."*

Key Project Personnel:
SEI Team: Justin Kolster, Project Manager; Brian Strane, Superintendent; Nate Weidmeyer, Superintendent; Craig Smet, Foreman. NEORSD Team: Kellie Rotunno, Chief Operating Officer; Robert Auber, Construction Manager

Pipe Bursting Pit, Melvin, MI

LOCAL AND REGIONAL VARIANCES IN USE OF TRENCHLESS TECHNOLOGY METHODOLOGIES

By: Gary Smolinski, OHM Advisors

The mission of MSTT is to promote trenchless technology education and development for public benefit in the Midwest. MSTT hosts a variety of seminars, short courses and field demonstrations - for example the regional "Trenchless Technology SSES and Buried Asset Management Seminars. But as professionals with demanding schedules, it's often challenging to find the time to attend worthwhile events like these, not to mention participate in professional groups in our industry.

I am fortunate to work for an organization that encourages its employees to get involved with organizations such as MSTT, and to take an active role in professional organizations. As a partner at OHM Advisors, I have the freedom to promote the education and development of trenchless technology in my area – a practice which is important to me (and my firm) from a community benefit standpoint.

OHM Advisors has been utilizing trenchless technology for water distribution pipeline projects and sanitary sewer system projects for the past several years. As the technology has evolved and our understanding and experience with trenchless methodologies increased, we've adjusted our design and bid procedures for underground infrastructure projects.

I made an interesting observation about the application of trenchless technologies in Michigan when I was speaking on the topic of pipe bursting for water mains at the Michigan American Water Works Association (MI-AWWA) 2014 Fall Regional Conferences, which are held in the Southeast, Southwest, Central & Northern Lower regions of the state. I asked the attendees if they used pipe bursting for the replacement or renewal of deteriorating or undersized water mains. Their responses varied greatly – which surprised me. The majority of the Southeast Michigan attendees indicated that they used the technology, but only one to two attendees in Southwest Michigan said they used pipe bursting technology. Both the Central and Northern Lower parts of Michigan had less than 50% of attendees indicate that they used the technology.

I wondered about the possible reasons for these variances. Although trenchless technology is gaining acceptance in many communities throughout the country, there are different factors that may be driving what methodologies are considered, or not considered, for the installation, replacement or renewal of underground utilities with no or minimal excavation and surface disruption. Some of these factors may include:

Pre-qualification Requirements - Often, owners and engineers will include certain pre-qualifications that have to be met by

Pipe Welding Set Up, Bloomfield Orchards, MI

"reduced direct construction impacts to constituents and customers and the recycling of existing easements and utility alignment because of trenchless methods are also benefits that don't necessarily register on the bid sheet, however are nonetheless very valuable to the end user"

contractors bidding on trenchless projects. Many owners and engineers require that contractors meet pre-qualification requirements based on proven experience with similar projects, and a track record of a certain defined minimum of trenchless projects performed. Additionally, certifications and training records need to be in place prior to bidding on some trenchless contracts.

Local Contractor Influence – Open Excavation vs. Trenchless Methods - Local contractors are an important part of a community, and often are opinion leaders and local experts on underground infrastructure in the community. Due to prior investments and work history, it is unlikely a traditional open trench utility contractor is going to promote the use of trenchless technology on a project where open-cut excavation can be performed.

Investments to Perform Specialized Work - Trenchless projects typically require certain specialized tools, equipment and training to properly perform the work successfully. Some contractors have recognized the value of being able to perform utility renewal or replacement projects using trenchless technology, and have invested the capital expense needed to acquire equipment to perform trenchless projects. In addition they must invest in the necessary training and certifying of their employees to properly perform trenchless projects.

Selection of Pipe Material - Communities typically minimize the number of different types of material in their public utility systems, because it makes it easier to perform maintenance when needed. Decisions on the material used can sometimes limit the range of options considered, and often this can be due to limited awareness of current day advancements in trenchless methods.

For example, many utility owners with water distribution systems prefer the use of ductile iron pipe, yet many of these same owners are not aware some of the trenchless methodologies now available are done using ductile iron pipe as the replacement material. Even though HDPE pipe and fusible PVC pipe are the two most common materials used in Horizontal Directional Drilling (HDD) and pipe bursting, technical advances in trenchless technology prove that ductile iron pipe can often be used in HDD and even pipe bursting applications.

Lack of Education and Understanding of Benefits & Advantages of Trenchless - Utility owners are aware of the range of technologies that are available to them, however sometimes lack understanding of

how the use of specialized technologies can actually be the most reliable cost effective approach, providing maximum benefits for the community as a whole. Even while some trenchless projects may cost the same or slightly more than comparable open-cut in terms of contract price, the decrease in total effective costs compared to open-cut makes trenchless technology very attractive. Social costs such as traffic and business disruption, length of time and the mess from open-cut, reduced pavement life, environmental mitigation and other negative impacts can all increase the total effective cost of open-cut construction. The reduced direct construction impacts to constituents and customers and the recycling of existing easements and utility alignment because of trenchless methods are also benefits that don't necessarily register on the bid sheet, however are nonetheless very valuable to the end user.

Reduction of Overall Carbon Foot Print - Another attractive reason for utilizing trenchless technology is from the global perspective. Traditional open-cut methods and equipment for the installation and replacement of underground infrastructure can be highly polluting, and trenchless projects offer an alternative that improves the carbon foot print on construction projects. Research has shown that trenchless projects produce substantially fewer carbon emissions (Greenhouse Gas) by as much as 90% when compared to traditional open-cut excavation. In collaboration with gas and electric utilities NASTT has developed a Carbon Calculator which will derive the approximate reduction in carbon emissions from utilizing trenchless technology as an alternative to open-cut on underground infrastructure projects: https://www.nastt.org/carboncalculator.

With continued efforts on the part of professional organizations and individual outreach to promote the education and technology advancements of trenchless technology, a greater number of communities will begin to adapt trenchless technology methodologies as a viable option when rehabilitating or replacing their aging infrastructure. However, in the end, each specific method applied has to be accepted and found to be valuable to the engineers that provide the design expertise, and ultimately to the utility owners that will maintain and operate the asset for years to come.

ABOUT THE AUTHOR:

Gary Smolinski, *partner at OHM Advisors and current MSTT Treasurer, is pleased to share some of his experiences related to local and regional variances he observed while presenting on trenchless technology topics at seminars and short courses in Michigan, and other parts of the Midwest.* *His bio is on pg 9.*

TTC AND BAMI-I LAUNCH A COMPREHENSIVE ASSET MANAGEMENT CERTIFICATION PROGRAM

CTAM 300 & 400 Courses Released At Successful Training Event in Raleigh NC

By: Saleh Behbahani, Trenchless Technology Center

The Trenchless Technology Center (TTC) is an industry/university/government research center at Louisiana Tech University. For 25 years TTC has served as a global leader for the development of technologies influencing almost every aspect of trenchless construction methods. TTC has established a partnership with the Buried Asset Management Institute-International (BAMI-I) to continue to develop a comprehensive approach for utilizing best business practices in managing the treasures beneath our feet.

The Buried Asset Management Institute (BAMI) was established in the Department of Watershed Management (DWM) for the City of Atlanta in 2003 as a result of the leadership and inspiration of Mayor Shirley Franklin and DWM Commissioner Jack Ravan. In 2004, BAMI transitioned to BAMI-International (BAMI-I) as a non-profit organization. In 2006, BAMI-I was selected for U.S. EPA Cooperative Agreement (CP 83 282901-1), which was completed in 2008.

BAMI-I launched the first Certificate of Training in Asset Management course (CTAM 100) in 2010. The CTAM 100 course provides a comprehensive introduction to Asset Management principles and concepts – with special emphasis on their application to "buried assets" associated with water and sewer systems. The initial success of the CTAM 100 course created awareness of the need to broaden its scope and provide more detailed training in an expanded sphere of utility system concerns. This led to the release in 2013 of the CTAM 200 course level, which focused on the specifics of how to develop an Asset Management Plan. In July and August 2015, BAMI-I released the CTAM 300 and CTAM 400 course levels respectively. CTAM 300 & 400 focus on the ongoing management of the Asset Management Plan, as well as the financial aspects of funding Asset Management Plans.

Participants listen attentively. For the first time, all four CTAM courses were taught in a classroom format.

Dr. Tom Iseley introduces CTAM 300 course materials during successful training event Aug 17 – 20 in Raleigh NC.

This summer, the 300 and 400 level course materials were introduced in a live training session. TTC, in partnership with the BAMI-I, conducted a 4 day "Asset Management Training for Water Infrastructure", Certification of Training in Asset Management (CTAM) session in Raleigh, NC August 17 – 20. For the first time, all four CTAM courses were taught in a classroom format. After completion of these 4 courses (CTAM 100-400), participants received designation as an Associate Water Asset Manager (AWAM) plus 26 hours of PDH credits.

"The materials are very thorough and the instructors have been phenomenal, straight from industry"

Among the approximately 30 participants involved in this successful training event were:

- Professional Engineers in senior management positions,
- Professional service providers in the sanitary sewer system evaluation and rehabilitation industry,
- Professors and Research Professionals from academia directly involved in trenchless technology and asset management,
- Employees of public municipal utilities,
- State Government officials and employees involved in water infrastructure who desire to promote asset management principles within their state, and
- Asset Management Professionals actively involved in the development of asset management plans and promoting asset management principles in the USA.

ABOUT DR. TOM ISELEY

Tom Iseley, Ph.D., P.E.
Professor of Civil Engineering Director of the Trenchless Technology Center, Louisiana Tech University, Ruston, LA & Chairman, Buried Asset Management Institute-International, Inc.

Dr. Tom Iseley has over 35 years of experience in the planning, design, and construction of underground infrastructure systems. From 1982 until 1995, he served on the faculty of Mississippi State University, Purdue University, Louisiana Tech University, and as chairman of the department of Construction Technology at the Purdue University School of Engineering and Technology in Indianapolis.

In 1989, Dr. Iseley established the Trenchless Technology Center (TTC), an industry/university cooperative research facility, at Louisiana Tech University and served as director for 5.5 years and director of development for 2 years. He returned to Louisiana Tech & TTC on July 1, 2014.

He is a founding director of the North American Society for Trenchless Technology (NASTT). Also, in 1993, Dr. Iseley was selected as the Trenchless Technology Magazine's Person of the Year. He received the ASCE 1995 John O. Bickel Award and the 1999 Stephen D. Bechtel Pipeline Engineering Award.

This year Dr. Iseley was honored with election to a Distinguished Membership in the ASCE, the highest award bestowed upon members. According to the ASCE website, "A Distinguished Member is a person who has attained acknowledged eminence in some branch of engineering or in the arts and sciences related thereto, including the fields of engineering education and construction."

In 2016 the Underground Construction Technology Association (UCTA) and Underground Construction magazine will honor Dr. Iseley as the 2016 UCTA MVP (Most Valuable Professional) in a special luncheon ceremony held February 3, 2016 12:00 – 1:30pm at the Georgia World Congress Center, Atlanta GA in conjunction with the UCT annual conference.

Dr. Iseley holds a B.S. degree in Civil Engineering and an M.B.A. degree from the University of Alabama in Birmingham and a Ph.D. degree in Civil Engineering from Purdue University.

CTAM 100 – 400 COURSE AGENDA
AUGUST 17 – 20, 2015 RALEIGH NC

DAY 1: Monday, August 17, 2015
CTAM 100

8:00	**Welcome and Introductions**
8:30	Introduction to Asset Management (Ch.1) Quiz (15 min)
9:15	Sharing Asset Management Knowledge on a Global Scale (Ch.2) Quiz (15 min)
10:00	**Break**
10:15	Asset Management Technologies (Ch.3) Quiz (15 min)
11:15	Risk Management (Ch.4) Quiz (15 min)
12:00	**Lunch**
1:00 pm	Government Regulation (Ch.5) Quiz (15 min)
1:45	Case Studies (Ch.6) Quiz (30 min)
3:15	**Break**
3:30	Development of Center of Excellence for Municipal Asset Management (Ch.7) Quiz (10 min)
4:00	Phase 2
4:30	Phase 3
5:00	Social Event
6:00 pm	**Adjourn**

DAY 2: Tuesday, August 18, 2015
CTAM 200

8:00	**Introductions**
8:15	Introduction (Ch.1) Quiz (15 min)
9:00	Buried Asset Management Program (Ch.2) Quiz (30 min)
10:00	**Break**
10:15	Wastewater and Water System Inventory (Ch.3) Quiz (30 min)
11:30	Asset Management and Computer Support
12:00	**Lunch**
1:00 pm.	Condition Assessment – Wastewater System (Ch.4) Quiz (30 min)
2:15	Condition Assessment – Water Distribution System (Ch.5) Quiz (25 min)
3:40	**Break**
4:00	Conclusions (Ch.6) Quiz (15 min)
4:30 pm	**Adjourn**

DAY3: Wednesday, August 19, 2015
CTAM 300

8:00	**Introductions**
8:15	Organizational Considerations (Ch.1) Quiz (20 min)
9:50	**Break**
10:00	Conditional Assessment (Ch.2) Quiz (20 min)
11:00	Repair/Restore Options (Ch.3) Part 1
12:00	**Lunch**
1:00 pm.	Repair/Restore Options (Ch.3) Part 2 Quiz (30 min)
2:00 pm.	Priority Development (Ch.4) Quiz (15 min)
3:00	**Break**
3:15	Tabulation and Presentation of Priority-Based Long-Term Plan (Ch.5) Quiz (20 min)
4:35	BREAK
5:00	Round Table
6:00 pm	**Adjourn**

DAY 4: Thursday, August 20, 2015
CTAM 400

8:00	**Introductions**
8:30	Accounting Principles (Ch.2) Quiz (30 min)
10:15	**Break**
10:30	Infrastructure Stewardship (Ch.3) Quiz (25 min)
12:00	**Lunch**
1:00 pm.	Strategic Financial Planning (Ch.4) Quiz (15 min)
2:00	Contracting Methods (Ch.5) Quiz (15 min)
2:45	**Break**
3:00	Case Study: Town of Spindale Asset Management Plan (Ch.6) Quiz (15 min)
4:00 pm	**Course Wrap-up**
5:00 pm	**Adjourn**

JD Solomon, one of the participants in the Raleigh CTAM program, is a member of the State Water Infrastructure Authority in North Carolina and an asset management practitioner with CH2M Hill. After finishing CTAM 100-400, he said, "I have been impressed with the instructors and they bring a lot of practical experience and a lot of practical stories to the course. Training material was well focused and gives an overview of asset management but it really drilled into the buried asset management, which is the focus of BAMI-I. And I have been really impressed by the…depth of detail that goes to the buried asset on the water and sewer side".

Another participant in the Raleigh CTAM program, Dan Clinton, is a storm water engineer for Cary NC - a suburb of Raleigh with a population of about 150,000. When asked about the training materials, he replied: "I found the materials were excellent, a very comprehensive course that provides a good foundation for starting up a program through managing it as well as the financial side of things. The materials are very thorough and the instructors have been phenomenal, straight from industry and were able to provide a lot of practical experience that is used on a daily basis - they were able to share experience and what they have learned with the students."

ABOUT THE TRENCHLESS TECHNOLOGY CENTER (TTC):

The Trenchless Technology Center (TTC) *at Louisiana Tech University was established by Dr. Tom Iseley in 1989. It was created to promote research, development and technology transfer in the trenchless technology industry. The TTC is a cooperative research hub for academia, government and industry, and has world-class research and testing facilities at the National Trenchless Technology Research Facility (NTTRF) in South Campus at Louisiana Tech.*

SHIVELY INTERCEPTOR VCP PILOT TUBE PROJECT RETROSPECTIVE

3 years later, the 3rd largest pilot tube project completed in the US remains a significant milestone

By: Midwest Mole & A2B Publishing Inc.

Still considered the third largest pilot tube method (PTM) guided boring project ever done in the US, the Shively Interceptor is one of the most challenging and noteworthy PTM projects undertaken to date. Completed in April 2012, it remains a significant milestone in the continuing advancement of PTM technology towards ever larger diameters and even longer drives.

The Shively Interceptor is a gravity flow sewer that was built to replace an aging forcemain and eliminate the need for 5 pump stations regularly overwhelmed by wet weather events. It is part of the Louisville, Kentucky – Jefferson County Metropolitan Sewer District (MSD) sewer improvement and overflow abatement WIN program – Waterway Improvements Now. Shively is a small predominantly residential community located within the Louisville KY metropolitan region.

Trenchless contractor Midwest Mole, from Indianapolis IN, subcontracted the trenchless portion of the installation, commencing the project in November 2010 and completing it 16 months later in April 2012. The pilot tube construction project consisted of over 10,000 LF of jacked vitrified clay pipe (VCP) in varied diameters. There were 1,228 LF of 27-inch, 733 LF of 21-inch, 4,280 LF of 18-inch, and 4,437 LF of 15-inch VCP installed utilizing PTM technology. The 35 individual crossings ranged in length from 144 LF to 365 LF.

A total of 37 shafts were constructed, averaging 25 feet depth, with the deepest at 35 feet. The shafts were designed to allow for the installation of 1 Meter lengths of 15-inch, 18-inch, and 21-inch VCP utilizing an Akkerman 308 Guided Boring Machine (GBM) and 2 Meter lengths of 27-inch VCP with an Akkerman 4812 GBM. The shafts were built in advance of tunneling and covered with road plates. Roundabouts were constructed so that traffic flow was maintained around the shafts while tunneling proceeded.

Ground conditions consisted of loose medium dense coarse sands below the water table to loose fine sand above the water table. Many alignments were several feet below the water table. A notable feature of the project was the extremely flat grade - the entire alignment ranged from only 0.068% to 0.143%. In fact, the Shively Interceptor design was below established standards for grade in gravity sewers and needed special approvals in order to proceed with the project. This nearly flat layout, along with the length and depth of crossings and pipe diameters used necessitated the precisely accurate installation by line and grade offered by PTM technology.

Highlights and unique features of this monumental project follow in excerpts from the original "Shively Interceptor" paper authored by Joseph Butor and Brad Ream. This paper was first presented at the 2012 NASTT NO-DIG Conference in Nashville TN.

Pilot Tube – The Only Economical Choice

"When most companies are doing a tunnel or bore project they wouldn't consider being off by a tenth of a foot to be a bad outcome. Midwest Mole had to be within a tenth of a foot on this project, 35 times. We had grades ranging from 0.068% to 0.143% and crossings ranging from 144 feet long to 365 feet long. On top of all of that we were working in wet, loose sand with blow counts ranging from 1 to 19, and at times several feet below the water table. With these challenging ground conditions and strict grade requirements, pilot tube was the only economical choice.

On this project we installed 15-inch, 18-inch, 21-inch, and 27-inch Can Clay Denlok jacking pipe. The 27-inch VCP required the use of the Akkerman 4812 GBM due to the pipe diameter. We also chose to use the 4812 on two of the 21-inch crossings considering the length of the crossing and the pipe diameter to eliminate any possible thrust issues. The 4812 provides 200 tons of thrust with four cylinders which would allow us to provide additional thrust if jacking forces

increased. We used the Akkerman 308 GBM and 240 GBM for the 15-inch and 18-inch crossings and the 21 inch crossing that was a shorter crossing. The 308 and 240 can provide up to 100 tons of thrust with two cylinders."

Shafts

"The 4812 is designed to work out of 12 foot minimum ID shafts. We used secant pile shafts when installing the 27 inch clay jacking pipe. Each secant pile was three feet in diameter and overlapped the adjacent one by six inches.

We had the general contractor core out three holes in the secant piles based on centerline elevation to allow for entry of the tooling. The first hole was 8 inch in diameter for the pilot tubes, the second hole was 16-inch in diameter for the 11-inch temporary casings and the third hole was 36-inch in diameter for the Powered Cutting Head (PCH). The 36-inch core was the biggest core we were able to get which makes it tight when using the PCH28.5 due to the OD being 34 inch and having an over cut of an inch and a half.

On the first shaft we removed the 8-inch core and installed the pilot tubes. Once the pilot tubes were across we chipped out the 16-inch core to allow for the casings, and once the casings were across we chipped out the 36-inch core. This core was unable to make it all of the way through the secant piles due to the diameter and offset of the piles. We ended up letting the PCH cut through the last couple of inches of the piles which worked out very well.

The General Contractor elected to install a square sheet pile shaft for the last 4812 work pit. We used the square shaft adapters and installed a bulkhead in the front and used a piece of casing to allow the three passes to go through. We filled the bulkhead up with flowable fill around the casing to make it easy to remove and allow the general contractor to remove the sheeting easily.

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The Akkerman 308 GBM is designed for eight foot diameter shafts, but Midwest Mole elected to use nine foot diameter shafts to allow for more working room in the shafts. We added a one foot extension to the frame rails to allow them to fit tight in the shafts. The general contractor installed a galvanized corrugated can for the work shafts and receiving shafts."

Groundwater

"The use of a corrugated metal pipe shaft presented challenges sealing off the entry and exit portals of the shaft from flowing sands and groundwater. The corrugations of the can created an abnormal shape to mount a standard seal to, which in turn left voids between the seal and the CMP that allowed flowing material to enter the shaft. Therefore, we had to get creative with how we were cutting the can and how we were going to lower the groundwater table. We encountered groundwater elevations up to 5 feet above the crown of the product pipe.

The pilot tubes were successfully installed with minimal issues related to groundwater and flowing sands as the pilot tube steering head does not have an overcut band, i.e. the steering head is the same diameter as the pilot tubes. Thus, the pilot tube steering head was able to pierce through the can in a manner that the entry point was essentially the same diameter as the tubes and formed a seal around the pilot tubes. When it came time for the reaming head to enter and exit the shafts, we would cut along the reaming head anti-roll "fins" and allow the reaming head to push the can open.

This approach did not allow for a tight seal around the auger casings due to the overcut on the reaming head. In an effort to minimize ground loss, excelsior (artificial straw) was inserted into the area around the reaming head at the entry/exit portals to create a seal to limit the amount of soil entering the shaft. The PCH presented similar challenges to the reaming head except we were able to cut out a pie shape in the CMP and let the PCH push the flaps into the soil matrix. These flaps provided a little support for the soil, but typically excelsior would also be required to minimize soil flow into the shaft. Cutting the can this way allowed us to support each pass on the can without worrying about any of the passes settling. If we would end up cutting out too much we would weld a support across the bottom to prevent them from settling.

In some cases, the groundwater and soil pressure was so great deep wells were required on the outside of the shaft for entry/exit of the tooling. Chemical grout stabilization was successfully used in some cases, however this approach did not prove to be the best option. An alternate technique for dewatering the soils immediately outside the shafts which was successful and cost effective was the use of horizontal wells. We drilled 2" holes from spring line down following the circular shape of the pipe and installed perforated PVC pipe as 2" wellpoints to draw the water table down to a manageable elevation. While the soils were not completely dewatered at the entry/exit portals the ability to relieve some of the water pressure at these locations proved to be an adequate solution."

Settlement

"When engineering and pushing the pilot tubes we had to anticipate the crossing settling into the overcut of the casings and the PCH. With an overcut of 1-1/2 inches on both the reaming head and PCH, we were required to anticipate the line dropping 0.12

feet total. We would set up a couple hundredths high at the work pit, and on uphill crossings we would install them at a steeper grade and on downhill crossings we would install them on a flatter grade.

After setting the machine in the shaft and ensuring it was on line and grade we installed our theodolite stand in the back using concrete anchor bolts. We requested all concrete seals in the work pits be 49 inches below centerline in the work pit and 24 inches below invert in the receiving pits. This allowed for tolerance when setting up the machine in the event the seal elevation was not exact. The concrete seals were installed in the wet, which led to the seal quality being poor in most cases. The additional tolerance in seal elevation allowed for an additional 6 inches of concrete to be poured to cap the mud seal and allow for a rigid surface to mount the theodolite stand.

We could not afford for the theodolite to move therefore we took every precaution we could. We started welding angle iron underneath the machine's front plates to set the machine on so it was not resting on the seal and possibly moving the seal which in return would move the theodolite. As a precaution, we screwed the legs down so if the angle iron happened to break, the legs were there to prevent the machine from falling. This allowed for quicker set up and reduced the overall time for installation."

Traffic

"The majority of our shafts were installed in the center of the road and the work was performed with the roads open to local traffic. On one section of the job we would average about 50 cars an hour with the worst time of the day between 5pm and 7pm. Due to the equipment we utilized we were able to allow traffic to pass through in most instances. Temporary gravel roads were installed at each location to allow local traffic to pass through work locations."

Thrust

"Thrust pressure is always a concern when pushing through sand, especially when total thrust available is limited. The 308 produces 100 tons of thrust while the 4812 produces 200 tons of thrust. To ensure we didn't have any issues with jacking pressure in ground conditions that were highly variable across the project we had to use a several different bentonite mixes throughout the project. A great deal of effort was expended in the design and implementation (and quality control) of injecting bentonite into the annulus of the pipe and excavated earth to reduce skin friction while jacking the product pipe into place.

Our average thrust force was 60 tons for the crossings installed with the 308 GBM and 120 tons with the 4812 GBM. Of course there were a few sleepless nights where thrust pressures were at the maximum tonnage."

Conclusion

Challenges such as length and depth of the crossings, soil and groundwater conditions, along with nearly flat gradients demanded the excellent control of line and grade provided by the pilot tube method. Overall, the use of remotely controlled lifting equipment, superb trenchless equipment, an understanding of bentonite, and most importantly, a crew of dedicated employees with the technical ability to use the equipment properly were keys to success on the extremely challenging Shively Interceptor project.

(Excerpted, with updates, from paper B-2-04 "Shively Interceptor" (Butor, Ream) presented at NASTT NO-DIG Conference 2012 Nashville TN)

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GALVANIZED PIPE RELINE, SHEBOYGAN COUNTY WI

Extends service life of deteriorated culverts while maintaining traffic flow on busy highway

By: Hugh B. Mickel, P.E., Contech Engineered Solutions LLC

In Sheboygan County, Wisconsin a galvanized pipe had been installed under the intersection of Lakeshore Road and Najacht Road in an environment outside of the recommended resistivity (ohm-cm) ranges for galvanized metallic coatings. Given this environment, the existing pipe experienced rapid deterioration most noticeably in the invert and was in need of either replacement or structural repair.

As the highway above was one of the main roads running through Sheboygan County, the county was inclined to look into structural repairs rather than expensive open trench methods that would require road closures and detours. They consulted with Contech representatives to come up with alternate solutions. Ultimately, Smooth Cor™ polymer-coated double-wall corrugated steel pipe manufactured by Contech was chosen to reline the host pipe. It provided the necessary structural integrity needed during the installation process as well as the required hydraulics and service life the County desired for a fully structural repair. Smooth Cor is fabricated from polymer coated galvanized steel coils meeting AASHTO M246 specification.

"great cost-savings as well as little impact to the traffic along the busy highway above"

Upon arrival to the site, the pipe was pulled into the host pipe by the County and grouted into place. They were able to keep a single lane of traffic open during the entire construction process which provided great cost-savings as well as little impact to the traffic along the busy highway above.

Sheboygan County's Surveyor and Highway Engineer, Edgar Harvey, Jr. RLS/SE commented, "Relining this structure avoided conflicts with a sanitary siphon, a gas main, and other utilities which run under the existing concrete aprons. It saved the expense of replacing the apron-headwalls and allowed traffic to move through the site in at least one lane throughout construction. The construction period was greatly shortened. Environmental considerations were reduced, making permitting easier. We expect many added years of service from the rehabilitated structure."

Helically wound Smooth Cor™ is sliplined into the existing host pipe

The longer lay lengths made it easy to insert the Smooth Cor™ pipe using a smaller equipment

Completed Smooth Cor™ reline project extended the service life of the original culverts

ABOUT THE AUTHOR:

***Hugh B. Mickel, P.E.** is the Vice President of Reline Technologies for Contech Engineered Solutions and has been with the company for 30-years with 19-years of direct experience relining pipes, culverts and small bridges. Hugh holds a B.S. in Civil Engineering from Purdue University and has been a registered Professional Engineer since 1990.*

SINKHOLE CAUSED BY SOIL MIGRATION THROUGH SEPARATED PIPE JOINT

Repaired In Situ with Trenchless Mechanical Pipe Joint Seal

By: Lee Haessig, Cretex Specialty Products

The cause of the sinkhole was a two inch separation at the last joint of the pipe before the headwall where it discharges into the Mississippi River

A 60" RCP (reinforced concrete pipe) outfall line that runs from two skimmer ponds on the John Deere Works property in Dubuque IA, servicing industrial chill water and storm water, developed a sinkhole above the pipe near the discharge into the Mississippi River. The 60" RCP conduit is owned by John Deere Works and is partially located in an easement on private property. The sinkhole had raised the concerns of a nearby homeowner and was causing a safety issue for anyone walking in the vicinity.

When notified of the sinkhole, John Deere Works contacted McDermott Excavating, Dubuque IA, under contract with the owner to provide site and underground infrastructure maintenance. After an inspection of the pipe and surrounding area was completed, it was determined the most likely cause of the sinkhole was due to some displacement and a two inch separation at the last joint of the pipe before the headwall where it discharges into the Mississippi River. The slightly open joint was allowing rain water to infiltrate, which caused soil from outside of the pipe to erode and migrate in along with the water, creating the sinkhole.

In response to the findings of the inspection, McDermott Excavating researched a variety of trenchless methods and technologies for the repair of larger diameter pipes and found the HydraTite® Internal Joint Seal offered by Cretex Specialty Products located in Waukesha, WI. The HydraTite® Internal Joint Seal system provides a mechanical, trenchless remediation of defective pipe joints through use of a proprietary rubber seal which spans the joint and is held in place by stainless steel retaining bands on either side of the joint. These retaining bands are expanded into place, compressing the rubber seal, and these are then held in place with wedge locks to ensure a watertight seal and eliminate all infiltration or exfiltration at each joint.

Installation of the HydraTite® system requires a properly trained and certified installation contractor, and McDermott Excavating had not seen or installed the system before. Cretex Specialty Products agreed to and made arrangements to provide installation training on site for a nominal fee in conjunction with the actual seal installation during repair of the pipe. The flow of the pipe was to have been diverted during installation, but due to unforeseen circumstances, this was not the case. When the contractor and personnel from Cretex Specialty Products arrived on site, there was approximately 18" to 24" of standing water in the pipe. Sandbags were placed at the discharge end of the pipe and an attempt

There was approximately 18" to 24" of standing water in the pipe

Installation of the HydraTite® Internal Joint Seal was accomplished in less than an hour by two technicians

was made to pump the water to reduce the level, but this was unsuccessful.

Since the HydraTite® system can be installed in live flow; the decision was made to install the seal without further attempts to reduce the water level in the pipe. The rubber seal, retaining bands, hydraulic expansion tool and hand tools were handed to the two technicians in the pipe that would be performing the installation (one McDermott and one Cretex employee). The surfaces of the pipe on either side of the joint were inspected, cleaned and repaired where necessary. A series of alignment marks were made on the pipe to properly locate the seal for installation. The rubber seal was positioned at the joint, opened and "popped up" into place in the pipe. Prior to placing the stainless steel expansion bands, the area at the invert of the pipe behind the seal was checked for any debris, silt, or stones that may interfere with the installation. Once checked for debris, the first of two expansion bands was assembled and positioned against the rubber seal. The retaining band was expanded using the special hydraulic expander tool to a pressure of approximately 4400 psi. Once tight, the proper width wedge lock was selected and driven into position to hold the band in its expanded, tightened position. The second band was then assembled and installed using the same expander tool and wedge lock to complete the installation process. The entire installation of the HydraTite® Internal Joint Seal was accomplished in less than an hour by the two technicians.

With the defective joint now sealed, the sinkhole was filled in and future soil migration is prevented with no further ground settlement issues above the pipe. The HydraTite® system provided a quick and permanent solution to a major safety issue caused by the development of a sinkhole without any need for excavation, dewatering or bypass pumping.

ABOUT THE AUTHOR:

Lee Haessig *is General Manager at Cretex Specialty Products, and has been with the company for 23 years. Involved in the underground utility construction industry for over 30 years, Lee is NASSCOM PACP/MACP Certified and active within many industry organizations, including NASSCO, NASTT & MSTT. Lee is a current MSTT Board Member.*

PIPE EXTRACTION AND INSTALLATION THROUGH PNEUMATIC PIPE RAMMING

Contractor Battles Immobilized Tar Resin Gas Main in Aurora, Illinois

By: Dave Holcomb & Scott Kneip, TT Technologies, Inc.

The ramming pit for the Nicor ramming extraction project measured approximately 65 feet in length and almost 40 feet deep

Pneumatic pipe ramming continues to be used in a wide range of applications, both for primary pipe installation and as a method to help facilitate the installation of other pipes or products. The method is proven effective for horizontal, vertical, and angled applications. Design engineers with the help of contractors and equipment manufacturers are finding new and unique ways to utilize ramming technologies.

On a recent project for natural gas utility Nicor in Naperville, Illinois, several 36-inch steel natural gas transmission lines, located 25 feet below Interstate 88 in the neighboring community of Aurora needed to be extracted and replaced with new mains. The contractor, KS Energy Services, LLC, from New Berlin, Wisconsin attempted to remove the lines using static pulling force. The pipes, installed decades ago, were housed inside a 42-inch steel casing with plastic spacers and grouted in place with a tar resin. Because the condition and consistency of the tar resin prevented a static pull option, KS Energy Services contacted trenchless equipment manufacturer TT Technologies (also located in Aurora, Illinois), to help develop a solution to extract the mains and install new ones.

TT Technologies pipe ramming specialist Scott Kneip said, "Initial attempts to extract the pipe by static pull force proved unsuccessful due primarily to the hardened tar resin that surrounded the casing. The tar resin, used for cathodic protection, cures over time, effectively immobilizing the pipe. The decision was made to attempt to push the pipe out with the assistance of a pneumatic pipe rammer."

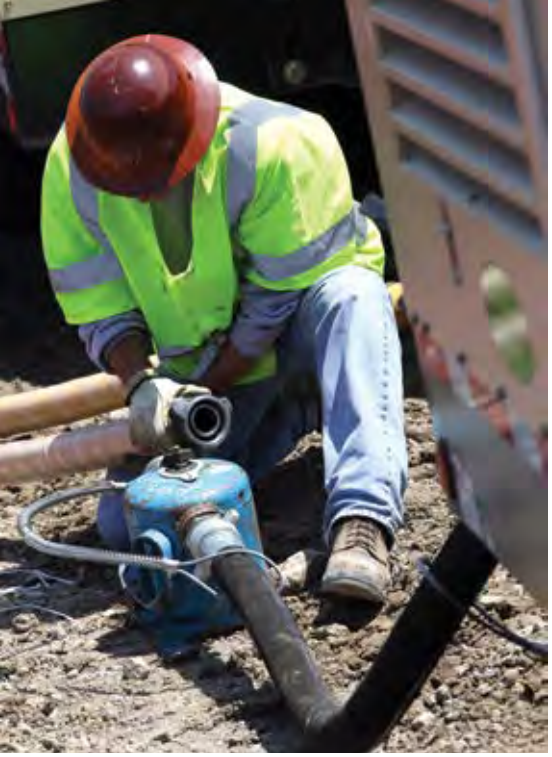
Pipe Ramming Considerations

Ramming tools are capable of installing 4- through 80-inch diameter pipe and steel casings. Diameters up to 148 inches have been successfully installed using large scale ramming equipment. Ramming requires minimal working depths and is proven effective for horizontal, vertical, and angled applications. Ramming is also ideal for installations under roads and rail lines because it displaces the soil without creating voids or slumps.

Typical pneumatic ramming tools require a compressor outlet pressure of 85-100 psi. If two compressors are used in parallel, non-return valves should be placed between the outlets to ensure that air is not being pushed from one compressor back into the other. Install the non-return valves directly to the T-connector that joins the two lines together, and make sure that the non-return valves are facing in the proper direction.

Proper lubrication is essential to the optimum performance of the pipe rammer during operations. Synthetic lubricant is often used. The lubricant is specially formulated for pneumatic tools and will not deteriorate air hoses or plastic pipe. The lubricant typically used is biodegradable and non-toxic. It is water-based, water-soluble and does not contain ethylene glycol. It contains no environmentally hazardous materials and is nonflammable and non-corrosive. It is an all-season lubricant available in summer grade and winter grade formulas.

The lubricant is fed into the pipe rammer



The ramming tool is lubricated during operations, inline, with a specially formulated lubricant designed for pneumatic tools that does not deteriorate air hoses or plastic pipe

through an inline lubricator. The lubricator is connected between the compressor and the ramming tool. It atomizes the lubricant and feeds it into the rammer through via compressed air. Lubricant flow can be regulated by adjusting the lubricator settings.

Pipe Ramming Pit Construction

Pipe ramming bore pits do not typically require the use of reinforced back abutments and are not restricted in the length or diameter of the product pipe sections that can be used. Bore pit preparations will, in part, be dictated by job site conditions and will vary by project.

Generally, the bore pit needs to have a minimum length equal to the sum of the measurements of the ramming tool, the ram cone, soil removal cone, the length of the product pipe sections being used, plus 5 feet of working space behind the tool.

For the Nicor gas main replacement project, the ramming pit measured approximately 65 feet in length and almost 40 feet deep. The pit was thoroughly shored and a face wall for the pit was constructed. A workable ramp was constructed to allow for the transport equipment, materials and new sections of pipe to the ram pit. A 24-inch diameter Grundoram Taurus pipe rammer was selected for the ramming operations.

On the Job

The replacement of the existing 36-inch gas transmission main was part of larger infrastructure rehab and replacement program along the I-88 corridor west of Aurora. This particular 280-foot pipe section was targeted for replacement as part of the utility's program because of its age and condition. The program includes the replacement of approximately 5-8 miles of transmission pipe annually.

A section of new 36-inch pipe was attached to the end of the existing pipe. The rammer was suspended with side booms and attached to the end of the new 36-inch pipe standard 36-inch diameter ramming gear. A single 36-inch ram cone made the connection between the 24-inch diameter tool and the new pipe.

"After the percussive force of the pneumatic pipe rammer was introduced, the resin began to break down and liquefy to an extent, releasing the bond with the pipe"

Kneip said, "In order make pipe ramming an effect option, static tension was incorporate to limit the amount "bounce-back" effect created by the percussive rammer. The ramming pit measured almost 65 feet in length, but the exit pit was much smaller. Because the exit pit was too small to facilitate an effect pull tension set up, a block and tackle configuration was established on the face wall of the ramming pit. An eye was welded on the top of the 36-inch pipe and another on the 42-inch casing at the front of the pit. A sheave was attached at that point."

A winch line was run from the top of the 36-inch casing, to the bottom of the pit, around a sheave attached to the 42-inch sleeve casing and back over the top of the pit and the rammer to a D-8 dozer winch. As ramming commenced, the dozer winch provided tension on the pipe to limit the amount of bounce back.

New 40-foot sections of 36-inch pipe were rammed into place one section at a time while the existing main was simultaneously pushed out. Ramming would stop every 16 feet so that crews could cut off sections of the old main with welding torches and remove them as the existing pipe was pushed into the exit pit. It took approximately 20 minutes to ram out a 16-foot section of the old pipe. After the percussive force of the pneumatic pipe rammer was introduced, the resin began to break down and liquefy to an extent, releasing the bond with the pipe. At that

Crew used a 24-inch diameter Grundoram Taurus pneumatic pipe rammer for the Nicor project

To limit the bounce back effect, crew used a block and tackle system. A winch line attached to a D-8 dozer provided the tension needed for ramming operations to be most effective

point it was hoped that the pipe would be able to be removed quickly. However, in the time it took to extract and remove the first section, the resin began to reset and it was evident that ramming would need to continue.

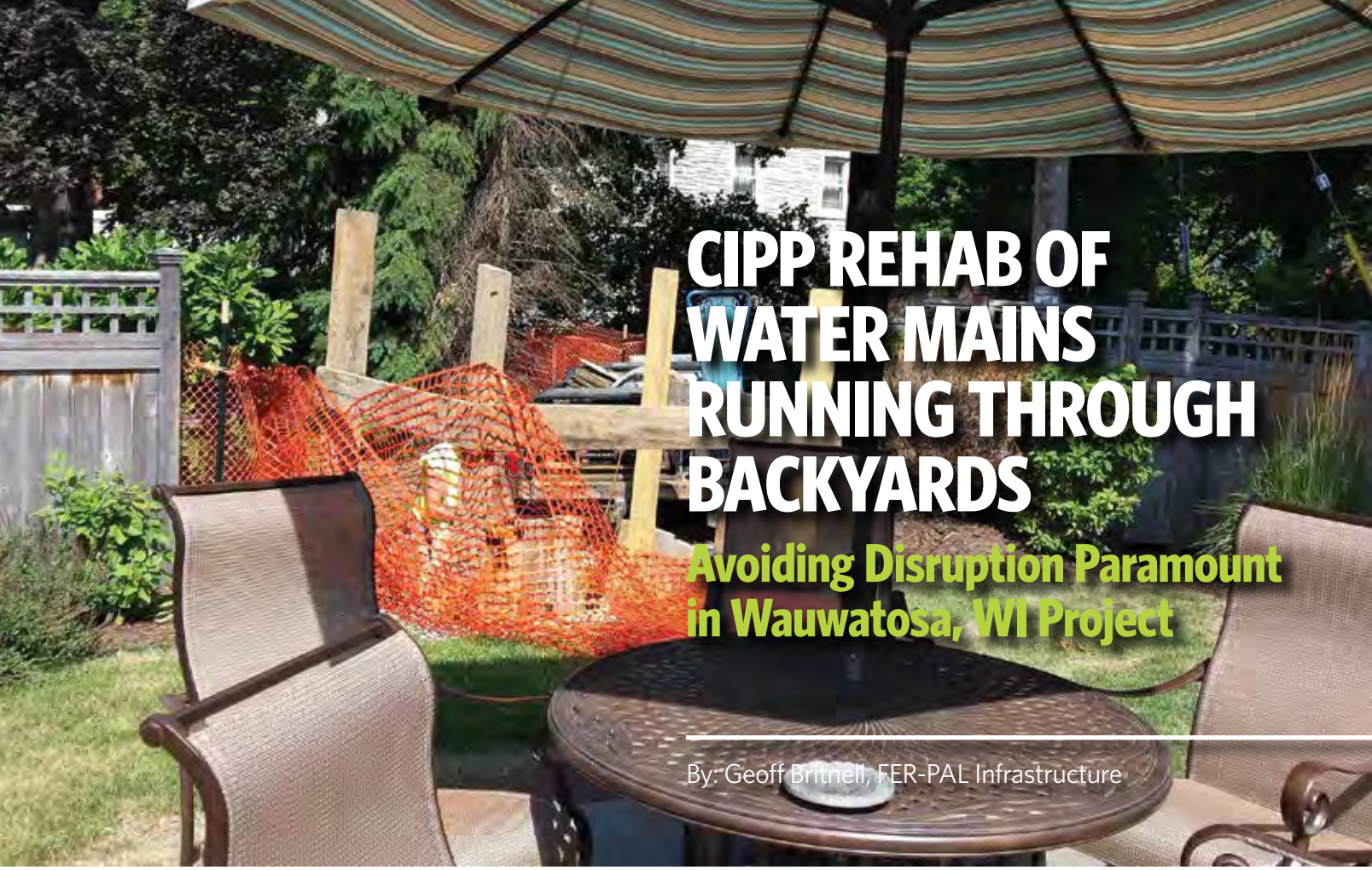
Future Projects

During the completion of this particular project, the same situation was encountered at another section of pipe in a different location. A second ramming tool and crew was dispatched to that pipe and the same process employed. KS Energy Services will continue with the Nicor infrastructure gas main upgrade project. After the success of the ramming application for the extraction of the tar resin encapsulated main, the process will be utilized in the future and provides KS Energy Services with an effective option for pipe extraction and replacement.

ABOUT THE AUTHORS:

Dave Holcomb *is a Corporate Vice President and serves in a dual capacity as a Regional Manager of TT Technologies, Inc. He has been involved in a variety of underground construction applications for over 30 years. He has educated engineers, contractors, and municipalities on the extensive benefits of various trenchless technologies.*

Scott Kneip *is a Product Specialist for TT Technologies, Inc. He has been involved in a variety of underground construction applications for over 20 years. This includes sales and servicing of boring tools, pipe ramming, horizontal directional boring machines and pipe bursting systems. Scott has also been heavily involved in pursuing overall growth of the trenchless technology market. He has assisted in educating engineers and contractors on the extensive benefits of various available trenchless technologies and trenchless equipment techniques.*



CIPP REHAB OF WATER MAINS RUNNING THROUGH BACKYARDS

Avoiding Disruption Paramount in Wauwatosa, WI Project

By: Geoff Britnell, FER-PAL Infrastructure

With location along the rear yard easement, excavations were designed to impact the residents as little as possible

When water mains were first installed, ease of replacement was not necessarily the first thing on the minds of those who designed the project. In addition, new developments can leave mains that were once easy to access in difficult and precarious situations as their lifespan comes to an end. Some utility owners have avoided replacement, as the cost, along with the disruption, would cause a challenge too hard to overcome. While others, like the municipality of Wauwatosa, have looked to new technologies to help tackle the problem. Through a water main rehabilitation bid process, the Wauwatosa Water Utility was able to work with their hired contractor, FER-PAL Infrastructure, to rehabilitate the water main through cured-in-place pipe (CIPP).

Background

Wauwatosa, Wisconsin is a community of over 46,000 located along the Menomonee River just to the west of Milwaukee. Originally sourced from ground water, the Wauwatosa Water Utility began purchasing water from the Milwaukee Water Works (MWW) in 1963. The water is sourced from Lake Michigan and treated by MWW. Overall the Utility looks after 202 miles of water main which supplies 15,515 customers with 1,325,223,000 gallons of clean fresh water yearly.

> **"We knew that because of the limited access to the main that CIPP was the only viable option for this main."**

The Utility has designed a preventative maintenance program in order to keep the water system functioning at a high level. The goal of this is to keep in line with the Wisconsin State Department of Natural Resources (WIDNR – Chapter NR811) "Requirements for the Operation and Design of Community Water Systems."(https://docs.legis.wisconsin.gov/code/admin_code/nr/800/811/)

In order to do this Wauwatosa Water Utility has utilized a mixture of technologies to replace or rehabilitate an annual average of 1% of the water mains in its system.

One technology that has been used to keep the Utility on target with this goal is CIPP. First using CIPP as a pilot project in 2012, Wauwatosa looked to the technology to rehabilitate a section of water main located through a backyard easement. Subsequently, in 2014 and 2015 the Utility budgeted a yearly CIPP program to rehabilitate the existing water mains located within ten foot wide backyard utility easements.

The 2015 CIPP project consisted of 2880 LF of 6-inch cast iron pipe which had 55 residential services located along it. Due to the location along the rear yard easement, strictly replacing the main was not an option. With electric power poles located

Epoxy migrates through the outer jacket of the liner to fill all voids around the services and any existing spaces within the host pipe, creating a full bond to the interior of the old water main

above and a sewer main running adjacent to the water main, CIPP was determined to be the least disruptive approach. Through a review of current technologies and past projects Wauwatosa Water Superintendent, Jim Wojcehowicz, felt that CIPP was the best alternative. "We knew that because of the limited access to the main that CIPP was the only viable option for this main."

The project was bid in May 2015 with FER-PAL Infrastructure of Elgin, Illinois submitting the lowest bid for the project. FER-PAL, a trenchless technology specialist, is a licenced installer of Aqua-Pipe, the leading manufacturer of CIPP liners in North America. Construction work for the project began on June 29th this year.

Challenges

The most significant challenges for this project came with the location of the water main itself. As the main ran directly through the backyards of the residential properties it meant that avoiding disruption would be paramount. In addition to the location several of the most important connection points of the main lay directly under We Energies power poles.

In order to overcome these challenges, FER-PAL worked diligently with their sub-contractor, Mid City Plumbing, and the Utility to plan a work site that left little impact to the neighborhood. Each tee connection that lay below a power pole was abandoned and repositioned. This allowed for new tees to be connected in a new and more convenient position after the main was lined.

All additional excavations were designed for locations that impacted the residents as little as possible. The pits themselves were designed to be 6ft by 9ft and had specialty shoring designed and built by FER-PAL inserted into the pit to allow a safe working environment.

Lastly FER-PAL looked to utilize a new technology in order to continue the path of least disruption. Through research by cleaning crew Foreman Joe Townsend, the contractor was able to source out a remote flushing unit in order to clean the old water main. The unit was purchased in nearby Joliet, IL and allowed for the pipe to be cleaned and prepped without the use of the usual flusher truck. A flusher truck would need a larger area to be maneuvered into place and would cause more damage to the surrounding landscape. Through the use of the remote unit little to no surface areas were damaged and left in need of restoration. In addition to this, FER-PAL was able to limit the disruption to tracks on the nearby roadways.

Construction

Once the project itself was laid out, a temporary bypass system was set up in order to provide residents with water throughout construction. Excavation was then performed including the use of vacuum trucks to limit the impact and size of the access pits. Following this work the water main was cleaned with the remote flushing unit to prepare it for lining. This unit was able to provide enough pressure to clean the tuberculation from the walls of the pipe and restore the main to its original diameter.

"This project would not have been a success without a fine attention to customer satisfaction."

After the cleaning process, FER-PAL performed a full video inspection followed by a laser analysis and GPS/GYRO profile of the water main. Both of these tools were developed by FER-PAL in order to ensure a high quality of installation of the CIPP liner. The profiler gives an exact diameter of the main which ensures the product that

is installed fits perfectly and is left without voids between the cured liner and main. The GPS/GYRO tool provides an XYZ coordinate for each service and features along the main with a full elevation profile. The data from these tools allowed the Utility to have a full "as-built" drawing to reference for future projects in the area.

As a final preparation before installing the CIPP liner, service line plugs were robotically inserted into each residential service connection along the main. This prevented any epoxy used in curing from travelling up each service.

Once the interior of the main was prepared, the CIPP liner was pulled into place through rollers on the installation truck and rollers attached to the main. Epoxy resin was injected in between the two layers of the liner as it was pulled through a refrigerated truck and into place inside of the main. Once in place, the liner was capped off on each end, pressurized, and cured with hot water for a period of 1.5 hours. During the curing process epoxy migrates through the outer jacket of the liner to fill all voids around the services as well as any existing spaces within the host pipe. In doing so, it creates a full bond to the interior of the old water main.

Following the curing period, the liner was left to sit overnight under normal working pressure. Each section was then pressure tested to the municipality standard. Finally, each service was reinstated robotically. An operator inside of a camera truck used a robotic drill to drill through the liner and into the service, fully removing the plug and clearing the access to each service along the main.

To complete the work, the water main was reconnected with new valves, hydrants and fittings. This left the main fully rehabilitated and ready to be placed back into service.

Results

The project was successfully completed within the time specified time by the contract. There were no delays and surface disruptions were successfully avoided. Commenting on the project, Lou Magurno, FER-PAL Vice President of Project Management Services praised the FER-PAL Team. "Our crews really worked hard to deliver a high level of customer service" stated Magurno. "We were right in these resident's back yards which meant daily interaction. This project would not have been a success without a fine attention to customer satisfaction."

The utility completed this project on time, leaving the neighbourhood residents happy with the finished product. Through projects such as this, CIPP maintains itself as a viable option to open-cut replacement, demonstrating benefits economically as well as socially.

ABOUT THE AUTHOR:

Geoff Britnell *is the National Business Development Manager for US and Canada for FER-PAL Infrastructure. He has been with FER-PAL for over three years specializing in Businesses Development, Government Relations and Communications.*

"THE RIGHT SOLUTION" SAVES PIPE AND ROADWAY

By: Angus W. Stocking, L.S.

When a two lane paved road in Jerseyville, Illinois was failing, City Engineer Robert Kincaid, PE, discovered a 60-inch by 100 foot long CMP sewer was in very bad shape. The invert was close to being completely rotted out and much of the pipe's top arc was also failing. The road was slumping due to a wide gap near the middle of the sewer run where sections were out of horizontal alignment by about eight inches.

Complicating matters, this sewer had limited staging areas, with a golf course on the south end and a treatment plant evaporation pool just 20 feet away on the north end leaving about a 14-foot pad for equipment. So trench-and-replace seemed like a bad strategy; Kincaid says, "Altogether, it would have been a horrible and costly dig for us."

Kincaid first thought cured in place pipe (CIPP) might be used to save the pipe without digging, but found that contractors were reluctant to even bid on such a large diameter repair, and when they did, "The price seemed extremely high."

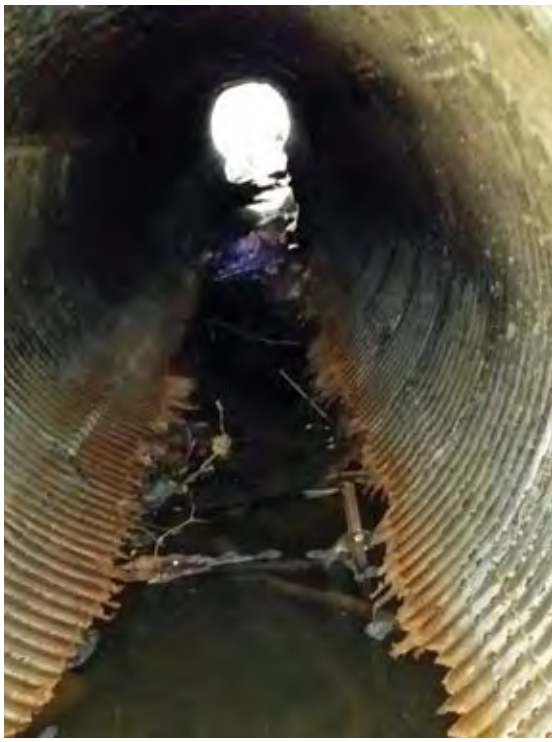
Searching online for alternatives, Kincaid found CentriPipe, a centrifugally cast concrete pipe (CCCP) trenchless solution from AP/M Permaform that sounded promising. Proven over a decade or more, CentriPipe has been approved for use by many DOTs and other large agencies. Using a precisely controlled spincaster, pulled through pipe, the system applies PL-8,000, high-strength cementitious mortar, in thin, even layers, creating a new, structurally sound concrete pipe within the old pipe while requiring very minimal staging area. Since the new pipe is thin (two inches or less in most cases) and adheres tightly to the old substrate, pipe capacity is only minimally reduced. And since it is concrete, waterproofing or antimicrobial agents can be mixed in as part of the rehabilitation, if needed. Perhaps best of all, staging area requirements are modest, trenching is avoided, and CCCP is exceptionally cost-effective compared to CIPP and similar solutions.

Jerseyville selected Ace Pipe Cleaning Inc., headquartered in Kansas City, Missouri, as their CentriPipe contractor. Bryan P. Dobson was the operations manager, and Jackson Lewis was the onsite project manager.

An Unpleasant Surprise

Dobson bid and planned the CentriPipe project based on photos, and when he arrived in Jerseyville on a Monday morning discovered a difficult challenge. "Photos taken in a wet season showed the pipe bottom covered with what looked like a shallow flow, of course." he explains. "But in September (2014), when we showed up with everything we needed to get started with rehabilitation, we discovered that the seasonal flow had obscured a 'canyon' running along the bottom of the sewer—the CMP had failed so completely along the invert that erosion had created a three foot deep trench along 40-50 feet of the sewer bottom. That was a surprise for us and the city."

A smooth bottom is needed for CentriPipe spincaster withdrawal, so most projects require some sort of resurfacing. In this case, Kincaid worked with a local batch plant to make a pumper truck available on short notice, and on Tuesday the Ace crew was able to fill in the eroded trench with ten cubic yards of diggable fill, which they then topped with a few inches of sprayed and troweled PL-8000, a high-strength, workable engineered cementitious product from AP/M Permaform. After a solid day's work, they had the smooth strong surface they needed to begin spincasting the next day; in the area of the eight-inch gap, they filled in and beveled to make an even transition. Dewatering was accomplished with coffer dams and a two-inch pump, and to complete



The CMP failed so completely along the invert erosion created a 3 ft. deep trench along the sewer bottom

pipe preparation, sewers are usually scoured with high-pressure spray (sometimes with the CentriPipe spincaster), and some hand troweling of pitted or peeling sewer sections is usually needed.

Work began on Wednesday morning with the placement of 'depth pins'; since the cement layers applied are thin, it's important that each layer be applied evenly. Ace uses a standard rivet gun to set aluminum rivets at 12:00, 3:00, 9:00, and (sometimes) 6:00 (viewing the pipe diameter as a clock face), every 20 feet or so along the sewer, then trims the rivets to an inch. This gives CentriPipe sled operators a good visual gauge of thickness as layers are applied and, at project end, assures that the final design thickness—one and a half inches in this case—has been reached. For a redundant check on final thickness, Ace

Sewer rehabilitation was completed on schedule, even with the surprise 'canyon' to fill

also tracks material volume used; in Jerseyville, about 4.5 pallets were used, translating to an applied volume that exceeded design specifications.

One important detail to work out before spincasting begins is winch placement. "We knew when we started working with this system that we needed a good, flexible way to place and anchor the withdrawal winch," Dobson explains. "So we built a 'winch skid' out of planks and angle iron that can be carried by two people. If we're working from

"I believe this has been the right solution for us."

a grass surface, we can drive rebar to anchor the skid, and if we're on pavement we can set lag bolts through the angle iron, and patch up the holes when we're finished." On this particular project, since inline placement of the winch was difficult, a pulley arrangement had to be improvised so that the winch could be withdrawn in a straight line through the sewer.

Even with all this preparation, the first layer of PL-8000 was applied on Wednesday. Since the material cures quickly, within a few hours, new layers can be applied on successive days. In Jerseyville, two 3/4 inch layers were applied in two days. Hand troweling for a smooth bevel at the entrance and exit transitions completed the CentriPipe work. "We're getting better at doing the spincasting right to the sewer entrances," says Dobson. "But still, mainly for looks, we find that hand troweling and brushing is necessary to really finish off the ends well."

Final clean up, walk through, and inspection was performed by Kincaid on Friday morning, completing the sewer rehabilitation on schedule, even with the surprise 'canyon' to fill. And in fact, Kincaid had been visiting the site regularly during work. "He stopped in every few hours to take a look and check the pins," says Lewis. "And he even brought by some of the local engineers to come see how things were progressing."

For his part, Kincaid says he is well pleased with Jerseyville's first CCCP project. "We had actually used a similar technology for manhole rehabilitation," he says. "So I had a good idea that CentriPipe would work here. Still, it was a pleasure to see it go on so well and, four months later, I've walked through twice, once after a major rain event, it appears to be holding up perfectly—we'll inspect again after winter, but right now I believe this has been the right solution for us."

ABOUT THE AUTHOR:

***Angus W. Stocking, L.S.** has been writing full time about infrastructure since 2002. Feature articles by Stocking have appeared in several dozen infrastructure trade journals. Prior to taking up writing full time, he enjoyed a 14-year career as a licensed land surveyor, working in California, Idaho, Kentucky, and Wisconsin, including stints as a right-of-way surveyor for CalTrans and survey manager at Midwest-based consulting firm MSA Professional Services.*

CURED IN PLACE LATERALS:

New Technology for the Future of Metropolitan St. Louis Sewer District

By: Ryan Poertner, Ace Pipe Cleaning, Inc.

As of October 16, 2013, the Metropolitan St. Louis Sewer District (MSD) owned and maintained 9,578 miles of collection and trunk sewers and force mains, ranging in size from six inches to 29 feet in diameter. Sewers maintained by MSD range in age from less than a year old to more than 150 years old. Approximately 524 miles are more than 80 years old and 311 miles are more than 120 years old.

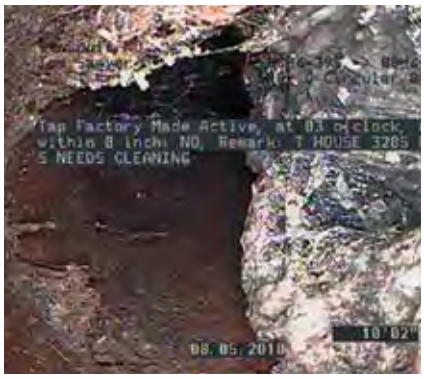
The sewers are classified as one of three types: sanitary/wastewater, storm or combined. Sanitary sewers accommodate household and industrial waste. Storm sewers carry rainwater and surface water runoff. Combined sewers carry both types of waste. The system currently includes approximately 4,744 miles of wastewater sewers and force mains, approximately 3,028 miles of stormwater sewers and force mains, and approximately 1,806 miles of combined sewers that handle both wastewater and stormwater flows.

Prior to 2004, MSD addressed maintenance issues one reach at a time with a blanket contract. The staff determined it was time to implement Infrastructure Repair (IR) projects to address inflow, infiltration, cleaning, point repairs, lateral rehab, manhole rehab and work order tracking. The blanket contacts went from $1 million each to three contracts worth $5 million each as well as several area/basin specific contracts. Because of the new focus, MSD needed to create new specifications and incorporate new technology to ensure maximum efficacy.

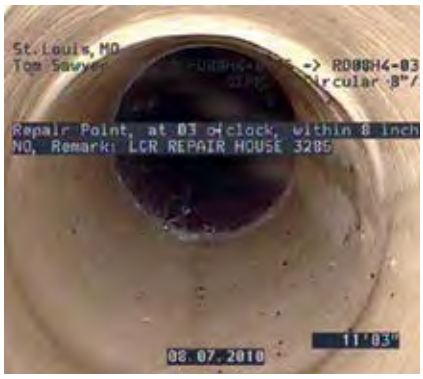
Ronald Moore of MSD was the project manager for rehab work and decided to test and research several technologies before moving forward. The first test project was the Missouri Bonfils: the contractor had the option to install a Cured-In-Place Lateral (CIPL), or dig and replace five feet of lateral at the connection. Because of the shallow depths the contractor chose to dig and replace all of the laterals. The open cut laterals cost $2,600 in the grass and $5,200 in the street.

> **"The only impact is the trucks working on the streets."**

The next project Moore looked at was Bissell Hills: the project had 65,000 feet of Cured-In-Place-Pipe (CIPP) and approximately 1600 laterals to reinstate. After research, Ronald Moore selected the EPROS Lateral Connection Repair (LCR) product as the baseline product for the CIPL lining system. The specification required a minimum length of 20-inch up the lateral from the mainline; a wall thickness of 3mm, and a resin that exceeds ASTM F1216 flexural modulus of elasticity. All main line sewers had CIPP liner installed. Then a test section that had approximately 235 laterals was selected to receive the CIPL trial. Ace Pipe Cleaning, Inc., a Midwest based contractor specializing in lateral connection



Lateral with roots



Same lateral after LCR installation

repair, completed the installations in 2009 at a price of $1,800 each, much less than using the open cut method.

The LCR is designed with a one piece full wrap material in the mainline along with a seamless transition to the lateral. By utilizing Silicate or Epoxy resin the LCR creates a watertight structural repair of the lateral/mainline connection. Moore said, "Using a trenchless technology approach also significantly reduced the impact on the general public. With the open cut method yards and streets needed to be dug up, but with the CIPL process it's all done underground. The only impact is the trucks working on the streets."

Since the test installation of Bissell Hills, MSD has removed one of two bypasses in the Bissell Hills watershed, and currently is installing the remainder of the laterals, which should result in the removal of the last bypass. To date MSD has installed over 10,000 CIPL liners.

Moore said some of the benefits are a reduction in service calls due to backups, a reduction in inflow & infiltration, a reduction in insurance claims, a reduction in the disruption to traffic, and a reduction in site restoration costs.

The future of CIPL liners include vacuum impregnation of the resin system, increased lengths of lateral repair, new ASTM requirements, and lateral installation from the main to the house (over 100 feet long). Also, due to the increase in quantities and awareness of the lateral connection Moore said, "The prices have dropped since the first pilot project. Depending on the scope, LCRs are being installed for anywhere from $1,300 each to $1,500 each."

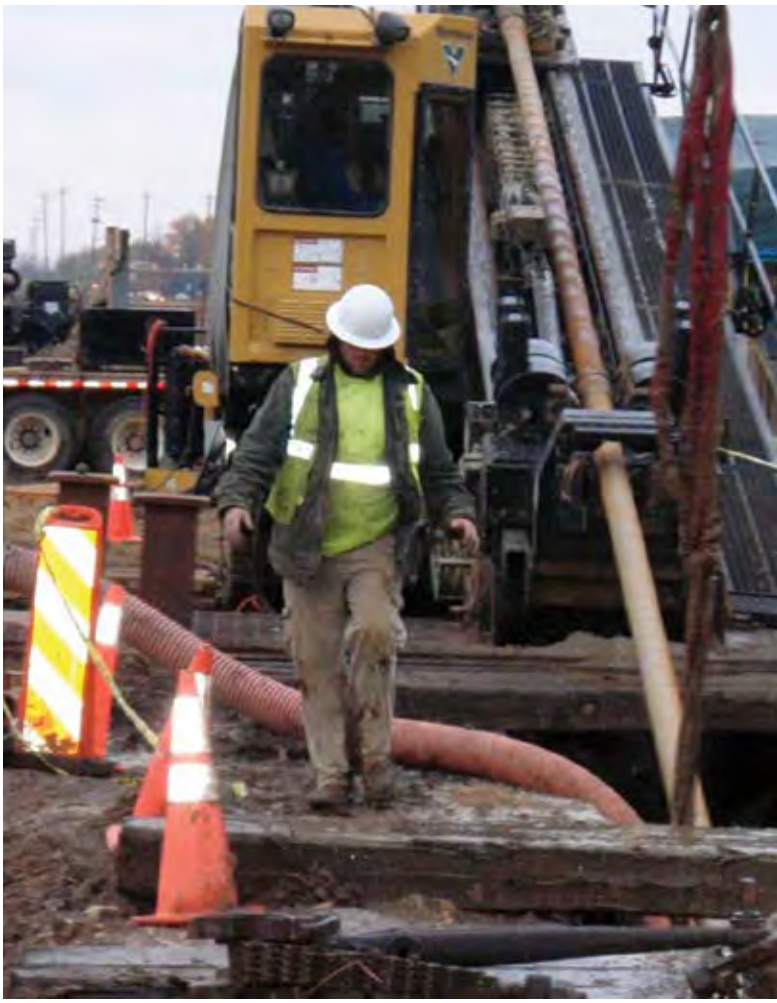
ABOUT THE AUTHOR:

Ryan Poertner *is General Manager of Ace Pipe Cleaning, Inc. (a member of the Carylon Corporation) a Midwest contractor specializing in Lateral Connection Repair, CIPP Point Repairs, Structural Rehabilitation, Laser/Sonar/HDCCTV Profiling, Sewer Cleaning, among other things. Ryan is a current member of the MSTT Board of Directors.*

HDD CROSSING UNDER RIVER EXPANDS POTABLE WATER PIPELINE TO MEET GROWING DEMAND

Crew Overcame Acute Angles of Entrance and Exit

By: Chris Schuler, Miller Pipeline



As if running a 30-inch diameter, 1,000-foot pipeline 40 feet under a river wasn't enough of a challenge, the crew also had to deal with sharp elevation changes for the horizontal directional drilling (HDD) installation under the White River, a broad tributary of the Wabash River which winds its way through Indianapolis. For this Citizens Energy Group project, Miller Pipeline Corporation, Indianapolis IN, also faced mixed soil conditions, multiple jurisdictions, wetlands, topographic relief, numerous property owners, levees, construction access and regulatory requirements. In spite of all these challenges, Miller completed the potable water project on time and within budget. The keys were proper planning and pipe that could meet the extreme turning radius needed for the steep entrance and exit angles.

Ground conditions were less than desirable

Just north of Indianapolis, Hamilton County has a population of 275,000 and is one of the fastest growing counties in Indiana. The White River was in the path of Citizens Energy's planned water transmission main needed to provide for growing demands. Citizens Energy Group is a Charitable Public Trust providing services to more than 266,000 customers in and around Marion County.

According to Chris Schuler, General Manager of the Miller municipal service division. "The profile of the bore was pretty significant. We couldn't be 30 feet deep when we came out because the tie-in was only about eight feet deep. We needed to get the pipe turned up and leveled off to a workable depth.

"There was a big elevation change from the east side to the west of the river. We were basically going high up to a cliff which is hard to imagine in Indianapolis, but naturally it was there right where we were working. It's about a 45 foot drop to the level of the river and then we ended up having to be approximately 40 feet below the bottom of the river -- a total of about 85 feet.

1,100 feet of 30-inch diameter solid wall HDPE was used

"The challenge was that we had a very short distance to go up and go down and get leveled off and at a depth where we could tie into the existing main on the east side."

Miller used 1,100 feet of 30-inch diameter, solid wall, PE 4710 high-density polyethylene (HDPE) pipe with a dimension ratio (DR) of 13.5. McElroy units were used to heat-fuse sections of HDPE pipe to construct a leak-free line.

"HDPE pipe has been made since the late 1950's and in the early 1980's gas utilities started installing one and two inch distribution lines using HDD," explained Tony Radoszewski, president of the Plastics Pipe Institute, Inc (PPI). "Matter of fact, Citizens predecessor company, Indianapolis Water Company, pioneered work in adopting HDPE and it was the first major utility in North America to convert to large diameter HDPE."

According to Jeff Miller, manager of Wet Distribution Design for Citizens and whose department is in charge of design for all water distribution capital projects, "We started using HDPE pipe along with HDD back in the mid-1990's primarily for creek crossings or in projects where we can minimize any digging. The HDPE pipe allows trenchless use and flexibility. And we needed that on this job because the east side was higher than the west, and we didn't have the land that would allow the pipe to follow a gradually sloping path."

"This job is pretty high up there on the difficulty scale and we've done some really challenging jobs," stated John Gregor, manager, HDD division for Miller with more than 21 years of experience. "And this one ranks right up there as one of the hardest ones.

"Overall, the toughest part of this job was the elevation changes with the short distance to work in and the ground conditions, which were less than desirable to say the least.

"When we did the preliminary design underneath the river, we talked about setting up on the higher elevation, and in a lot of cases that's the right thing to do. But we made the hole from the low end and we immediately hit moderately hard Cherty limestone rock, which has abrasive factors to it. We were half way across the river, 43 feet below the river bed, and we hit a pocket

of both sand plus small and large cobble, for about 60 feet, and then we hit rock again. And at the same time we have to make up the elevation difference of 82 feet in a short distance. The entire line was just 1,000 feet long. So yes, we had our challenges --- an 82-foot elevation difference in a short distance, plus all the different soils, and coming up and out of the rock again, sand and eventually back to clay."

The Miller crew, however, didn't change bits due to the short distance. "The bit was designed to cut rock and not efficient in clay. But it was a short distance so we decided to bite the bullet and keep going in the clay," Gregor said. "It might take longer to get through it, but if we had tripped out and changed the tooling we still would have had the same amount of manpower and hours invested into it. It was just a judgment call on our end. If it had been a longer distance, we probably would have stripped out and changed," he explained. "But we were doing push reaming and running our hole openers through the rock first. One of my biggest concerns, however, was if we were to pull a hole opener through the sand and clay and cobble and possibly damage it before we got to the rock, we wouldn't have a smooth cut. And we wouldn't have known that until we would have gotten to the rock. So we were pushing the hole openers through the rock and took steps increasing the hole diameter...24, 38, 42, and then eventually got to a 46-inch diameter path for the OD on the pipe that was of a little over 32 inches.

"We were lucky," Gregor stated. "We started off with a 1200 radius and pretty much maintained that the whole way. You really don't know until you do your survey and put it on paper, and maybe we could have gotten a lesser radius at that top. I like to set my radius higher than they need to be so that way you do have a little flexibility."

For the pilot run, there were seven in the crew, and then nine for the reaming and pulling. A Vermeer 330 x 500 drill along with a Para Track 2 guidance system was used. Additional equipment included a MudTechnology MPCT 1000 'Mud Maxx', two Vermeer SA400 mud pumps along with high volume bentonite. "We used one pump out there until we got to the final cut, then we had to put two SA 400's together to get the required volume to deal with a hole that big and carry the proper amount of cuttings out of the hole," Gregor said.

"We even pulled three large gauge copper tracing wires with it and they made it across. We just hooked it to the end of the pull head and dragged it though there freely.

"With little bits of downtime, which is typical with larger drills, we were at 35 days total.

I felt it was perfect. I can't imagine we could have gotten it done any sooner than that."

ABOUT THE AUTHOR:

***Chris Schuler** is proud to be hosting the upcoming MSTT seminar at the new Miller Pipeline training facility in Indianapolis IN. Chris is dedicated to expanding knowledge and awareness of trenchless rehabilitation methodologies. Chris serves on the NASTT Program Committee, and is current MSTT Vice President. His bio is on pg 9.*

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