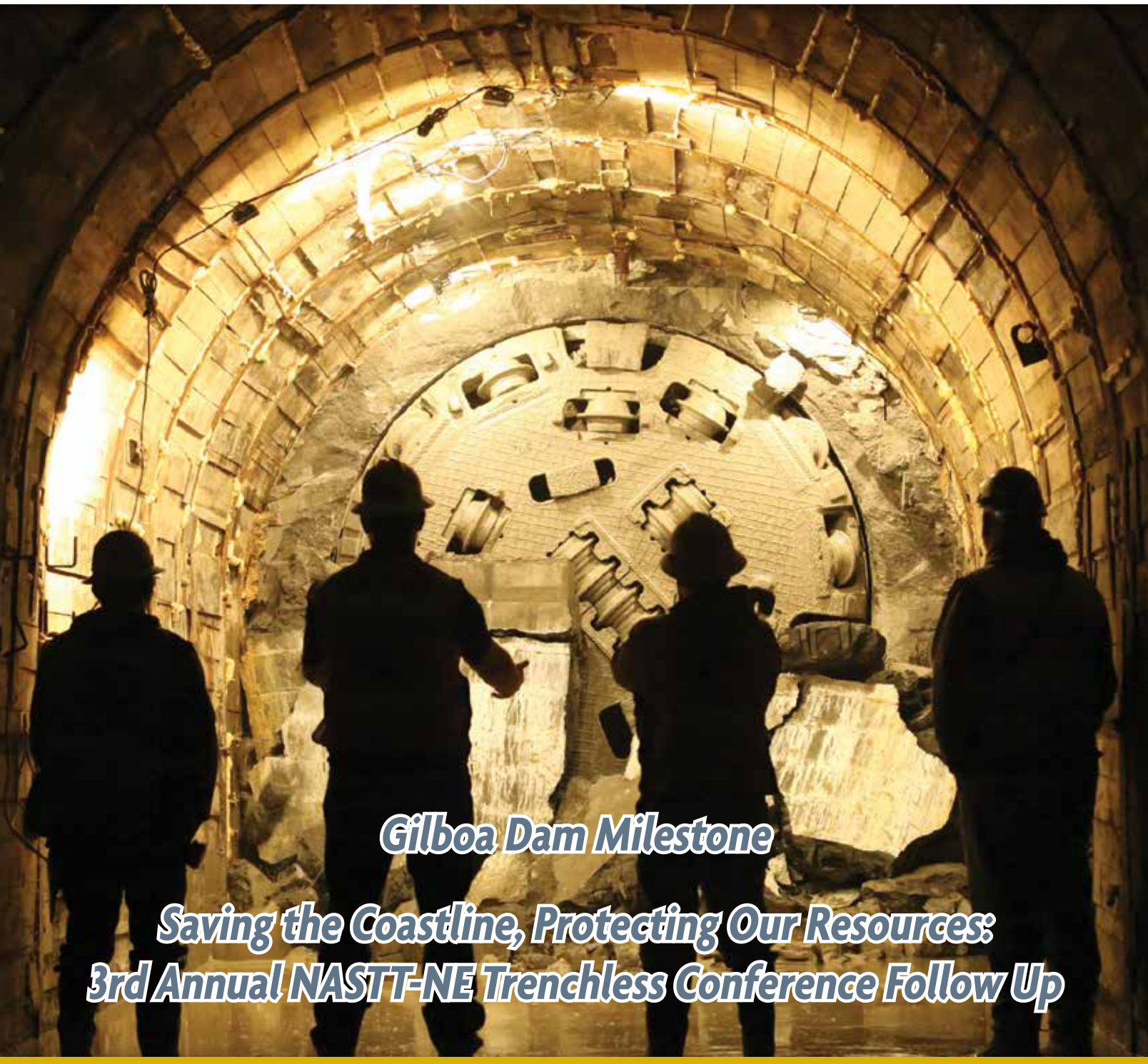
NORTHEAST REGIONAL CHAPTER

NORTHEAST JOURNAL
OF TRENCHLESS TECHNOLOGY PRACTICES



Gilboa Dam Milestone

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2019 SPRING EDITION

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MESSAGE FROM NASTT-NE CHAIR

Ian W. Mead, P.E., BCEE, NASTT-NE Chair

Welcome to the spring 2019 edition of the NASTT Northeast Regional Chapter's *Northeast Journal of Trenchless Technology Practices*.

In this edition we showcase an important milestone in the completion of the Gilboa reservoir Dam microtunnel project in upper state New York. Other articles include the Shelter Island NY Electrical Conduit HDD project and a close look at a non-destructive testing method for assessing pipe wall thickness in cast iron and steel pipe. There is also full coverage of our 3rd annual Trenchless Technology Conference held in Mystic CT last November, and a report from the UMass Lowell NASTT Student Chapter on the live field demos held at the Conference.

Save the date! The NASTT-NE Chapter has been hard at work planning our 2019 trenchless conference. In consideration of our goal to expand awareness of trenchless technology and growth of New York representation in our chapter, we will be holding our conference in Syracuse, NY on Tuesday, November 12th, at the Embassy Suites by Hilton Syracuse Destiny. A free welcome reception will be held at Dinosaur Bar-B-Que Monday, November 11th for all conference attendees. Please visit our website at www.nastt-ne.org for the latest information, registration and hotel details.

The annual conference will also include a changing of the guard at the chapter level. Later this year we will be holding elections for the next two-year cycle of the Board of Directors. Please stay tuned for more information.

We have been working with our UMass Lowell student chapter to schedule guest lectures and field trips for the year. We are also discussing the establishment of a trenchless center of excellence at UMass Lowell, to facilitate additional industry events and aid in the training and development of the next generation of trenchless professionals. **Please take a moment to engage with our student chapter members when you see them at our annual conference, as they represent the future of our industry.**

Conducting the business of this chapter (especially hosting our annual conference and the publication of this journal) would not be possible without the generous support of our sponsors and vendors. Please reach out to those who have advertised and contributed to the journal, and visit with our vendors at the annual conference. We hope the time you spend reviewing the articles and information in this latest edition will encourage you to get involved in the chapter, perhaps with an article for the next journal or a presentation at the next conference. The Northeast Chapter is a strong voice for trenchless in the region, and we need your support to ensure that the Chapter succeeds and grows.

The Board of Directors continues to explore ways to maintain the connection with past presidents and founding members of the Northeast Trenchless Association, an independent group that led to the formation of our Northeast Chapter. Reinforcing connections and relationships with these trenchless professionals will broaden the representation in our Chapter and contribute to new initiatives and learning opportunities for our members.

Thank you to all of our chapter members for participating, reading and sharing the journal, and joining us at our annual conferences. Thanks also to our Past Chair, Executive Committee, and Board of Directors for your time and dedication to the chapter.

"PLEASE JOIN US"

Please join us!

Ian W. Mead

Ian W. Mead, P.E., BCEE
Chair, NASTT-NE

NASTT-NE SITE

MESSAGE FROM NASTT CHAIR

Craig Vandaelle, NASTT Chair

It is the grass roots effort of our Regional Chapters that is the foundation of our Society. Our volunteers are the reason for our growth and success. Thank you for being a part of our organization and dedicating your careers to the trenchless industry.

Planning has been underway for the past year and we're ready to hit Chicago for NASTT's 2019 No-Dig Show, March 17-21. We hope you'll be joining us for a week of networking, learning and fun! We're looking to break attendance records, yet again, for the premier trenchless conference in the world!

NASTT exists because of the dedication and support of our volunteers and our 11 regional chapters. There are many Northeast Chapter Members that serve on our No-Dig Show Program Committee and volunteered this past summer to peer-review the 2019 abstracts. These committee members ensure that the technical presentations are up to the standards we are known for: Dennis Doherty, Brian Dorwart, Sahar Hasan Kunay, Tony Hranicka, Abhinav Huli, Johnathan Kunay, Carrie Layhee, Gerry Lundquist, Babs Marquis, Nick Strater, Paul Savard and Rick Trieste. The Northeast Chapter is also home to some of our Track Leaders. Track Leaders are Program Committee members that have the added responsibility of managing a track of the technical program and working with the authors and presenters to facilitate excellent presentations. I would like to extent a special thank you to the Northeast Chapter Members that also served as Track Leaders: Dennis Doherty, Johnathan Kunay, Carrie Layhee and Babs Marquis.

I would like to thank Northeast Chapter Member, Tony Hranicka, for his time serving on the NASTT Board of Directors. Tony completed his six-year term at the end of 2018 and he will be missed. I'd also like to thank two of our current Board Members from the Northeast Chapter for their continued support, Babs Marquis of McMillen Jacobs Associates and Gerry Lundquist of National Grid. These trenchless champions will help direct the affairs of the Society along with the rest of our board.

The North American Society for Trenchless Technology is a society for trenchless professionals. Our goal is to represent our industry and provide valuable initiatives. To do that, we need the involvement and feedback from our members. We are always seeking volunteers for our various committees and programs. If you are interested in more information, please visit our website at www.nastt.org/membership/volunteer. There you can view the committees and learn more about the ways to stay involved with the trenchless community and to have your voice heard. Please consider becoming a volunteer – we would love to tap into your expertise.

Thank you again for your support of our society and the trenchless technology industry. I hope to see you in Chicago!

Craig Vandaelle

NASTT Chair

MEMBERSHIP IN NASTT

Carolyn Hook, NASTT Membership Coordinator

MEMBERS TALK NASTT MEMBERSHIP

As the Membership Outreach and Database Manager at the North American Society for Trenchless Technology (NASTT), it's my job to be able to speak about the value of NASTT membership and all it offers beyond professional credibility and information. NASTT is a community of peers where members are connected to go-to people in the trenchless industry – innovators, experts and a network of students and future trenchless professionals.

At every stage of their career, NASTT members have access to a comprehensive set of tools ensuring success.

- **Engage in learning**. NASTT member-only pricing for top-notch training courses, conferences and webinars.
- **Expand your knowledge set**. Largest online trenchless library of technical papers.
- **Increase your visibility**. Opportunities to speak at conferences, write for publications, volunteer to serve and give back.
- **Propel your career**. Career resources, including NASTT's Job Board.
- **Empower your position**. *NASTT's No-Dig Show* - North America's premier Trenchless Technology Conference and Trade Show.
- **Connect locally**. Regional educational and networking events.
- **Find answers at your fingertips**. Subscriptions to *NASTT's Trenchless Today*, *NASTT's Regional Chapter magazines*, *ISTT's Trenchless International* and *Trenchless Technology*.

NASTT is the largest community of trenchless professionals in USA and Canada committed to promoting better and more responsible ways to manage underground infrastructure and advance trenchless technology for the benefit of the public and the natural environment.

That's what I would say. But what about NASTT members, do they agree? It's also my job to know what NASTT members think about membership. So, I asked a few to share their insights. Here's what I found out.

NASTT Transforms Careers

"Having come from an entirely different industry focusing on natural gas, the common link of construction bonds the two industries closely together. Membership has made me a well-known nationally recognized expert in the use of trenchless and its applications in two industries. When I do not know the answer, I can call on an established network of key contacts and access a library of technical papers. Membership allows me to maintain a current and state-of-the-art awareness of trenchless methods and potential improvement areas that I address through my R&D activities." – *George Ragula, Distribution Technology Manager, PSE&G*

NASTT Provides Leverage for Corporations, Municipalities, Educational Institutions and More

"NASTT is far and away the leading educator and networking pool in the trenchless industry. If your company plays a part in the trenchless industry, you will benefit from NASTT membership much more than you realize." – *Joe Lane, Vice President, International Operations, Infrastructure, Aegion Corporation*

"We advertise that our staff are members of NASTT for RFPs and on Trenchless resumes." – *David Crowder, C.E.T., C.D., Senior Associate, Trenchless Practice Leader, R.V. Anderson Associates Limited*

"I get to network and share ideas with other like-minded professionals. I've learned about new technologies that make us work more efficiently." – *Tayo Olatunji, PE, PMP, CCM, Supervisor Construction Projects, DC Water*

"The bottom line is that active membership benefits me professionally and, in turn, my company can provide unique and cost-effective solutions to challenging projects." – *George Ragula*

Regional Chapters Bring NASTT to Your Backyard

"The quality and dedication of local volunteers makes working in the industry much easier, more fun and extremely fulfilling." – *Joe Lane*

"Regional chapters make it easy to meet locally with engineering consultants and municipal staff who share the same passion for trenchless technology, learn new ideas and discuss other trenchless topics." – *David Crowder*

"Seeing the impact that trenchless technology has on our communities and the country makes chapter participation worthwhile." – *Alan Goodman, Strategic Accounts Sales Manager, HammerHead Trenchless Equipment*

What about you? How has NASTT membership made a difference in your career? Email me at chook@nastt.org and let me know. You Belong in NASTT!

YOU BELONG IN NASTT!

2018-2019 NASTT-NE BOARD

IAN MEAD – CHAIR

Ian Mead, P.E., BCEE is a Senior Project Manager with Tighe & Bond in Worcester MA, and has over 20 years of experience working as design engineer, project manager and construction coordinator. His varied experience includes work on drinking water, wastewater, pipeline, site and civil, energy and other municipal infrastructure projects. His more recent focus is on development and delivery of projects for municipal clients across New England. Born and raised in the construction industry, Ian has spent his entire lifetime on and around heavy equipment on various construction sites. While working for a private engineering company doing survey and site design work, Ian studied civil engineering at the University of Massachusetts Amherst. His first job after graduation was doing site inspection work on pipeline projects throughout MA and RI. He was quickly introduced to trenchless technology as many municipal clients were then expanding sanitary sewer collection systems, and some of this work involved trenchless applications such as HDD, bursting, and CIPP. More recently his experience has also included comprehensive pressure pipe condition assessment and rehabilitation, and the incorporation of this information into enterprise asset management programs. Ian thinks that increasing owner acceptance, and convincing local decision makers that trenchless methods should be part of any utility's asset management plan, are important keys to future growth of the industry. Education and information provided to municipalities and utilities will help spread the word that trenchless is a viable and proven option. Ian feels there is a great opportunity to generate more interest in trenchless technology with mid to smaller sized utilities across the Northeast. Another major goal he has is building general awareness of the NASTT-NE Chapter, and coordinating its resources and activities, such as website, publications and conferences, with the parent NASTT organization and other regional chapters across North America.

BABS MARQUIS – VICE CHAIR

Babs Marquis is presently the Trenchless Practice lead for the East Coast and Construction Manager with the Burlington, Mass., office of McMillen Jacobs Associates. He previously worked for Jacobs Engineering Group for 10 years and Stone & Webster for 11 years. During his extensive career in the trenchless industry, Babs has been involved in major tunneling and trenchless projects in the Northeast for clients such as the Massachusetts Water Resources Authority, Boston Water & Sewer Commission, the Metropolitan District Commission (Hartford, CT), Narragansett Bay Commission (Providence, RI), NYC Dept. of Design & Construction and NYC Dept. of Environmental Protection. For the past 19 years, he has focused on underground construction management for tunnels and conveyance including water and wastewater pipeline design and construction projects, with emphasis on trenchless construction methods. He has worked on various pipeline projects utilizing microtunneling, pipe jacking, horizontal auger bore, pipe bursting and pipelines renewal methods. From 2009-2011 Babs was resident engineer on the pivotal Microtunneling, & Pipe Bursting components of the East Boston Branch Sewer Relief Project. His commitment to the trenchless practice includes co-author for revision and update of the ASCE Manual of Practice (MOP 106) for Horizontal Auger Boring Projects and is the chair leading the effort for review and update of ASCE MOP 112 for Pipe Bursting Projects. Babs was instrumental in the development of the Auger Boring School at the Louisiana Technical University where he continues to assist with the annual planning and teaching at the auger boring school. Babs views the NASTT-NE Regional Chapter as an important vehicle to promoting greater awareness and understanding of trenchless applications at the local level. He sees the level of interest and confidence in trenchless technology growing among owner groups based on the successful completion of many high profile projects across the Northeast. Drawn to the varied unique and innovative aspects of trenchless technology, Babs believes access to ongoing education is key to even greater owner acceptance and NASTT-NE Chapter is a key component towards achieving this acceptance by making information available at the grassroots level as well as attracting student chapters from the region and a robust local participation in the Chapter activities throughout the region.

ERIC SCHULER – TREASURER

Eric Schuler is the City Engineer for an upstate-New York community that is rich in history. As a Department Head, he oversees all of Public Works, Sanitary Sewer, Storm Sewer, Water Distribution, Water Treatment, Wastewater Treatment, Facilities, and Traffic departments. Mr. Schuler has over 8 years of experience as a consulting engineer for nationally-recognized firms prior to switching to the municipal world. He earned his Bachelor of Science in Civil Engineering degree from Clarkson University in Potsdam, NY and has primarily been involved in wastewater, drinking water, civil-site, and stormwater sectors. Eric is a licensed Professional Engineer in New York whose design, project management, and construction-related experiences have helped successfully execute many "trenchless" - focused projects. Early in his engineering

EXECUTIVE COMMITTEE

career he gained exposure to various trenchless technologies through utility evaluations and development of utility project design alternatives. He immediately started to envision great opportunities for communities plagued by utility deficiencies and construction constraints to utilize CIPP, HDD, among other trenchless technologies; and for them to be able to benefit from both social and economic perspectives. Eric has also stressed the importance for municipalities to incorporate asset management into utility system evaluations and system rehabilitation designs in order to aid development of capital projects and to determine the most suitable trenchless applications for implementation. In addition to NASTT-NE, Eric is also an active member of the American Public Works Association (APWA) and New York Water Environment Association (NYWEA); and is consistently pushes for growth of trenchless technologies in upstate-New York. Eric has previously presented on the use of hydraulic modeling methods for proper development of utility rehabilitation project design. He is an advocate for educating (designers & installers) of trenchless applications through proper training and increased accessibility of industry standards/guidelines to ensure successful project design and execution. The successful use and increased awareness of modern-day trenchless technologies that incorporate innovative equipment and materials are what Eric believes will continue to shape and drive the direction of the utility industry for the coming decades.

MARSHALL GASTON – SECRETARY

With more than 40 years of experience in the construction industry, Marshall Gaston's diverse background and experience bring a unique perspective to trenchless project development. Marshall has always maintained a foot in both the academic and practical fields. Earning a Bachelor's Degree in Construction Technologies from Purdue, he was heavily influenced by his father's job as a contactor. This duality of education and hands-on experience has been evidenced throughout his career. After graduation, Marshall went back to work for his father, literally learning from the ground up. His career then shifted to work in smaller consulting firms, where he was first introduced to trenchless technology. Marshall currently serves as a Senior Project Manager in the Water and Natural Resources Department at Fuss & O'Neill.

Marshall's current focus is design and construction of major sewer extension and roadway projects. He sees trenchless technology as a useful component to his work, as there is increased demand for less invasive technology. He believes that trenchless technology is fast becoming mainstream as the demand for less intrusive construction techniques will drive both improvement in technology and costs downward. As Secretary, Marshall looks forward to a deeper understanding of the industry and translating that knowledge to his clients. A problem solver by nature, amplified by a lifelong interest in construction, Marshall's devotion to his clients is evidenced by the numerous facility planning, gravity and low pressure wastewater collection systems, pump station design and commissioning, and on-site decentralized renovation systems changing the landscape of New England.

DENNIS DOHERTY – PAST CHAIR

With over 30 years of experience in the trenchless technology industry, Dennis Doherty has developed a unique understanding of the full scope of trenchless techniques and risk management as it relates to trenchless design. He earned his BSCE in Civil Engineering from the University of Massachusetts at Lowell, and M.S in Management of Projects and Programs from Brandeis University. Dennis began his career in in trenchless in 1989 at Bryant Associates, moving to Metcalf & Eddy in 1996, and later for Jacobs Engineering in 2000, where he spent 10 years. Since 2010, his focus as a Senior Consultant and the National Practice Leader, Trenchless Technologies, at Haley & Aldrich has been applying a total trenchless approach, from feasibility through construction, utilizing microtunneling and HDD on projects primarily for private sector energy clients. Throughout his career Dennis has worked on a variety of innovative trenchless projects around the greater Boston area, including the New St. James Avenue Interceptor Project for the Boston Water & Sewer Commission - the first and only project to win the Trenchless Technology Magazine's Project of the Year award in both New Installation and Rehabilitation categories. Dennis has been a long-time proponent of the benefits and value of trenchless technology. He believes regional education and outreach activity is the foremost priority for the new NASTT-NE Chapter. In his view, another positive step forwards is the formation of the new U. of Massachusetts at Lowell Student Chapter which will help draw more young engineering professionals into trenchless practice. Dennis currently serves on the NASTT No-Dig Show Program Committee and teaches the NASTT HDD Good Practices course. He is involved in ASCE Standard Design and Construction Guidelines, and Pilot Tube and Other Guided Boring methods Manual of Practice. His passion for all things trenchless is exemplified by his Twitter handle: "@TrenchlessGuru".

professionals into trenchless practice. Dennis currently serves on the NASTT No-Dig Show Program Committee and teaches the NASTT HDD Good Practices course. He is involved in ASCE Standard Design and Construction Guidelines, and Pilot Tube and Other Guided Boring methods Manual of Practice. His passion for all things trenchless is exemplified by his Twitter handle: "@TrenchlessGuru".

2018-2019 NASTT-NE BOARD OF DIRECTORS

2019 UPCOMING TRENCHLESS EVENTS

March 17, 2019
NASTT Introduction to Trenchless Technology - Rehabilitation
8:00 AM - 12:00 PM
Donald E. Stephens Convention Center
Rosemont, Illinois
Information:
www.nastt.org/training/events

March 17, 2019
NASTT Introduction to Trenchless Technology – New Installations
8:00 AM - 12:00 PM
Donald E. Stephens Convention Center
Rosemont, Illinois
Information:
www.nastt.org/training/events

March 17 - 21, 2019
NASTT 2019 No-Dig Show
Donald E. Stephens Convention Center
Rosemont, Illinois
Information: www.nodigshow.com

March 20 – 21, 2019
NASTT Pipe Bursting Good Practices Course
March 20 2:30 PM - 5:30 PM
March 21 8:00 AM - 12:00 PM
Donald E. Stephens Convention Center
Rosemont, Illinois
Information:
www.nastt.org/training/events

March 20 – 21, 2019
NASTT New Installation Methods Good Practices Course
March 20 2:30 PM - 5:30 PM
March 21 8:00 AM - 1:00 PM
Donald E. Stephens Convention Center
Rosemont, Illinois
Information:
www.nastt.org/training/events

March 20 – 21, 2019
NASTT CIPP Good Practices Course
March 20 2:30 PM - 5:30 PM
March 21 8:00 AM - 1:00 PM
Donald E. Stephens Convention Center
Rosemont, Illinois
Information:
www.nastt.org/training/events

March 20 – 21, 2019
NASTT Laterals Good Practices Course
March 20 2:30 PM - 5:30 PM
March 21 8:00 AM - 12:00 PM
Donald E. Stephens Convention Center
Rosemont, Illinois
Information:
www.nastt.org/training/events

March 20 – 21, 2019
NASTT HDD Good Practices Course
March 20 2:30 PM - 5:30 PM
March 21 8:00 AM - 2:30 PM
Donald E. Stephens Convention Center
Rosemont, Illinois
Information:
www.nastt.org/training/events

March 20, 2019
NASTT Gas Good Practices Course
2:30 PM - 5:30 PM
Donald E. Stephens Convention Center
Rosemont, Illinois
Information:
www.nastt.org/training/events

April 3, 2019
MASTT Trenchless Technology, SSES & Buried Asset Management Seminar
Mount Laurel, Maryland
(Date may change)
Information: Leonard Ingram,
mastt@engconco.com

May 22, 2019
SESTT Trenchless Technology, SSES & Buried Asset Management Seminar
Charleston, South Carolina
(Date may change)
Information: Leonard Ingram,
sestt@engconco.com

June 26, 2019
MSTT Trenchless Technology, SSES & Buried Asset Management Seminar
Indianapolis, Indiana
(Date may change)
Information: Leonard Ingram,
mstt@engconco.com

August 21, 2019
MASTT Trenchless Technology, SSES & Buried Asset Management Seminar
Arlington, Virginia
(Date may change)
Information: Leonard Ingram,
mastt@engconco.com

September 25, 2019
SESTT Trenchless Technology, SSES & Buried Asset Management Seminar
Charlotte, North Carolina
(Date may change)
Information: Leonard Ingram,
sestt@engconco.com

November 11 - 12, 2019
2019 NASTT Northeast Trenchless Conference
Embassy Suites by Hilton Syracuse
Destiny USA
Syracuse, New York
Information:
www.nastt-ne.org/seminar-2019.html

December 4, 2019
MSTT Trenchless Technology, SSES & Buried Asset Management Seminar
Council Bluffs, Iowa
(Date may change)
Information: Leonard Ingram,
mstt@engconco.com

April 5 - 9, 2020
NASTT 2020 No-Dig Show
Colorado Convention Center
Denver, Colorado
Information: www.nodigshow.com

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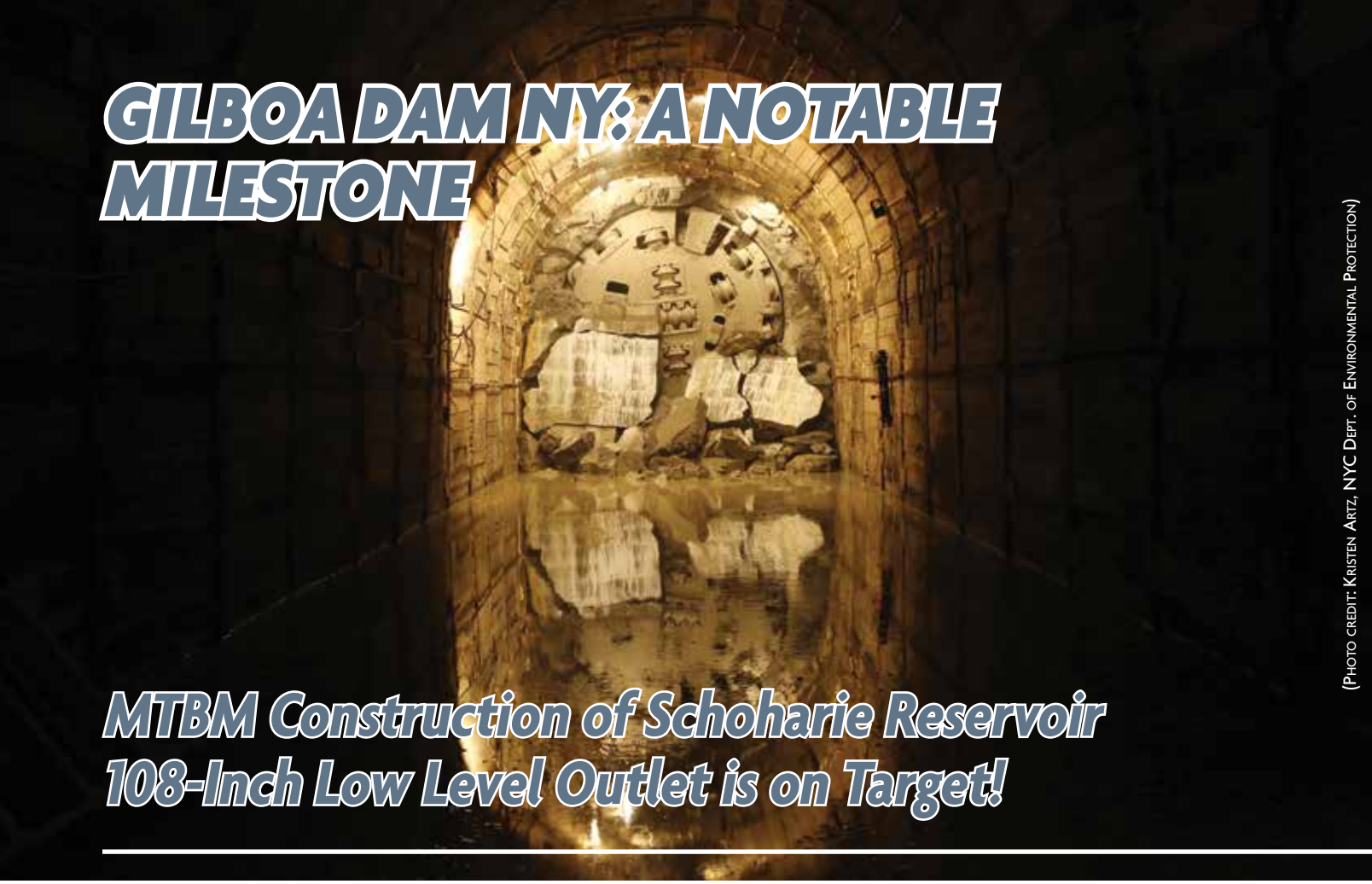
GILBOA DAM NY: A NOTABLE MILESTONE



(Photo credit: Kristen Artz, NYC Dept. of Environmental Protection)

MTBM Construction of Schoharie Reservoir 108-Inch Low Level Outlet is on Target!

By: Emory Chase, NYC Department of Environmental Protection
Babs Marquis, CCM, McMillen Jacobs Associates
John Arciszewski, Southland/Renda Joint Venture
Julio Diamante, PE, AECOM, NY Metro-Water

(This article is a sequel to: "108-Inch Low Level Outlet Construction...", published originally in the NASTT-NE Journal Fall/2016)

INTRODUCTION

Gilboa Dam, in upstate New York, impounds Schoharie Creek to form the Schoharie Reservoir and is the northernmost reservoir in the Catskill System of the New York City water supply. The reservoir yields approximately 15% of the water supply for the five boroughs in New York City. To ensure the long-term performance and reliability of the dam over the next hundred years, the New York City Department of Environmental Protection (NYCDEP) embarked on a Capital Improvement Program that includes dam stabilization with the installation of high-capacity multistrand rock anchors (2006), placement of over 100,000 cubic yards of mass concrete (2013), installation of automated geotechnical monitoring systems (2014), and more recently, the construction of a 108-inch Low Level Outlet (LLO) to allow NYCDEP to drain the reservoir and meet proposed water conservation releases.

SUBSURFACE AND GEOLOGIC PROFILE

The subsurface investigation program for the Gilboa LLO tunnel was conducted in several stages, commencing in 2006 and completed in 2010. The program consisted of a series of water and land-based borings drilled along several potential tunnel alignments. The borings encountered various types of deposits ranging from man-made fills, recently deposited soft reservoir sediments, and glacial drift deposits consisting of glacial till and glacio-fluvial deposits, to bedrock. The bedrock primarily consists of sandstone and interlayered siltstone, with occasional seams of shale. The mechanical properties of the rock vary by location. The Cerchar Abrasivity Index ranged from 1.2 to 6.6, while the unconfined compressive strength ranged from 13,900 to 32,600 psi. Groundwater flow at the site was observed to be very complex because of the interlayering and diversity of the original depositional environment of the glacial soils, as well as the water level fluctuations of the reservoir. Although hazardous or toxic gases were not detected during the subsurface investigation program, flammable gases were encountered in several places during the excavation of a nearby tunnel located 11 miles from the project site. As a result,

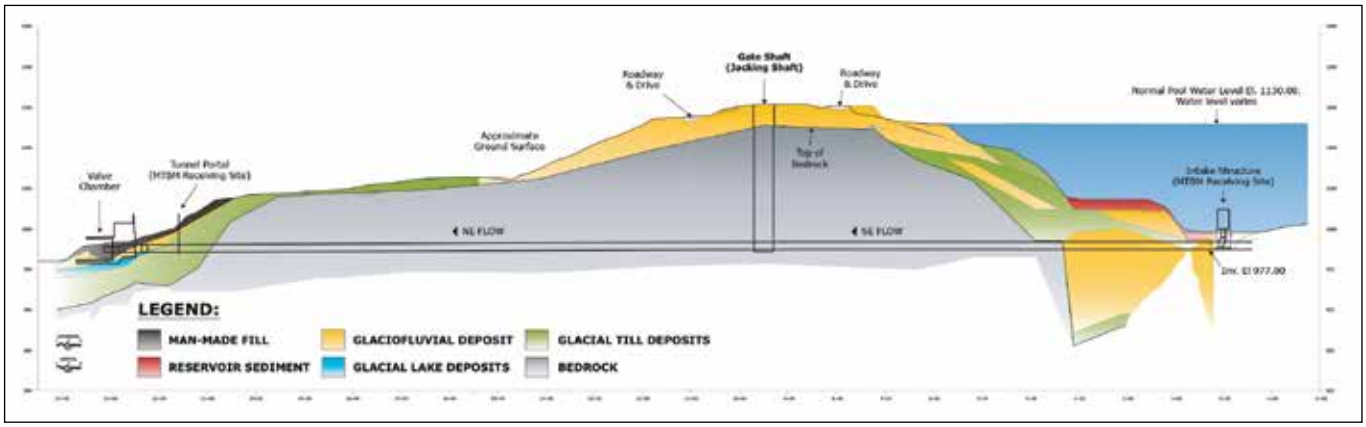


Figure 1: Geologic profile for the Low Level Outlet shaft and tunnels

the Contract classified the proposed shaft and tunnel excavation as potentially gassy in accordance with OSHA hazardous classifications. **Figure 1** shows the subsurface profile for the gate shaft, land leg, and water leg tunnels.

LOW LEVEL OUTLET MICROTUNNELING ALIGNMENT: SHAFT AND TUNNEL CONSTRUCTION

The microtunneling alignment originates at the intake structure at the bottom of Schoharie Reservoir, on the upstream side of the dam, under 153 feet of water. The water leg of the microtunneling alignment proceeds northeast of the dam from outside of the dam footprint at the intake structure, to the gate shaft at the right abutment, which also serves as the jacking shaft, as shown in **Figure 2**. The land leg of the LLO projects northwesterly towards Schoharie Creek, downstream of the dam, and terminates at the portal face of a steep slope, where the valve chamber for the LLO discharge system is located.

The Schoharie LLO Tunnel Project includes the construction of a gate shaft, 40 feet in diameter, 180 feet deep, and excavated through 30 feet of overburden soil and approximately 150 feet of bedrock using drill-and-blast techniques. The circular gate shaft, serving as the jacking shaft from where both the land and water leg tunnels were excavated, was the first of the LLO features to be constructed. The overburden section of the shaft was constructed and braced with steel liner plates to top of rock. The shaft excavation sequence and construction involved perimeter pregrouting in the overburden to about 25 feet into bedrock to control groundwater inflow. Pregrouting in the bedrock section of the jacking shaft was completed in two 75-foot zones as shown in **Figure 3** with battered grout holes circumferentially drilled from within the shaft. The drill-and-blast rock section of the shaft received rock face stabilization consisting of welded wire fabric, rock bolts, shotcrete facing, and grout plug at the bottom of the shaft.

Initially, it was planned that, for the land leg tunnel receiving site (located at the valve chamber), the microtunnel boring machine (MTBM) would pass

Figure 2: Low Level outlet tunnel alignment

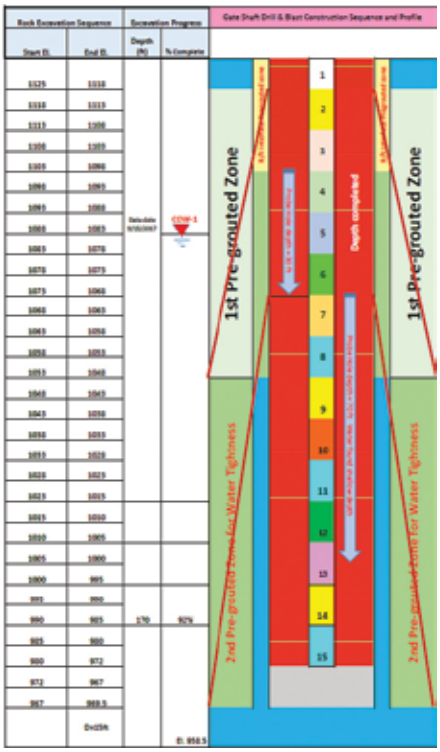


Figure 3: Gate shaft rock excavation and construction sequence

through the valve chamber portal with the grout plug located within a soil nailed wall with ground stabilization. However, as the soil nails progressed it was determined that four soil nails encroached into the tunnel horizon, presenting obstruction hazards to the advancement of the MTBM as it neared the final reach of the land leg tunnel. To mitigate the risk of obstruction and damage to the MTBM, a 12-foot horseshoe-shaped tunnel was hand-mined for 80 feet centered on the alignment to remove glacial till from the portal face

Figure 4: MTBM holed through into the hand-mined tunnel

Figure 5: MTBM pushed through valve chamber portal

Figure 6: Water leg cofferdam structure with fiberglass soft eye

towards the gate shaft and from the rock face to remove the drifted soil nails within the tunnel horizon.

With the end reach of the land leg hand-mined to remove drifted soil nails, the MTBM excavated the land leg tunnel entirely in the bedrock from the gate shaft into the hand-mined tunnel and jacked through to the portal platform (**Figures 4 and 5**).

The receiving site for the water leg at the intake structure location, under the reservoir, was dredged and the intake structure foundation prepared. A circular 35-foot-diameter cofferdam constructed with steel liner plates was installed at the intake structure location and acted as the MTBM receiving structure. It was fitted with an 11-foot by 11-foot fiberglass soft-eye target to allow the MTBM to break into the cofferdam (**Figure 6**). The cofferdam was then locked in position by placing tremie concrete around it and for 75 feet over the top of the tunnel alignment to provide ballast in the low cover area.

For the water leg, the MTBM excavated 500 linear feet in rock and 450 liner feet in soft ground, transitioning through decomposed rock into glacial till, fine sand, and marine deposits before grinding through the tremie concrete around the cofferdam to hole through the fiberglass soft-eye target into the cofferdam on January 19, 2019.

LESSONS LEARNED

Southland/Renda Joint Venture (SRJV), the general contractor, selected and deployed a Herrenknecht AVN2200B microtunnel boring machine (MTBM) to excavate the approximately 2,176 linear feet of tunnel for the LLO from the reservoir to the valve chamber portal downstream of the dam at Schoharie Creek (**Figures 7 & 8**). The AVN2200B for the Gilboa LLO tunnel is the first of its kind manufactured by Herrenknecht with explosion-proof (Class I Division II) electrical components

Figure 7: The Herrenknecht AVN2200B MTBM "Miss Diane" lowered to the land leg tunnel launching site

Figure 8: Commemorative last pipe to complete the LLO water leg tunnel

THE MTBM DIAMETER AND THE DEPTH OF THE SHAFT POSED UNIQUE CHALLENGES TO THE PROJECT. BEING ONE OF THE LARGEST MICROTUNNEL MACHINES MANUFACTURED BY HERRENKNECHT (WITH A 9.5-FOOT EXCAVATED DIAMETER AND TOTAL WEIGHT OF MORE THAN 80 TONS) AS WELL AS BEING CONFIGURED FOR HYPERBARIC INTERVENTIONS AND WET RETRIEVAL MADE THIS A ONE-OF-A-KIND MICROTUNNEL BORING MACHINE...

and tunnel support accessories designed to mine in "gassy" environments. As they are one of a kind with Class I Division II classification, replacement parts are not shelf-stocked. Therefore, replacement parts that cannot be repaired on-site required a long lead time for fabrication and delivery.

The MTBM diameter and the depth of the shaft posed unique challenges to the project. Being one of the largest microtunnel machines in existence (with a 9.5-foot excavated diameter and total weight of more than 80 tons) as well as being configured for hyperbaric interventions and wet retrieval made this a one-of-a-kind microtunnel boring machine. The microtunneling system was initially designed to have only two return pumps on the slurry circuit, one behind the machine and one mounted 30 feet up the shaft wall on a platform; however, it was determined early on that a third pump would need to be installed to lift the slurry from the shaft and into the separation plant. As previously mentioned, because the equipment had to conform with the Class I Division II requirements and because of the specialized nature of the slurry pumps themselves, a third pump was not readily available that could be located in the tunnel or shaft. A non-explosion proof pump was sourced and located on the surface where it proved to be beneficial.

While it was initially determined that four soil nails may have penetrated the land leg tunnel horizon from the valve chamber portal, findings during the hand-mining excavation revealed more than four fugitive soil nail bolts penetrated the tunnel horizon within the excavated

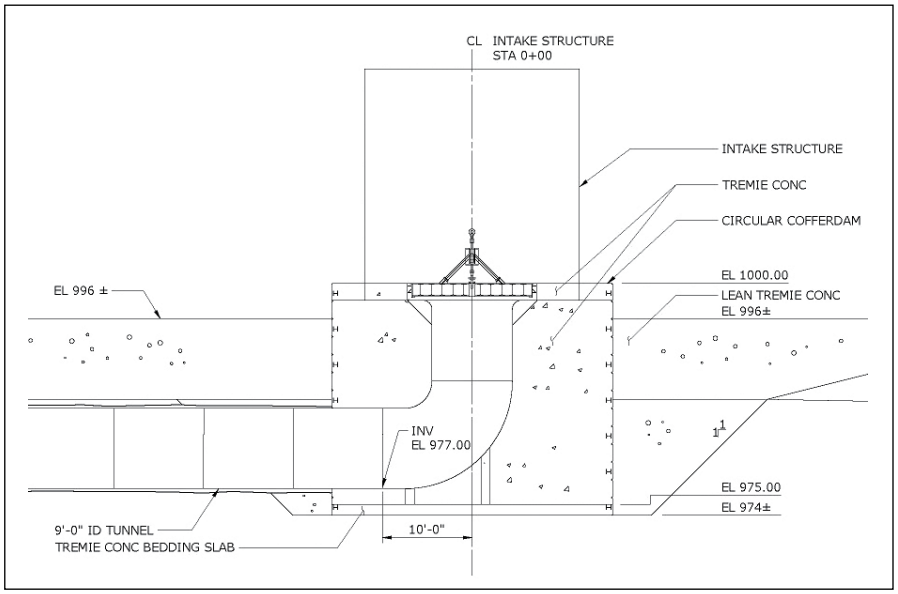


Figure 9: Intake Foundation and Structure Section

horseshoe-shaped tunnel. To make certain that the MTBM did not encounter stray bolts, the hand-mined tunnel excavation was extended 80 feet to intercept with the rock face to essentially remove the glacial till and rubble fill in the land leg.

The removal of nine errant bolts from above and both sides of the hand-mined tunnel revealed that driven soil nails do not travel or maintain a straight path as they penetrate the soil. Driven soil nails deflect and take erratic paths, causing some bolts to be twisted and inter-lock. Perhaps this is why soil nail and braced excavation systems are so effective.

LOW LEVEL OUTLET CONSTRUCTION: STATUS

Since completing the water leg tunnel, grouting of the annulus is underway along with removing utilities and demobilizing surface equipment. After the tunnel annulus has been grouted, the remaining utilities, hydraulic sled, pump, and airlock will be removed from the tunnel and two bulkheads reinstalled near the gate shaft. The MTBM will be retrieved from the reservoir at a depth of approximately 153 feet in mid-March. Following the retrieval, divers will cut the adaptor piece from the Permalok® pipe, whereby the tunnel will be flooded back to the bulkhead near the shaft. A 108-inch elbow will then be set into position and welded to the tunnel pipe underwater, followed by tremie concrete encasement. A bulkhead will be installed in the bellmouth to allow the tunnel to be

dewatered during the shaft concreting and mechanical installations. Lastly, a stainless-steel intake structure will be set and tremie concreted in place (see **Figure 9**). Additional work remaining on the project includes the valve chamber structure and the East Overlook, which will serve as a visitor's center for the dam and reservoir.

ABOUT THE AUTHORS:

Emory Chase *is the Gilboa Program Manager with the NYC Department of Environmental Protection. He has worked for the NYCDEP for the last 18 years, managing various construction projects throughout the upstate watershed. These projects include the WWTF upgrades, WWTF Process and Safety Improvements, and sewer system extensions/rehabilitation projects. For the last ten years he has managed the reconstruction of the Gilboa Dam including the site preparation, Crest Gate installation, dam reconstruction, rehabilitation of the Schoharie Tunnel Intake Chamber, and the Schoharie Reservoir Low Level Outlet.*

Babs Marquis, CCM*, is a Construction Manager with McMillen Jacobs Associates in Burlington, MA. He is a tunnel engineer and risk manager providing microtunneling oversight CM services for the project. For the past 19 years, he has focused on underground construction management for tunnels and conveyance including water and wastewater pipeline design and construction projects, with an emphasis on trenchless construction methods. Babs is the current Vice Chair for the NASTT-NE Chapter.*

John Arciszewski *is the Project Manager with Southland/Renda Joint Venture responsible for the construction delivery of the CAT-212C contract. For the last 20 years he has worked on underground projects for transportation, water, and wastewater across the United States including the Lake Mead Intake No. 3, East Side Access and, most recently, the Jollyville Transmission Main.*

Julio Diamante, PE*, is the Resident Engineer with AECOM, NY Metro-Water responsible for the construction management of the CAT-212C LLO contract. For the last 17 years he has worked on multimillion-dollar Capital Improvement Programs for the public and private sectors. Since 2011, he has been fully involved in the delivery of the Gilboa Dam Improvement Program.*

THIRD ANNUAL NASTT-NE NORTHEAST TRENCHLESS CONFERENCE 2018 ANOTHER GREAT SUCCESS!

By: Marshall Gaston, Fuss O'Neill, (NASTT-NE Board Secretary)

More than 120 delegates gathered for a full day of trenchless technology education and networking

More than 120 trenchless professionals, municipal attendees, industry exhibitors and students gathered in Mystic, Connecticut on November 13 for the third annual North American Society for Trenchless Technology Northeast Chapter (NASTT-NE) Trenchless Conference & Municipal Outreach Forum.

Ian Mead, Chair of the NASTT-NE Chapter, moderated the day's proceedings that started with NASTT Executive Director, Michael Willmets, opening remarks about trenchless technology; a service award presented to Past Chair, Dennis Doherty, and a presentation by the UMass Lowell Student Chapter and much more.

One of the highlights of the one day event was the lunch time presentation by Mr. Scott W. Jellison, Chief Executive Officer of The Metropolitan District Commission (MDC) in Hartford, CT who provided an overview of the MDC's large construction

NASTT-NE Paper of the Year Award Co-Authors Jonathan Kunay CDM Smith (center left) and Nicholas Rystrom, City of Revere MA (center right) receive award plaques from Paul Savard, NASTT-NE Board Member and Ian Mead, NASTT-NE Chair, for the paper "Tying Up Loose Ends: Rehabilitating the Downstream End of an Egg-Shaped Brick Interceptor Near Boston"

Distinguished Service Award presented by Ian Mead, NASTT-NE Chair to NASTT-NE Founding Chair Dennis Doherty (right)

initiative explaining their many accomplishments and providing insight to their future water and wastewater plans.

Fourteen papers presented in 2 tracks covered a wide range of topics showcasing trenchless rehabilitation techniques, investigative methods, equipment innovations and good housekeeping practices and followed with a roundtable discussion on Trenchless Technologies in the Northeast; "Saving the Coastline, protecting our resources". The NASTT-NE chapter is publically sharing these presentations and they are available for download from our website: www.nastt-ne.org.

The NASTT-NE chapter would like to give a special recognition to the two companies that conducted live demonstrations in the mid-afternoon. A Spin Lining Demonstration presented by Warren Environmental located in Carver MA and a Pneumatic

UMass Lowell NASTT Student Chapter members such as Liam Henderson (left) and Steve Fallon (????) (right) were again instrumental to the success of the Conference. Future of trenchless is bright in the hands of people like these!

Mr. Scott Jellison, CEO of the MDC in Hartford (center) receives Plaque of Appreciation from Babs Marquis NASTT-NE Vice Chair (left) and NASTT-NE Chair Ian Mead (right)

Networking and close personal access to industry expertise is an important aspect of the annual NASTT-NE Conference

Pipe Bursting Demonstration presented by Pipe Bursting of New England located in Avon MA. Many thanks to these firms for taking time from their normal workday to mobilize and share their technology and expertise with the attendees. We are very grateful for their support.

In keeping with our chapter's training and educational goals, Dr. Raj Kumar Gondle, lecturer and faculty advisor for the UMass Lowell Student Chapter and student members, met industry professionals at their exhibit booths, participated in the conference as presenters, and also

Seminars covered a wide range of trenchless subjects and were intensely followed by conference delegates

Live mid-afternoon field demos are a regular conference highlight

provided support activities to the conference, such as staffing the registration table.

The seminar took place at the luxurious Mystic Marriott Hotel and Spa, where participants had easy access to 26 industry exhibitors available to converse with attendees. Additional networking opportunities were found by those who chose to visit the nearby Mystic Seaport for an informal gathering at Mystic Pizza.

The NASTT-NE Chapter Board of Directors thanks everyone for their participation in a highly successful third annual

Roundtable panel discussion on "Saving the Coastline, Protecting our Resources" was a fitting end to a busy day of seminars. From left to right: Babs Marquis, Guy Campinha, Dennis Doherty, Matt Timberlake, Nicholas Rystrom

UMass Lowell NASTT Student Chapter member Gumisayi Vengesayi informs delegates about the field visit to a microtunneling project site on Randall Island New York and the lessons learned

Registration Area had NASTT-NE shirts for sale and a display from the UMass Lowell NASTT Student Chapter

THE NASTT-NE CHAPTER BOARD OF DIRECTORS THANKS EVERYONE FOR THEIR PARTICIPATION IN A HIGHLY SUCCESSFUL THIRD ANNUAL NASTT-NE NORTHEAST TRENCHLESS CONFERENCE.

Lunch hour presentation by Mr. Scott W. Jellison, Chief Executive Officer of The Metropolitan District Commission (MDC) in Hartford CT was a highlight of the day's proceedings

NASTT Executive Director Mike Willmets gave opening remarks to delegates

NASTT-NE Northeast Trenchless Conference. We wish to extend our appreciation to all our presenters, moderators, and attendees for their participation, time and effort. A special thanks also goes out to our Premium Sponsors & Exhibitors.

Building on these past year's success the NASTT-NE Chapter is taking the yearly seminar event on the road and plans to host seminars throughout New York and New England in the coming years. The 2019 Conference is scheduled November 11 - 12 at the Embassy Suites Destiny USA in Syracuse, New York.

For further details and updates please visit:

www.nastt-ne.org

We look forward to seeing everyone again in 2019!

Delegates had easy access to 26 trenchless technology exhibits and numerous industry experts

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SHELTER ISLAND, NEW YORK DEPENDS ON FUSIBLE PVC® CONDUIT

HDD project on Long Island provides energy reliability

By: Ed Lobello, Underground Solutions, Inc.

First of 3 conduits is pre-assembled for installation

Before Hurricane Sandy hit the New York coastline in 2012, the residents of Shelter Island, an idyllic community at the easternmost tip of Long Island, felt that their power infrastructure was well protected. At the time, Shelter Island had three circuits providing power - one of which was known to be inadequate but provided some back up capability at peak power use. Sandy destroyed one of the two remaining circuits and left the island with no adequate back up circuit. This was especially problematic in the summer months when demand was at its peak.

Shelter Island officials acted quickly to resolve the issue and obtained the funding and permissions to replace the line under the Peconic River and Pipers Cove using horizontal directional drilling (HDD) methods. The HDD process would be used to install three conduits under the water, each 3,300 feet long, from Southold to Shelter Island. However, this initial installation was a failure. The original drilling contractor used a high-density polyethylene (HDPE) conduit and attempted to install all three conduits in a bundle in the same 36-inch bore hole which got stuck during the installation.

"IN EARLY MEETINGS WITH PSEG, CARSON CORPORATION WAS DETERMINED TO REDUCE THE RISK. IN ORDER TO ACCOMPLISH THIS, WE CHOSE TO DRILL THREE SEPARATE BORE HOLES AND USED 8-INCH FUSIBLE PVC® PIPE DUE TO THE SAFE PULL FORCE AVAILABLE AND CALCULATED PULL FORCE NEEDED TO ENSURE A SUCCESSFUL DRILL."

- Bob Carson, VP Business Development, Carson Corporation

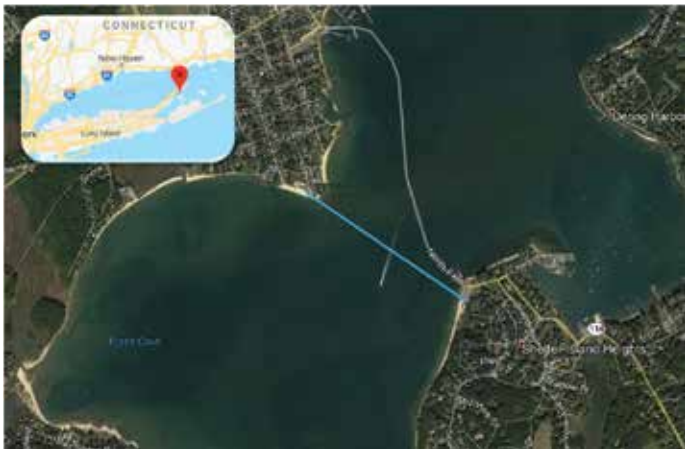
Insertion of first conduit is almost complete

The HDD had to be abandoned, and the project had to be shut down. A new approach was necessary.

There were delays for several years while the failed installation was dealt with and a new plan was considered. Shelter Island officials brought in one of the premier drilling contractors in the nation, Carson Corporation, to help them complete the project. Carson partnered with Underground Solutions, makers of Fusible PVC® pipe, to tackle this challenging project. Carson chose to use Fusible PVC® conduit because of its superior safe pull force and strength to weight ratio compared to HDPE. With the cooperation of the power company, Heights Property Owners Corporation (HPOC), Shelter Island Town and the Town of Greenport, drilling began in Fall/2016.

At the recommendation of Carson Corporation, three separate bores were performed instead of a single bundled installation. A single 8-inch diameter Fusible PVC® conduit was installed in each bore, approximately 3,300 feet in length. The bores were drilled from

Work continues through winter to meet project schedule



Power supply needed to cross below Pipers Cove from Greensort to Shelter Island

Greenport to Shelter Island, up to 120 feet below water body. Of the three conduits installed, only one currently carries an active circuit, while the other two will provide options for future reliability and capacity expansion projects.

According to Bob Carson, VP Business Development at Carson Corporation, "In early meetings with PSEG, Carson Corporation was determined to reduce the risk. In order to accomplish this, we chose to drill three separate bore holes and used 8-inch Fusible PVC® pipe due to the safe pull force available and calculated pull force needed to ensure a successful drill."

In the end, the second attempt at the project was delivered on time and on budget. Thanks to the experience and diligence of Carson Corporation and the use of Fusible PVC® conduit, Shelter Island has the energy capacity and system resiliency needed for the future.

ABOUT THE AUTHOR:

***Ed Lobello** is responsible for Sales in VA, DC, MD, DE, NJ and Eastern PA. He has 18 years of experience in consultative sales, business development, and product development in the civil engineering community. Previously Ed served as Business Development Manager for Water Reclamation Solutions. Additionally, he served as Sales Engineer and Plant Manager for Lane Enterprises, Inc. in the Mid Atlantic area. Ed earned a Bachelor of Science Degree from Virginia Tech.*

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CONTRACTOR PROFILE:
DIRECTIONAL DRILL PULL BACK ASSIST

ALL STATES UNDERGROUND, INC.

By: Fabian Tinajero, All States Underground, Inc.

We go to where we're needed – all states. Hence the name of our company, All States Underground, Inc. I became familiar with trenchless technology pipe ramming equipment 25 years ago when I was a sales rep for a construction rental house company.

Back then, I was trained on pipe ramming equipment so I could demonstrate the proper use on the equipment we sold or rented out. I would actually stay with the customer the whole time and work with the pipe ramming equipment until the job was finished. I became very good at it. So good in fact, the customers would always say at the end of jobs "you are so good at this, that you should start your own pipe ramming business". And because I was thinking of starting a business anyway, that's how we got started back in 1999.

Nowadays, a lot of my customers call me for emergency jobs when their directional drills get immobilized. They depend on me to get there quickly. And in most cases I can be there the very next day. I move equipment, materials and crews rapidly into place and can do the following on short notice:

PIPE RAMMING:
Road bores, river crossing, wet lands, railroad tracks and culverts. Any size steel casing. Often used for culvert replacement. Average speed is in feet per minutes.

DIRECTIONAL DRILL/ PULL BACK ASSIST:
When directional drill is immobilized percussive power frees product pipe when you attach our air hammer.

EXTRACTING OLD PIPE:
Attach a new pipe to the old pipe that needs to be replaced. Then attach our air hammer and push out old pipe while replacing with new pipe.

CONDUCTOR BARREL:
Pipe rammer installs steel casings for clean bore start for directional drilling. We install 4-inch to 80-inch casings and can go even larger diameter if needed.

PILE DRIVING:
Installation of steel beams vertical.
Installation of steel casing vertical.

Often we get called on HDD assist jobs where we use the percussive power of pipe ramming to free immobilized pipe strings. Most cases we can be there the next day. With pipe ramming used as HDD assist even longer pipe sections can be installed, saving overall time on the project. We also rent out equipment as needed.

Call us at 732-859-1170!
We can be there the next day...

ABOUT THE AUTHOR:

Fabian Tinajero *is President of All States Underground, Inc., specialists in pipe ramming since 1999. He believes in the importance of trenchless technology and truly enjoys his chosen profession. Fabian is a member of the NASTT-NE Chapter.*

ALL STATES UNDERGROUND, INC.

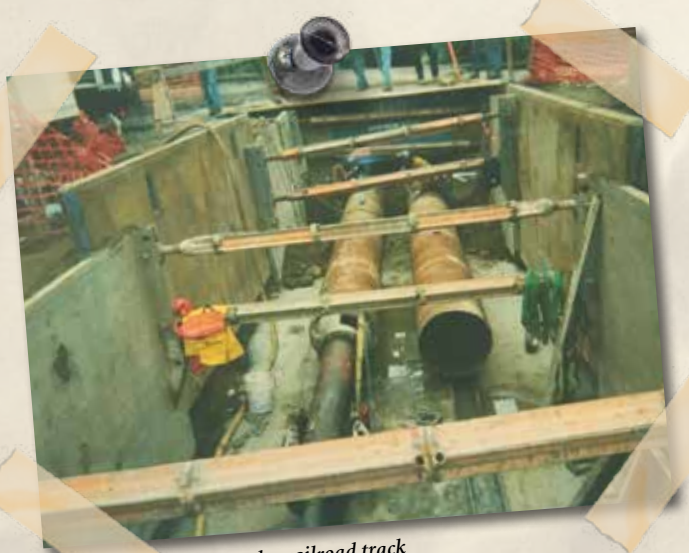
Road Bores • Culvert Crossing • HDD Assist • Extract Pipe

Two 30-inch Pipes Underneath Connecticut River

With pipe ramming assist even longer pipe strings can be installed

42-Inch Conductor Barrels - pipe rammer installs steel casings for clean bore start

When directional drill is immobilized percussive power frees 2500 feet of 24-inch pipe with air hammer attached



Two 30-inch casings under railroad track

Pipe ramming 48-inch casing under railroad tracks

TRENCHLESS LIVE DEMONSTRATIONS – A UNIQUE & INTERACTIVE WAY TO LEARN

UMass Lowell NASTT Student Chapter

By: Steven Fallon, Susom Dutta,
Dr. Raj Kumar Gondle (Faculty Advisor)

The UMass Lowell NASTT student chapter had an opportunity to attend the Northeast Regional Trenchless Conference for the third consecutive year and learn more about advancements in the trenchless industry. Once again, the conference was well attended by engineers, contractors, vendors, and industry leaders with an amazing kickoff at the famous Mystic Pizza place. Among the impressive list of exhibits and technical sessions, live demonstrations of pneumatic pipe bursting and pipe lining were unique and interactive. These demonstrations not only showed the potential of each method but also portrayed an effective way to address some of the underground construction challenges associated with aging pipeline infrastructure.

Figure 1: Pipe bursting crew and conference attendees witnessing the demo

Pipe bursting is a pipeline rehabilitation and replacement method that involves replacing an existing pipeline by means of "bursting" or "splitting," and simultaneously pulling a new replacement pipe of equal or larger diameter, which is attached to the bursting head. The benefit of this method is that the pipe bursting follows the path of existing utilities avoiding sizable surface damage and costly restoration when compared to the open cut methods. In addition to replacing the damaged or aged pipes, pipe bursting techniques can be used in upsizing pipe capacity to fulfill the increasing demands of the society. On a typical upsizing project, the diameter of the pipe can be increased to a considerable amount by significantly cutting down the construction costs.

Students from UMass Lowell were interested to see in particular how the pneumatic head would actually "burst" the pipe, as it may appear a bit difficult to understand how a machine is able to cut open and replace a pipe underground simultaneously. It was fascinating to see the burst head follow the pipeline trajectory and burst the pipe in such a short period of time with a minimal crew. The main idea behind the technology was effectively presented and successfully perceived by the attendees. With every pipe bursting project being unique, the type and condition of the existing pipe must be known prior to design and construction so as to choose the correct bursting head. In addition, engineers and field crew must be aware of the geologic conditions surrounding the pipe to ensure that the installation method can proceed smoothly. A specific method is chosen from there, and contractors must be rather careful during the rehab process, giving attention to the location and progression of the bursting head.

Students and conference attendees also had an opportunity to witness another outstanding live demo on Cured-In-Place-Pipelining (CIPP), which is one of the several impressive rehabilitation and restoration methods providing an affordable, long-term solution to aging underground infrastructure. The method employs a high-speed spinning head that moves inside the pipe and sprays out the epoxy throughout the inner wall of the pipe. A 40 foot pipe section with

Figure 2: Pipe bursting live demo

ESTABLISHED RELATIONSHIPS BETWEEN UNIVERSITIES AND TRENCHLESS FIRMS, ARE ESSENTIAL IN ATTRACTING DEVELOPING TALENT TO THE TRENCHLESS INDUSTRY...

Figure 3: Students and attendees observing progression of pipelining

several cuts and incisions was used for the demo. An environmental friendly resin coating was applied along inner walls of a pipe demonstrating pipelining product featuring excellent cured in-place properties. The complete rehabilitation process of the 40 foot pipe section took nearly 20 minutes including the time spent to set up process. This is significantly rapid compared to the conventional techniques used in the repair of existing pipelines. The solid, impregnable surface provides a seamless, corrosive-resistant lining with substantial bond strength improving the structural integrity and extending the service life of the existing pipe.

Due to technological advancements, this application process has become more precise and robust employing robotics and automated controlled devices that centrifugally sprays the resin with minimal human error. The progression of the application head and its relative speed can also be controlled. The process involves minimal to no site disruption, as it only requires one utility truck for equipment and supplies. As a result, the entire rehabilitation process can be completed in a quick and timely manner, especially when compared with open trench replacement method and even some other alternate pipe rehabilitation methods.

Knowing the apt trenchless method for a project is of great importance, especially when clients are in search of cheaper and more effective methods. Therefore, it is essential that the engineers, project managers, and contractors understand the fundamentals of each installation method so that the service provided is among the best in the industry. In a field where trenchless technologies are gaining relevance and being selected over open-trench more often, it is essential that those in the field ensure that their

projects proceed with minimal error so as to continue.

The live demonstrations provided an opportunity for the students to see in person what they normally hear in presentations and lectures. This learning is essential for the student's professional and academic careers. Conferences open for everyone interested in the trenchless industry, well established relationships between universities and trenchless firms, are essential in attracting developing talent to the trenchless industry in order to sustain and meet growth. The roundtable discussion at the end of the conference left students inspired at the possibilities the trenchless industry holds for them and motivates everyone to keep the industry alive and thriving for years to come.

Figure 4: Relined Pipe

ABOUT THE AUTHORS:

***Steven Fallon** is a junior in Department of Civil and Environmental Engineering at UMass Lowell. He takes part in several organizations at Lowell, notably serving as secretary for the school's NASTT student chapter. Steven is also an undergraduate research student on the UMass Lowell Structural Engineering Research Group, as well as the professional development chair for the ASCE Student Chapter and a student leader on the school's Concrete Canoe Team.*

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PIPELINE WALL CONDITION INSPECTION USING BROADBAND ELECTROMAGNETIC PROBE (BEM)

By: Jean Rivard, Progressive Pipeline Management

The ability to identify and measure the integrity of ferrous pipe walls, particularly cast iron pipe, provides critical data needed to determine the strength and expected life of an underground facility. Broadband Electromagnetic Probe (BEM) pipe inspection technology provides the ability to make an informed decision on the most appropriate manner to replace gas facility and accurately rank pipe replacement in a gas utility's Distribution Integrity Management Program (DIMP) program.

Current and conventional approaches to DIMP programs vary by utility and how risk management is defined. Often, they include gathering information about the history of a pipe, including the miles and material categorized into sizes and pressure ranges. The definition of the "history of failure" includes the number of breaks, leaks, cracks in a certain distance. The goal is to target pipes that are going to leak and cause problems first. Cast iron pipes with known history of breaks and elevated operating pressures may automatically be targeted for replacement. Some utilities make replacement decisions based solely on pressure and location, for example in densely populated areas a blanket decision is made to replace pipes. These conventional methods of decision making are based on theoretical risk management, without a fact-based assessment of ferrous wall conditions.

PIPELINE RISK MANAGEMENT

Gas utilities from the mid-Atlantic to the northeast region represent over 22,200 miles of cast iron facilities ranging in size from eight-inch to greater than thirty-inch diameter according to the 2017 PHMSA Annual Gas Distribution report. While PHMSA and State commissions are urging and/or requiring utilities to replace cast iron pipe, PHMSA also recognizes the need for technology that can identify the conditions and anomalies in pipes. In September 2018, PHMSA R&D held a working session in Baltimore which focused on pipeline integrity inspection technology with special attention to cast iron pipes, which are being targeted for replacement. The following excerpt is from PHMSA's 2018 workshop:

"Expanding In-Line Inspection Capabilities & Application – This group will discuss development of technology that can internally inspect natural gas and hazardous liquid pipelines. It will cover both piggable and hard to inspect pipeline systems where robotic solutions are necessary. A primary focus of this group is to envision technology solutions that advance the state of the art beyond current abilities and push for technology to detect anomalies having complex features."

The need to utilize technology to identify the integrity of cast iron pipeline health is not only recognized by industry operators but also by the governing bodies of the natural gas industry. BEM technology specifically developed for cast iron pipe integrity assessment can determine wall thinning, graphitization and cracks, both by external or internal means. With the data provided by BEM tools, replacement methods can be evaluated with empirical data and facts to help determine the most cost effective and environmentally efficient solution.[1]

Often, the first decision of pipeline replacement is to utilize direct bury methods. This requires a full trench excavation and the abandonment of the old pipe. It is costly, especially when using steel for larger diameter pipes. Other costs include back filling, paving (temporary and final restorations), equipment and labor. Some streets are so congested there's no place to put another piece of pipe, and conditions such as bridges, railways and historical protected areas make excavation difficult or impossible. BEM can help determine whether the effort and costs of direct bury are absolutely necessary.

An alternative method is to insert a new pipe into an old pipe. For example, a 10-inch pipe being retired can be inserted with a 6-inch pipe inside the 10-inch pipe. A downside to this approach is potentially reduced capacity flowing through the system.

Another option to replacing pipeline is Cured-In-Place-Lining. CIPL is proven to extend the life of pipelines by 100+ years. Lining can cost about one third the cost of direct bury replacement. Benefits to lining also include the ability to maintain flow volumes through systems. The use of CIPL also allows for capitalization of asset replacement costs. BEM is a valuable tool when considering CIPL as it captures actual data on pipe conditions providing decision makers real time data as opposed to the current practice of speculation and educated guesses.

WHAT IS BEM?

BEM is a patented, main ferrous assessment tool that's been in operation in Australia for over 20 years. It was developed by Rock Solid Pty. Ltd. The Australian company has extensive experience with non-destructive assessment of cast iron and other ferrous piping. It is a true NDT method for investigating ferrous pipelines

of all types and all diameters. All ferrous pipeline materials can be investigated – steel, cast iron and ductile iron. Pipes of any size from 110mm (4 inches) diameter upward can be investigated. The tool has applications for external and internal surveys, described in more detail below. It is also possible to evaluate other ferrous structures such as tanks or sections of pipes through coatings. BEM is available through Progressive Pipeline Management and will be a valuable addition to a utility's DIMP program.

BEM empowers operators to make better decisions both to prioritize pipes that need replacement and make informed decisions. An informed decision maker can determine replacement priorities and options that enhance safety, reduce installation costs, decrease unnecessary exposure and damage to underground utility infrastructure, reduce impact on surface strata, reduce inconvenience to the community, while reducing the carbon footprint.

One prominent northeast utility dug up a series of cast iron pipes that had perfectly good wall conditions. If BEM technology had been utilized, the operator could have made a more informed decision on replacement strategy and prioritization. Considering other replacement alternatives would have cost significantly less when compared to the investment of direct bury, while conserving rate payer funds and company resources.

HOW BEM TECHNOLOGY WORKS

The technology works by inducing eddy currents to flow in close proximity to the transmitter. In a ferrous pipe these eddy currents migrate with time allowing a complete profile of the ferrous pipe to be obtained. BEM recorded data can reveal the location of perturbations in the thickness of the ferrous pipe and with appropriate configuration, indications of fracturing can also be detected. BEM data is recorded at distinct frequency increments with the duration and number of increments being dependent upon the material conditions as well as the nature of the target. These parameters can easily be set with the aid of a pre-survey calibration of the ferrous material or less accurately with the aid of 'as built' documentation.[2]

APPLICATIONS: BEM IN THE FIELD

Because of the way in which BEM operates, sensor shapes and sizes for emitting and collecting suitable data are highly flexible. The BEM tool allows for a number of assessments including:

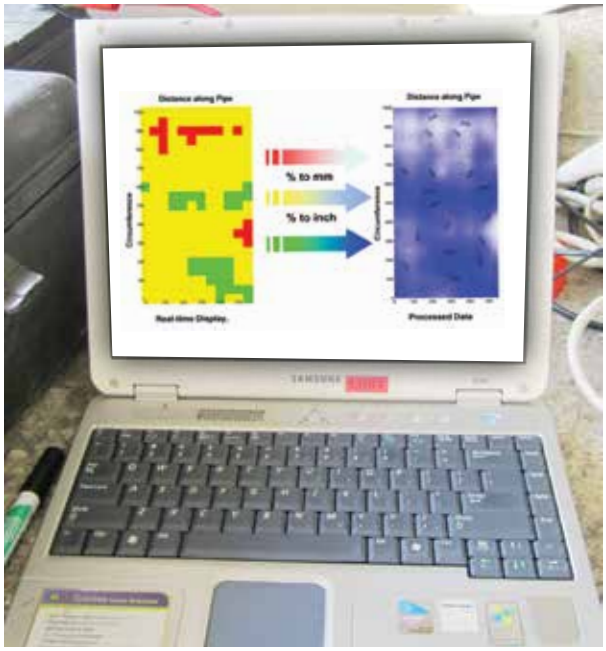
(1) External or surface application devices where manned access is possible and (2) In-line or remote application where an internal delivery vehicle such as a 'pig' is used to transport the device. Both inspection techniques produce the same data.

1) External Ferrous Wall Condition Assessment Tool. Flexible Array Scanning Tool (FAST) is ideal for external pipe wall condition assessments carried out on all types of ferrous pipelines to explore the integrity on pipe diameters from 2 inches upwards. The pipe wall is scanned externally and pipe wall integrity is determined without interrupting the pipe flow or disrupting gas service. Manned access is needed to position the sensors and antennae which surround the pipe. 100 percent pipe coverage can be obtained without diameter or shape restrictions. Individual readings are taken along the surface of a pipe. The coating (bitumen, polyethylene, or even concrete) does not need to be removed. The wall can be scanned with the aid of a temporary marked grid around the outside of the pipe allowing for accurate positioning of each reading taken.

The Flexible Array Scanning Tool (FAST) strips adjust to the pipe circumference and form a "blanket." Inside each strip are sensors, antennae and cables that connect to the core processor

Strips that adjust to the pipe circumference form a "blanket." Inside each strip are a series of sensors, antennae and cables that connect to the core processor. The blanket holds the array and wraps around the pipe. Once set, the program is initiated using

a magnetic field and each antenna sends out a pulse received back at the processor. Data goes back to the core processor on the computer. Initial results are seen on screen.



Initial results can be seen live via a laptop. The real-time wall thickness display uses color to denote wall thickness ranges and areas of concern.

The FAST tool is good for taking measurements on a specific area that has suspect compromised wall conditions. The corrosion group at a major northeast utility is investing in the BEM FAST tool for random excavations. It will be used to survey sections of pipe that have been exposed during the course of normally scheduled and unscheduled activities to gather data about the characteristics of their system.

(2) In-Line Internal Ferrous Wall Condition Assessment

Internal pipe wall condition assessments can been carried out on pipe diameters of pipe 4 inches upwards. Once the pipeline is taken out of service, a pig is moved down the pipe and placed in a position/location. During in-pipe data acquisition, the NDT probes are either winched or rodded through the pipe. In large diameters, personnel can assist the mechanical movement of the pigs on the inside of the pipe.

LINING CAN COST ABOUT ONE THIRD THE COST OF DIRECT BURY REPLACEMENT.

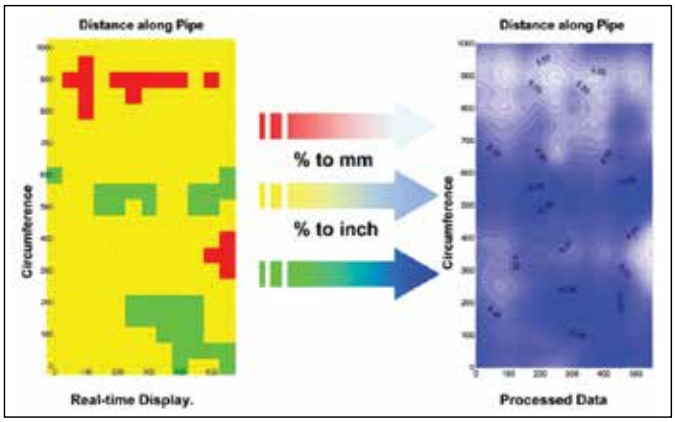
The PIG (Pipe Inspection Gauge) moves through the pipes via tether or rod and takes three readings per section. It can handle up to 90 degree bends with a single point of entry

The Pig moves through the pipes via tether or rod and takes three readings per section. It can handle up to 90 degree bends. Continuous data can be recorded along extensive lengths of pipeline. Due to the large volumes of data recorded as part of any scan, distances surveyed along smaller diameter pipes are typically 1,500 - 2,000 feet per day, while in large diameters lower footages per day are scanned. Data acquired is generally represented graphically or as color contour plots.

REAL TIME WALL THICKNESS RESULTS

Whether using the FAST tool or the PIG the results are the same for each of the two applications. The results come in two

forms. Data gathered in the field is converted to a topographic map, using proprietary software. Onsite, live data looks at ranges. For deeper analysis, the scans get uploaded to Rock Solid Group for a detailed interpretation of the data. Post survey data processing allows a presentation of results in an easy to understand and accurate color contour heatmap.

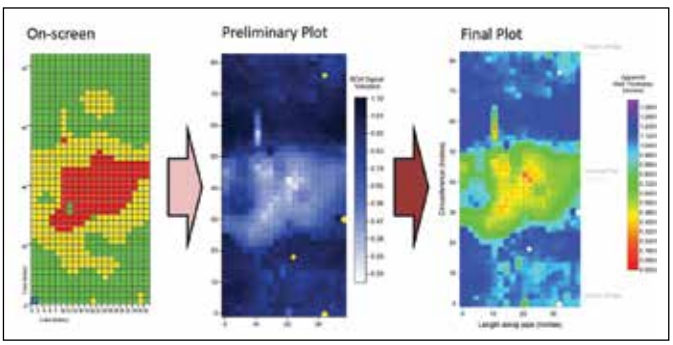


Data is processed in a number of ways with initial readings and in depth data analysis. In the heat map, green areas have 90% wall thickness in tact, and red shows areas of concern

Colors are used to differentiate between differing thicknesses, so that a visual assessment can be made. The plot contours are a representation of the variation of the ferrous thickness or condition across the contoured area. The blue and light green colors indicate a good piece of pipe at that scan point.

DATA POINTS AND ANALYSIS

The figure below shows a sample of a pipe section plot. The pipe is horizontal, with the 180° position running through the horizontal centerline, and the 0° at top and 360° position at the bottom.



Post survey data processing allows an easily understood and accurate presentation of results

PPM is working with a number of gas utilities who are committed to reducing their carbon footprint and conserve rate payer funds. BEM pipe inspection technology provides the ability to make more informed decisions on the most appropriate manner to replace gas facilities and accurately rank pipe replacement in a DIMP program.

...CONVENTIONAL METHODS OF DECISION MAKING ARE BASED ON THEORETICAL RISK MANAGEMENT, WITHOUT A FACT-BASED ASSESSMENT OF FERROUS WALL CONDITIONS.

"We are pleased to have partnered with Rock Solid on this important and vital technology. A key reason why PPM has invested in BEM is it will help our customers with critical and strategic decision making regarding their pipeline replacement programs. The ability to investigate wall thickness and condition of the pipeline before committing capital or maintenance dollars pairs very well with our Starline cured- in-place lining technology for complete pipeline renewal."

-David Wickersham, CEO, Progressive Pipeline Management.

REFERENCES:

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- *Investigating Pipeline Integrity Using Broadband Electromagnetic Technology,* Glyn Hazelden; Jason Consultants, Inc., George Ragula; PSE&G; Paul Beckendorf; GTI, Martin Roubal; Rock Solid Pty, Ltd.

ABOUT THE AUTHOR:

Jean Rivard *works with Natural Gas Distribution companies to develop pipeline lining solutions. His extensive experience includes working with maintenance and construction of city gate stations, district regulator, maintenance, and leak repair activities. Jean's career has spanned construction and maintenance management, safety and technical training, construction, main installation and retirements using tapping and stopping equipment, pressure regulation, leak repair and system maintenance.*

NATURE HIKE TURNS INTO LARGE SCALE PIPE BURSTING PROJECT!

By: Matt Timberlake, Ted Berry Co., A Vortex Company

Environmental challenges presented the best opportunity for trenchless methods to show their benefits

In 2018, the water transmission main that feeds the small Town of Hebron, Maine and the prestigious Hebron Academy preparatory school reached 120 years in age. For reference and context: 120 years ago the Spanish American War took place where the USS Maine was sunk in Havana, Cuba, killing 266 men; German chemist Karl Ziegler was born (Karl Zeigler was credited with creating the first polyethylene compounds); and William McKinley was President.

Dirigo Engineering from Fairfield, Maine was hired to perform a comprehensive analysis of the Hebron water system, including its hydraulic flows and future needs, and a long cross-country water transmission main that would need replacement. Dirigo Project Engineer Jim Lord, who has previously designed pipe replacement projects using a variety of trenchless rehabilitation methods, walked the site numerous times. He evaluated the environmental and physical confines of the remote site, the constructability of a project using either traditional methods of excavation or a trenchless method (or methods), and determined how the system would need to operate in the future.

Privately owned until 1996, much of the Hebron Water Company's infrastructure consisted of an 8-inch cast iron water transmission main that ran approximately 2 miles through the woods and through private easements to the distribution system in the Town of Hebron and at the Hebron Academy. As part of continued expansion, it desired greater flows to the system in order to increase fire protection and to reduce the risk of failure due to a pipe failure.

During the preliminary design phases of the project, Dirigo Engineering considered all options including exploration for a new groundwater source closer to the distribution system, construction of a new water storage tower that would allow for a smaller diameter water transmission main, and a full replacement of the existing infrastructure while increasing the capacity. The chosen method or methods of construction had to take into consideration several identified priorities. These priorities all had equal importance and value. Listed below in no particular order:

"THIS PIPE WILL LONG OUTLIVE US ALL"

- Lew Williams, Hebron Water Company Superintendent

Original CI Main installed 120 years ago when McKinley was US President

Priority 1: Replace existing pipe deemed the best reasonable option.
Priority 2: Increase hydraulic capacity of the system.
Priority 3: Maintain adequate flows during construction.
Priority 4: Protect the environment.
Priority 5: Respect for the landowners.
Priority 6: Maintain the scenic character of the community and surroundings.

The evaluation considered 8-inch, 10-inch, and 12-inch pipes constructed of DI, PVC, and HDPE. It was determined through hydraulic modeling that a 12-inch pipe would be required; however, DI, PVC, or HDPE pipe would all be able to meet the flow demands.

The cost comparison heavily favored the pipe bursting method vs. open cut: the cost comparison was $1M for pipe bursting and $1.6M for open cut.

The environmental challenges also presented the best opportunity for trenchless methods to show their benefits. Stream crossing, wetlands, and vernal pools were identified. It was essential to eliminate or reduce the impacts to these areas and the US Army Corp of Engineers would need to approve construction plans. Other environmental considerations included Atlantic salmon, the Northern long eared bat, and deer habitat.

Using a detailed pre-bid design process, Dirigo Engineering and the Hebron Water Company put to a public bid a construction project, which included the replacement of more than 2 miles of existing 8-inch cast iron pipe with the installation of new 12-inch HDPE DIPS SDR11 pipe. In accordance with the identified priorities, the construction methods used would: A) Eliminate disruption to designated areas along the

Equipment accessed the site through a series of private easements secured with local landowners

Fusing HDPE pipe string on site

project and, B) Reduce impact to other areas and private property.

There were two bids received, with the Ted Berry Company of Livermore, Maine being the low bidder. Trenchless Services Manager, Isaiah Bean, and Matt Timberlake, President of the Ted Berry Company, assembled a construction approach that included static pipe bursting of the existing 8-inch CI pipe with a new 12-inch HDPE pipe. They utilized a 100-ton static system that could accomplish pulls in the range of 300-1,000 LF, depending on the actual conditions along the locations and positioning of the required machine and pipe pits in the best way to reduce environmental impacts.

Construction began in May 2018 and completed in November 2018. The construction included the installation and maintenance of an above ground temporary water system that Ted Berry Company constructed of HDPE pipe and installed in three phases ranging from 3,000 to 6,500 LF. Construction equipment would need to access the site through a series of private easements that were secured with local landowners and many spots along the site could not be accessed due to wetlands and stream crossings, making the installation of long pipe bursts desirable.

Hebron Water Company Superintendent Lew Williams oversaw construction of the project and was glad to announce at commissioning of the new pipeline, "This pipe will long outlive us all".

ABOUT THE AUTHOR:

***Matt Timberlake** is a Regional Vice President for the Ted Berry Company, A Vortex Company with over 25 years' experience with municipal and industrial pipeline, cleaning, inspection, and rehabilitation.*

More than two miles of new 12-inch HDPE DIPS SDR11 pipe installed

Ted Berry Company President Matt Timberlake at exit of another long pipe-bursting run

PROTECTING MARSHLANDS WATERWAYS & COASTLINE: EPOXY CIPP REHAB OF 18/21-INCH RCP INTERCEPTOR

Town of Wareham MA Plans to Use Trenchless Epoxy CIPP to Preserve Valuable Coastline Resources

By: Guy Campinha, Town of Wareham, MA

Wareham is a densely populated beachfront community with narrow streets

Vitally important that the marshes and waterways of the town are protected

Using an epoxy CIPP liner was beneficial in 2017

A beautiful community in Plymouth County, with 54 miles of sandy beach coastline, the Town of Wareham has 22,000 year- round residents, and doubles to 44,000 residents in the summer months. Wastewater averaging 1.56 MGD is directed to the Water Pollution Control Facility (WPCF) through a network of 70 miles of gravity pipe and 45 pump stations, where it is subjected to biological nutrient removal extended aeration process, and eventual water body discharge.

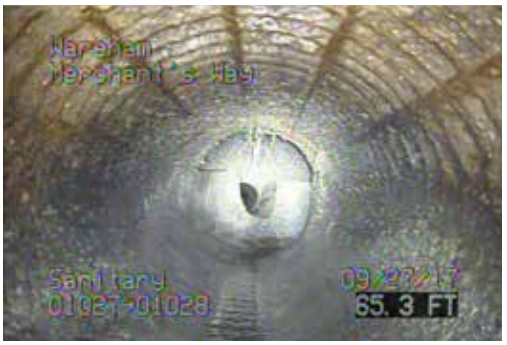
Recently, an 18/21-inch RCP interceptor which carries flow from the western side of town was discovered to have serious structural integrity issues along a 1.8 mile segment that runs through and around the marshes and water ways within the Town. The deteriorated length of RCP has visible spalling, deposited aggregate from infiltration, root infiltrations, and exposed structural reinforcement. The structural integrity of this length of interceptor is clearly weakened and in immediate need of repair. The manholes in the 1.8 mile run also show infiltration and structural compromise and need rehabilitation.

Much of Wareham's sewer network is 15-16 feet deep with a tidally influenced groundwater level of 6 to 8 feet deep and sandy soil with a high hydraulic conductivity. This makes the dewatering for necessary for open excavation sewer replacement work difficult and cost prohibitive. The location of the pipe in environmentally sensitive areas would make dig and replace a permitting challenge as well as a costly one. The issue has urgency because exfiltration would involve a costly cleanup and affect the flora/fauna of the marshland, damage the estuaries, and impair the shell fishing.

It is of vital importance that the marshlands and waterways of the Town are protected. The wildlife, and estuarine habitat, the commercial and recreational fishing, are worth preserving for the

Infiltration at joint

Roots at joint



Spalling concrete, exposed reinforcement

continued enjoyment of all Wareham residents and guests for generations to come. Also essential is reducing the impact of the repair work on local residents and minimizing disruption to their daily lives. Wareham is a very densely populated beachfront community with narrow streets, and the any underground construction work done requires a compact site footprint.

Trenchless technology has already proved to be beneficial to this sea side community. Wareham has familiarity with the efficacy and cost savings of using an epoxy CIPP liner to provide structural rehabilitation of gravity sewer pipe. During a very challenging job in 2017, a 1,600 LF 8-inch AC gravity main running at 17 feet below grade under the coastline near Swifts Beach was repaired using the trenchless epoxy CIPP method. Valuable experience was gained in using CIPP to reestablish a pipe's structural integrity when it is situated completely below a tidally fluctuating water table. (NASTT-NE Journal, Fall/2017)

Cured-In-Place Pipe (CIPP) has been widely used for wastewater sewers in the US since the 1980s and has been demonstrated to be safe and effective. However some types of CIPP may release chemical agents such as styrene utilized in the reaction process resulting in water contamination downstream of rehabilitated pipes or an off-gas emission to the air that create air pollution problems for workers and local residents. The low toxicity zero VOC epoxy CIPP products used in the Town's previous CIPP projects presented no residual odor on or near the site.

Accordingly, the Town of Wareham has again selected a low toxicity aquatic safe epoxy CIPP lining technology for this upcoming project. The epoxy resin is a zero VOC 100 percent solids, non-toxic, solvent free, laminar system certified to NSF Standard 61 and passing aquatic organisms toxicity testing. These epoxies are moisture insensitive with superior strength and chemical resistance properties.

Once the necessary permitting is in place, lining work is expected to begin in early March, with completion scheduled for end of April. Even with the knowledge gained from previous trenchless projects, it is anticipated the tidal influence and high water table will again present challenges during construction. Despite the known and unknown challenges that are ahead, trenchless technology will no doubt again prove to be beneficial to the beautiful seaside community of Wareham, helping preserve valuable coastline resources. A full report on this project will be published in the next Fall/2019 issue of the ***NASTT-NE NASTT-NE Northeast Journal of Trenchless Technology Practices…***

ABOUT THE AUTHOR:

Guy Campinha Sr. *is Director of Water Pollution Control for the Town of Wareham. He has spent the past 20 years managing Wastewater facilities and was also Past Chair of the Wareham Board of Health. Guy is a NASSCO: LACP, MACP, PACP certified Member, and is a Certified Grade 7 Wastewater Operator in Massachusetts. He is a currently serving member of the NASTT-NE Board of Directors.*

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