



# MID ATLANTIC JOURNAL OF TRENCHLESS TECHNOLOGY 2022

OFFICIAL PUBLICATION OF THE MID ATLANTIC SOCIETY FOR TRENCHLESS TECHNOLOGY

MASTT: A NON-PROFIT ORGANIZATION



***Atlantic City HDD - A Shore Thing!***  
***Improving Pipeline Technology for 20 Years***  
***Horizontal Hammer Boring Systems***  
***Baltimore Trenchless - Howard Street***

**8<sup>TH</sup> ANNUAL EDITION**



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Richard Thomasson  
MASTT Chair  
703.269.7070  
richard.thomasson68@gmail.com

Leonard Ingram  
Executive Director  
334.872.1012  
leonard@engconco.com

## PUBLISHER



662 Dudley Avenue  
Winnipeg, MB Canada  
R3M 1R8

## EDITORIAL

Andrew Pattison  
204.275.6946  
marcomap@shaw.ca

## ADVERTISING SALES

Bert Eastman  
204.997.6371  
bert@atobpublishing.com

Wayne Jury  
204.803.1300  
waynej@atobpublishing.com

## PRODUCTION TEAM

harper media  
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700 - 200 Main Street  
Winnipeg, MB  
R3C 1A8

## DIRECTOR

Aaron Harper  
204.318.1121 xt. 101  
aharper@harpermedia.ca

## LAYOUT & DESIGN

Joel Gunter  
204.318.1121 xt. 108  
joel@harpermedia.ca

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# MESSAGE FROM THE MASTT CHAIR

Richard Thomasson, P.E., MASTT Chair

**W**e are very pleased to produce our eighth publication of the Mid Atlantic Society for Trenchless Technology (MASTT) Journal. The MASTT was founded in 2004 as a Chapter of the North American Society for Trenchless Technology (NASTT) and serves the geographical region of Virginia, West Virginia, District of Columbia, Maryland, Delaware, Pennsylvania, and New Jersey. The region has a huge population and many large municipalities and also, a large industrial base. The infrastructure is very large for water, sewer, stormwater, gas and electric, which in many cases is older and deteriorating. There is an overwhelming need for replacement and rehabilitation of the infrastructure which drives the interest in Trenchless Technology.

There are also a lot of major academic institutions in the Mid Atlantic region which are heavily involved in research on Trenchless Technology. Being close to the nation's Capital, creates a high visibility on infrastructure funding and interest in new technologies which can make tight budgets be used more effectively. There are also major industry leading technology and service companies within the MASTT region. Also, there are major trade associations such as NASSCO, ASCE, NSF, NIST, PPI and others, who are essential in the infrastructure industry. Each has done a tremendous amount of work in asset management being used to manage the replacement and rehabilitation of all infrastructure in the region. Because of the above factors, MASTT is a valuable grassroots resource for education, training, specifications, governance, funding and promotion of the trenchless industry.

Both private and public infrastructure owners across the region have used the new service products and innovation for trenchless work. Educating and

introducing new trenchless technologies and services, MASTT has conducted 34 seminars throughout the Mid Atlantic region. These seminars have been very informative and have introduced Trenchless Technology to many people who were not aware of the information over the last 15 years. We are trying to incorporate some of the NASTT short courses into our seminar schedule. This year we had to cancel the two scheduled seminars due to the Covid virus.

We have an overwhelming opportunity and responsibility to bring the deteriorating infrastructure to an acceptable level of service for the huge populace that we serve. The infrastructure assets we are focusing on are generally out of sight and out of mind until a catastrophic failure occurs. A focus on asset management has started to address these assets in a structured and effective way. The major factors in asset management, such as condition assessment, risk management, safety, economic planning, and social factors flow seamlessly into trenchless technology as a major tool for accomplishing the desired outcomes. Environmental, social and economic factors are all addressed and greatly enhanced through the application of trenchless technology. Focus on performance, sustainability, and resiliency of the infrastructure systems to provide a level of service necessary to maintain a healthy nation are primary drivers in our vision for MASTT.

MASTT can be an integral part of the education of providers and users of the infrastructure which is critical to continued viability in the region. We need your participation and collaboration to be able to provide the resources to accomplish this vision. Join in active membership in MASTT and be a part

***“THERE IS AN  
OVERWHELMING  
NEED FOR  
REPLACEMENT AND  
REHABILITATION OF  
INFRASTRUCTURE.”***

of this critical work to enhance the infrastructure in our region.

This has been a very tumultuous and challenging year for everyone. The Covid virus has affected everyone in some way. We need to keep everyone in our prayers as we continue to endure the devastation that occurs in everyone's life while trying to be safe and also serve others in any way we can. Although the trenchless work has been affected to some degree, the utility work has been deemed essential and work has continued although affected in various ways. We have rebounded close to a new normal and the trenchless work has picked up. Stay strong, healthy and persevere for the future in our new normal operation.

Richard Thomasson  
Chair, MASTT



MASTT SITE





# GREETINGS FROM THE MASTT EXECUTIVE DIRECTOR

Leonard Ingram, Sr., PWAM Executive Director, MASTT

I am the Executive Director for the Mid Atlantic (MASTT), Midwest (MSTT) and Southeast (SESTT) Society for Trenchless Technology. Coronavirus 19 has been a large factor in the last three years when trying to organize and conduct one of our “Trenchless Technology, SSES and Buried Asset Management” seminars.

Municipal guest presenters, municipal attendees and others, sometimes, have not been allowed to attend and hotels have had layoffs and are now short of staff. I never thought I would call several hotels for a seminar venue and they would not return my call. Some are busy and some just do not have the staff to return the calls or no staff to support the seminar for a day. It is not like it used to be. But, when I do get someone in the sales and finalize a deal, I have been getting

better deals for the seminars. And this is not to mention the airline problems we have. Hotel and airline problems have gotten better this year. So far this year, I have conducted successful seminars in Nashville, Cincinnati, Baltimore and I am currently planning a seminar for Atlantic City. The Baltimore seminar had Mr. Timothy Wolf, P.E., BCEE, Chief, Office of Engineering & Construction, Bureau of Water and Wastewater, Baltimore City Department of Public Works as the Guest Presenter (see pages 36-37). His presentation was “Trenchless Technology in Baltimore”. The seminar offered 5 PDHs and ASCE Maryland Section was the co-sponsor. The seminar was conducted at the Hyatt Place Baltimore Inner Harbor, Baltimore MD. There was a lot of networking and learning!

The Atlantic City seminar is planned for Wednesday, September 14, 2022 at the

## “THANKS FOR YOUR SUPPORT”

Claridge Hotel Atlantic City. I have Mr. Matthew DeNafo, P.E., Vice President, Centralized Maintenance and Asset Management and Mr. John Conover, P.E., Deputy Chief Engineer as the Guest Presenters with the presentation “Trenchless Technology at Atlantic County Utility Authority”. Plan to attend to enjoy the networking and learning and/or to receive the PDHs.

Leonard E. Ingram, Sr., PWAM  
Executive Director, MASTT, MSTT & SESTT

## PLEASE REVIEW THE MASTT, MSTT AND SESTT 2022 PROPOSED SEMINAR AND JOURNAL PUBLICATION SCHEDULE:

SOCIETY	LOCATION/PUBLISH	PROPOSED DATE	STATUS
SESTT SEMINAR	NASHVILLE TN	MAR 23, 2022 - WED	CONDUCTED
MSTT SEMINAR	CINCINNATI OH	MAY 17, 2022 - TUE	CONDUCTED
MASTT SEMINAR	BALTIMORE MD	JUL 20, 2022 - WED	CONDUCTED
MASTT JOURNAL	PUBLISH DATE (DEADLINE 08/5/2022)	SEP 2, 2022 - FRI	PUBLISHED
MASTT SEMINAR	ATLANTIC CITY NJ	SEP 14, 2022 - WED	ORGANIZING
MSTT JOURNAL	PUBLISH DATE (DEADLINE 09/09/22)	SEP 30, 2022 - FRI	ORGANIZING
MSTT SEMINAR	ST. LOUIS MO	OCT 26, 2022 - WED	PROPOSED
SESTT JOURNAL	PUBLISH DATE (DEADLINE 10/28/22)	NOV 18, 2022 - FRI	PROPOSED
SESTT SEMINAR	BATON ROUGE LA	DEC 7, 2022 - WED	PROPOSED

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# MESSAGE FROM NASTT CHAIR

Alan Goodman, NASTT Chair

## In Person Events are Back and Better than Ever!

It feels like we are embarking on a fresh start now that restrictions are lifting across North America. We are excited as we look forward to the future! We're riding high on the success of the NASTT 2022 No-Dig Show held earlier this year in Minneapolis. We hosted over 1,700 attendees and more sponsors than ever before. The trenchless industry is ready to be back to in person with networking and education leading the way.

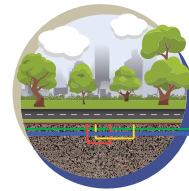
In the coming months we have many events planned to bring the underground infrastructure community together. This fall we hope you will join us in Toronto for the 2022 No-Dig North conference, October 17-19. No-Dig North is hosted by the Canadian Chapters of NASTT and offers two full days of training, education and networking. This is a must-attend event for trenchless training and networking in Canada. Visit [www.nodignorth.ca](http://www.nodignorth.ca) for details!

Be sure to mark your calendars and save the date for the NASTT 2023 No-Dig Show in Portland, OR, April 30 – May 4. The city of Portland is a perfect location for our industry to come together to celebrate and educate with the theme, *Green Above, Green Below*. It is important that our

***“RIDING HIGH ON  
THE SUCCESS OF  
THE NASTT 2022  
NO-DIG SHOW!”***

industry is a steward of our precious natural resources, and we welcome the opportunity to provide a forum to learn about the latest in innovative trenchless products and services. Learn more at [www.nastt.org/no-dig-show](http://www.nastt.org/no-dig-show).

If you or your company has attended a NASTT Conference (National or Regional) you may leave that conference wondering how you could get more involved. I ask that you consider getting engaged in one of the many NASTT committees that focus on wide variety of topics. Everything from Publications Committee, Good Practice Course Committee, No Dig Planning Committee with many others for you to consider. With education as our goal and striving to provide valuable, accessible learning tools to our community, one



**GREEN ABOVE.  
GREEN BELOW.**

of the things of which we are most proud at NASTT is that we have been able to grow. In keeping with our mission of education and training, we are offering our Good Practices Courses in a live, virtual format throughout the year. For the latest information on upcoming events, visit our website at: [www.nastt.org/training/events](http://www.nastt.org/training/events).

For more information on our organization, committees, and member benefits, visit our website at [nastt.org](http://nastt.org) and please feel free to contact us at [info@nastt.org](mailto:info@nastt.org).

We look forward to seeing you at a regional or national conference or training event soon!

*Alan Goodman*

NASTT Chair





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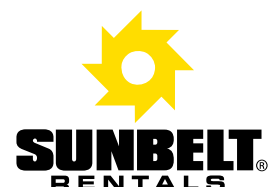
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# 2022-2023 MASTT BOARD OF DIRECTORS



## **Richard Thomasson – Chair**

Richard O. Thomasson has over 52 years of experience working in the water and wastewater field. He has been closely involved with Trenchless Technology for nearly his entire career. While at the Washington Suburban Sanitary Commission he directed many uses of new trenchless technologies, retiring after

31 years as the Director of Construction. He has worked with Parsons Brinckerhoff for 8 years, and Arcadis for the past 12 years, continuing his involvement in numerous trenchless projects. Presently he is a Senior Project Manager with EBA Engineering. Richard has a B.Sc. in Civil Engineering from Virginia Tech, a M.Sc. in Civil Engineering and a MPP in Public Affairs from the University of Maryland. He is a licensed P.E. in Virginia, Georgia and Maryland. As a Founding Director and the very first Chair of the North American Society for Trenchless Technology (NASTT), Richard believes fully operational water, wastewater systems, gas service, electric service and storm water systems are crucial assets for a healthy growing nation. In 2016 Richard was inducted into the NASTT Hall of Fame.



## **Dennis Walsh – Vice Chair**

Dennis M. Walsh, P.E. is a Senior Project Manager – Horizontal Directional Drilling for Public Service Electric & Gas in New Jersey. Dennis is a 1972 graduate of the University Of Dayton, Ohio with a B.S. in Civil Engineering and a 2002 graduate of the Polytechnic University of New York with

a M.S. in Technology. He retired from KeySpan Energy Company in 2005 after a 28 year career in the gas utility field with a background in engineering, operations, construction, Quality Assurance and HVAC. He led KeySpan's efforts to expand the use of trenchless technology in the early 1990's to decrease its main and service installation costs. Prior to joining PSE&G, he was a consulting engineer for various consultants in the natural gas industry. Dennis is a past Board member for NASTT, as well as a Board member for the NASTT Mid-Atlantic Chapter and on the Annual No-Dig Committee. He has designed numerous HDD installations for various utilities; including a 1,800 foot HDD for a 30 inch gas main under a tidal basin in Brooklyn, NY; a 2,000 foot 12 inch HDD under an environmental sound in south NJ; a 400 foot long Jack & Bore installation in Newark, NJ; and a 1900 foot HDD of a 30 inch steel pipeline for a 69kV electric system. Dennis is a licensed Professional Engineer in New Jersey. When he is not involved in trenchless projects, he enjoys traveling, and trying to play golf.



## **John Seibert – Secretary**

John Seibert, E.I.T. is the Director of Oil & Gas at Aaron Enterprises, Inc. John holds a B.S. in Petroleum and Natural Gas Engineering from Penn State. He was hired directly out of school by Aaron Enterprises, Inc. as an entry level engineer and has been with the company for 7 years. Over his time at Aaron, he has gained experiences in jack and bore, pipe

ramming, guided auger boring, microtunneling, TBM, pipe jacking and tunneling, pit excavations, shaft excavations, slip lining, pipe rehabilitation, grouting, dewatering and large HDD work which is his primary focus. He has been involved in over 100 large HDD installs to date along with all other forms of trenchless installation. In addition, he is well versed in design work having worked on 35 designs, many of which Aaron has installed. He has also authored and co-authored two papers on trenchless techniques for ACSE. His main goal is to continue to grow the company and provide world class trenchless services. He enjoys golf, working out and hanging out with friends outside of work.



## **Mike Hoffmaster – Treasurer**

Mike Hoffmaster is employed by OBIC as Director of National Business Development. OBIC is a manufacturer of protective coatings and grouts for wastewater, potable water and industrial environments. His responsibilities include educating municipalities and engineering firms on the benefits of OBIC products their products, as well as increasing

OBIC's market share across North America. Another key role is supporting their network of installers and recruiting new companies to install the OBIC products.

He earned a bachelor of science degree from Shepherd University and has over 35 years of experience in the construction industry. For the past 12 years his focus has been in trenchless construction and the previous 24 years was spent working in a variety of roles, for precast concrete company.

Mike has played a vital role in obtaining product approvals and specification writing for products he has been associated with. In addition to serving as Treasurer for the MASTT, he is an active member of Chesapeake Water Environmental Association (CWEA), Virginia Water Environmental Association (VWEA), Maryland Rural Water Association (MRWA), Virginia Rural Water Association (VRWA), Pennsylvania Rural Water Association (PRWA) and Water Environment Federation (WEF) and a member of NASSCO. The CWEA awarded him the Golden Manhole Award for his contributions to the organization. In his spare time Mike enjoys cooking, photography, traveling and volunteering with the Special Olympics - which is something he has been involved with for over 30 years.



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EBA Engineering, Inc.  
richard.thomasson68@gmail.com

**Vice Chair – Dennis Walsh**

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dennis.walsh@pseg.com

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Aaron Enterprises  
jseibert@aaronenterprises.com

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Vortex Companies  
mhoffmaster@vortexcompanies.com

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gucunski@soe.rutgers.edu

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george.gutierrez@nothreastemsco.com

**Scott Naiva**

Geopolymers & Concrete Cloth  
snaiva@CS-NRI.com

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Plastics Pipe Institute  
crubeiz@plasticpipe.org

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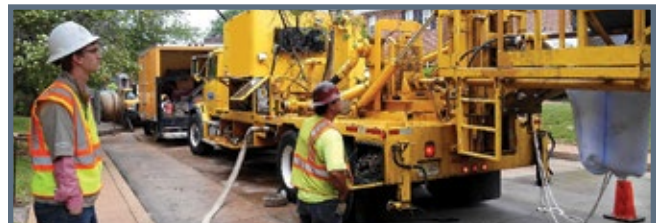
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# 2022 SEMINAR & JOURNAL SCHEDULE

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**MSTT - MIDWEST SOCIETY FOR TRENCHLESS TECHNOLOGY**  
**SESTT - SOUTHEAST SOCIETY FOR TRENCHLESS TECHNOLOGY**

SOCIETY	PROPOSED DATE	LOCATION	STATUS
SESTT SEMINAR	MAR 23, 2022 - WED	NASHVILLE TN	CONDUCTED
MSTT SEMINAR	MAY 17, 2022 - TUES	CINCINNATI OH	CONDUCTED
MASTT SEMINAR	JUL 20, 2022 - WED	BALTIMORE MD	CONDUCTED
MASTT JOURNAL	SEP 2, 2022	PUBLISH DATE (DEADLINE (08/05/22))	CONDUCTED
MASTT SEMINAR	SEP 14, 2022 - WED	ATLANTIC CITY NJ	ORGANIZING
MSTT JOURNAL	SEP 30, 2022	PUBLISH DATE (DEADLINE (09/09/22))	ORGANIZING
MSTT SEMINAR	OCT 26, 2022 - WED	ST. LOUIS MO	PROPOSED
SESTT JOURNAL	NOV 18, 2022	PUBLISH DATE (DEADLINE (10/28/22))	PROPOSED
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Or call (204) 275-6946 to advertise in the journal or discuss an article for the journal.

Our 119 "Trenchless Technology, SSES and Buried Asset Management" seminars since 2001 have offered a lot of information, a lot of networking and a lot of learning. The journal and webinar are a great source for advertising, learning and teaching.



For registration and updated information on the 2022 "Trenchless Technology, SSES and Buried Asset Management" Seminars and Trenchless Journals, please visit:

Mid Atlantic: [www.mastt.org](http://www.mastt.org) | Midwest: [www.mstt.org](http://www.mstt.org) | Southeast: [www.sestt.org](http://www.sestt.org)



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# A SHORE THING!

## Inspiration for Monopoly, Atlantic City, Not Playing Games with Wastewater System: Sand Infiltration and Failures Force Major Pipe Replacement with HDPE

By: Camille George Rubeiz, P.E., F. ASCE, Plastics Pipe Institute, Inc. (PPI)

**B**eautiful beaches punctuate the New Jersey coastline, but while sand is welcomed and appreciated along the ocean's edge, it can wreak havoc on the pipes that comprise a community's wastewater collection system. The Atlantic County Utilities Authority (ACUA) struggled with this firsthand when a critical force main line connecting three shoreline communities to the wastewater treatment plant began to fail.

The original 30-inch-diameter, welded-steel force main that conveys wastewater from the towns of Ventnor, Longport, and Margate, a region referred to as Down Beach, was installed in the mid-1970s. It extends north from the Down Beach area toward the treatment facility. Along the way, it passes through a former municipal airstrip, Bader Field, under a navigable waterway called Beach Thorofare, and beneath both the Atlantic City Expressway and the New Jersey Transit train lines that run between Atlantic City and Philadelphia.

By the 1990s, the steel pipe began exhibiting signs of deterioration due to an excess of sand and grit in the system. "We're a beach community," said Tom Ganard, ACUA's chief engineer, "and we get a lot of beach sand coming into our system through various means — street manholes, infiltration, people coming off the beach and taking showers — and this grit runs through the line. It was literally wearing a groove in the bottom of the steel pipe," he explained.

After a series of failures in the line, the Authority sliplined a portion of the steel main coming from the Down Beach area

up to Bader Field. But in 2017, the worst-case scenario unfolded. "I can remember exactly where I was on September 23, 2017, when I got the call that you never want to get," said Joe Pantalone, vice president of ACUA's Wastewater Division. "That was the first main break of Bader field."

The ACUA acted quickly to bypass the line but it was only a temporary solution. The Authority knew it was on borrowed time and began the design and permitting process for the total replacement of a mile and half of force main. "Once we knew that we had problems in that one area, we

immediately decided to replace the entire Bader Field main," said Pantalone.

ACUA's troubles weren't over just yet. While in the design and permitting process, another catastrophic failure occurred in 2019, just south of the previous break. This kicked the project into overdrive, and the ACUA secured advanced permission to move forward with the total replacement it had already been planning.

The \$8 million replacement project was divided into two phases: the first was the replacement of the Bader Field



*The 30-inch diameter HDPE PE 4710 pipe being pulled backward in the HDD process. (PHOTO COURTESY OF ACUA)*



main line using a standard open-cut construction. This phase was completed in 2020 by Arthur R. Henry Inc. (Egg Harbor Township, NJ)

The second phase, which was not in failure mode but was part of ACUA's master plan, is the portion running under Beach Thorofare, the Atlantic City Expressway, and the New Jersey Transit lines. General contractor C. Abbonizio Contractors (Sewell, NJ) used horizontal directional drilling (HDD) for this section, including the formidable 1,500-linear-foot underwater segment.

For the HDD, the Abbonizio crew did a smaller 8-inch-diameter pilot hole drilled to establish the bore path direction. At the point where it comes out of the ground, they reattached a larger-diameter bore — in this case, a 42-inch drill — and then pulled it back through the same path, making the hole the size needed for the HDPE pipe replacement. Then, the new pipeline was pulled through the opening.

C. Abbonizio subcontracted the horizontal drilling portion to Michels Corporation, a family owned and operated energy and infrastructure construction company headquartered in Brownsville, Wis. The drill rig was a Uni 250x400 with a pulling force capacity of 250,000 pounds and a torque capacity of 40,000 ft-lbs.

The directional boring was completed in June 2021 and only took a few days. The accuracy of the drill was nothing short of amazing. "They literally hit the survey stake that was more than a thousand feet away that they had put in the ground at the exit point," said Ganard. "Now, the pipe just needs to be connected to the current system on both sides.

One of the benefits of using directional drilling is that it minimizes disruption to not only marine activity on the waterway but also the channel bed, water, and aquatic plants and animals in the bay. "The whole project is working in an environmentally sensitive area," Ganard noted. "So, the fact that we could do the directional drilling really saved a lot of environmental disturbance that could be related to a construction project." After installation, the pipe was approximately 80 feet below the Beach Thorofare.

"The entire process amazed me," said Nicholas Listner, with the engineering

***"THE FACT THAT WE COULD DO THE DIRECTIONAL DRILLING REALLY SAVED A LOT OF ENVIRONMENTAL DISTURBANCE THAT COULD BE RELATED TO A CONSTRUCTION PROJECT."***

**- TOM GANARD, CHIEF ENGINEER, ACUA**



*The 30-inch diameter HDPE PE 4710 pipe enters the HDD path to go under the Beach Thorofare waterway. (PHOTO COURTESY OF ACUA)*



*The HDD path for the HDPE pipe under the Atlantic City Beach Thorofare waterway. (PHOTO COURTESY OF ACUA)*

***“WE REALLY WENT THE EXTRA MILE TO  
CARRY OUT WHAT WE ARE PLEDGED TO DO BY  
REPLACING THE ENTIRE MAIN.”***

**- JOE PANTALONE, VICE PRESIDENT, WASTEWATER DIVISION, ACUA**

department of C. Abbonizio. “More specifically, watching them track the pipe as it was drilled was definitely the most interesting part for me. There was a team guiding the drill head from an office. They knew where the pipe was at all time — both the location and the elevation.”

For both phases of the Down Beach force main replacement project, high-density polyethylene (HDPE) pipe was the material of choice. The 30-inch HDPE DIPS has an outside diameter of 32 inches.

“We knew HDPE was a good solution for [this project] where we’re running at 60 psi,” Ganard said. “We had used it approximately 20 years earlier in another portion of our system, and when we inspected it, we did not see any signs of wear. We were comfortable that this pipe would have much better characteristics for what we’d be putting through it.”

According to the Plastics Pipe Institute, Inc. (PPI), the pipe can be used in methods of underground installation such as HDD or open cut. “A recent industry survey showed that HDPE pipe continues to be the most common type of pipe used in trenchless installations,” offered Camille George Rubeiz, P.E., F. ASCE, senior director of engineering for the Municipal and Industrial Division of PPI and is also the co-chair of the HDPE Municipal Advisory Board. “Properly designed, installed and fused, HDPE has a 100-year design life, zero allowable leakage, largest internal diameter and is the best water piping solution for open cut and trenchless installations. Plus, it has a larger flow capacity per PPIPACe.com, C coefficient of 150 -- up to 50 percent higher C than others, corrosion and tuberculation resistance, lowest initial cost and lowest life cycle cost.

“The prevention of infiltration was one of the key benefits of the pipe here in Atlantic City. But a critical factor was also taken care of and that was because of the HDPE pipe’s inherent resistance to salt water which eats away at other types of pipe. Plus, it has resistance to water hammer, fatigue, ground movements, freezing temperatures and earthquakes.” PPI is the major North America trade association representing the plastic pipe industry.

According to Listner, several HDPE pipe companies were used on this project. The pipe was produced by Performance Pipe (Plano, TX), a division of Chevron Phillips Chemical Company LP. A McElroy Manufacturing, Inc. (Tulsa, OK) Trackstar 900i butt fusion machine was used to join the straight pipe ends. “This machine basically melts the pipe together,” explained Listner.

The 45- and 11.5-degree bends were manufactured by GF Central Plastics, LLC. (Shawnee, Okla.). Electrofusion couplings were produced by Integrity Fusion Products, Inc. (Peachtree City, GA) “These are an alternative method of joining two pipes,” said Listner. “The pipe joints fit inside of this coupling and again the materials are heated to create a water-tight seal between the different products. We use these couplings in tight or uneven spaces where a butt fusion machine cannot be used.” Performance Pipe, McElroy, GF Central Plastics and Integrity Fusion are PPI member companies.

When it comes to pipe material, HDPE is ACUA’s preference. “Based on our history with steel pipe, we won’t be using that ever again,” noted Ganard. “But that’s old technology anyway. We’ve had a lot of success with the HDPE pipe, so it’s our preferred method for force main replacement.”

The Down Beach force main replacement project is a massive undertaking that will resolve decades of challenges with a deteriorating steel pipeline. But for ACUA, it’s much more than that. “No one pays attention to the Wastewater Division until there is a failure,” said Pantalone. “This shows the community that we are diligent in our reinvestment into our infrastructure, we

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stopped the bleeding as quickly as we could, and we didn't stop there. We really went the extra mile to carry out what we are pledged to do by replacing the entire main."

Additional information can be found at the Plastics Pipe Institute's Municipal & Industrial Division's website: [www.plasticpipe.org/municipalindustrial](http://www.plasticpipe.org/municipalindustrial)

#### ABOUT PPI:



**The Plastics Pipe Institute, Inc. (PPI)** is the major North American trade association

representing the plastic pipe industry and is dedicated to promoting plastic as the materials of choice for pipe and conduit applications. PPI is the premier technical, engineering and industry knowledge resource publishing data for use in the development and design of plastic pipe and conduit systems. Additionally, PPI collaborates with industry organizations that set standards for manufacturing practices and installation methods.



Heat fusing the sections of HDPE pipe was done and the resulting monolithic pipeline was staged along a runway at the former Bader airfield, ready for the 1,500-foot HDD pull 80 feet under the Beach Thorofare waterway. (PHOTO COURTESY OF ACUA)



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# PROVING AND IMPROVING PIPELINE TECHNOLOGY FOR TWENTY YEARS

## Progressive Pipeline Management CEO Dave Wickersham Reflects on the Development of Trenchless Technology for Gas Pipelines



*Since 2002, NASTT member Progressive Pipeline Management (PPM), based in Wenonah NJ, has been renewing natural gas pipelines from 12 to 42 inches along highways, bridges, railroad lines and urban environments. The Starline® Cured-in-place-lining trenchless technology is a proven, cost-effective method that extends the life of an existing pipeline by over 100 years. As they celebrate twenty years, Dave Wickersham, founder and CEO, reflected on the decisions that shaped the first twenty years and what he sees ahead in the gas pipeline renewal landscape.*

### A CALCULATED GAMBLE ON AGING GAS MAINS

Over twenty years ago, I was asked to help on a gas pipeline project in Philadelphia where the Contractor, Exelon Infrastructure, needed help with removing oil and potential PCBs from the line. They need to remove the oil before they could “line” the 20-inch natural gas main. This was the very first time I witnessed the Starline® Cured-In-Place-Lining (CIPL) technology. A year later, Exelon was looking for an exit in the Starline license and I was immediately interested. Investing in it was a gamble, although calculated. Would the industry adopt the lining technology and capitalize on its ability to repair aging cast-iron gas mains?

We secured an exclusive license for North America for Starline® from the inventor and patent holder, Karl Weiss of Berlin, Germany and began PPM in August of 2002. The first 10 years focused on understanding the technology, testing and fine-tuning how to utilize the equipment and approach projects. Our customers - PSE&G, National Grid, Con Edison and PECO Energy in Philadelphia, were willing to come with us. Our core team spent hundreds of hours understanding the capabilities, the limitations, the opportunities and use cases for utilities. The learning curve and drive to both prove the technology and improve it kicked in early and remains a cornerstone of our work. The gamble paid

**“REHABILITATING A CAST-IRON GAS PIPELINE MINIMIZES OR ELIMINATES GREENHOUSE GAS EMISSIONS WHILE FIXING LEAKS.”**

off, slowly. Years of testing eventually proved to have very positive results.

### R&D & INDUSTRY TESTING

Our team collaborated with industry experts at leading utilities focused on specialized gas pipeline issues. The natural gas industry has invested over \$15 million in testing of the Starline liner and its capabilities at Cornell University, Battelle Labs with research partners including the Gas Technology Institute, NYSEARCH and PHMSA. Multi-year research projects were co-funded by US DOT & PHMSA. Research & Development Program: Technology Transfer, Demonstrations and Post-Mortem Testing of Cast Iron and Steel Pipe Lined with Cured in-Place Pipe Liners.

With additional extensive R&D and independent testing on rehabilitated pipe with the Starline technology, CIPL has a confirmed service life of 100-plus years. At first, CIPL projects focused on smaller cast iron pipelines such as 12-inch diameter and less. We then moved up to 16-inch and 20-inch jobs. Starline® liner was developed specifically for lining high-pressure gas pipes. It is capable of installation applications at a maximum allowable operating pressure (MAOP) of 99 PSI, 180 PSI and 350 PSI. This culminated with meeting two ASTM Standards for lining gas mains and services. Namely F2207-02 and F2207-06.



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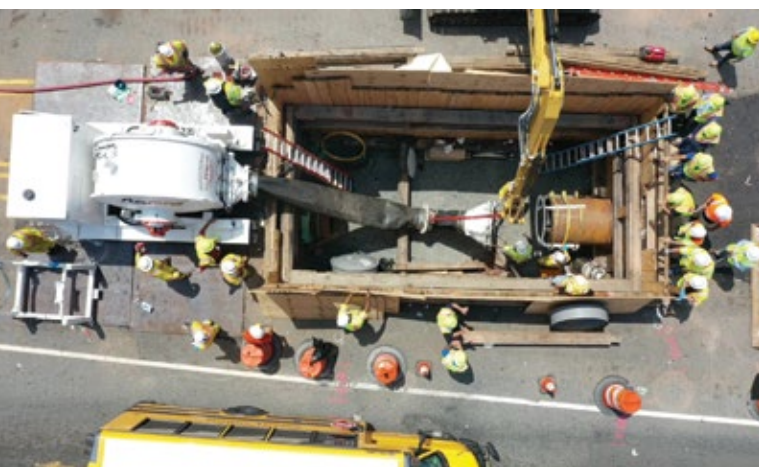
***“THE BEAUTY OF CIPL IS THAT IT NOT ONLY ADDRESSES THE LEAKS THAT OUR CUSTOMERS HAVE IDENTIFIED, BUT ELIMINATES THE ONES THAT HAVE NOT BEEN IDENTIFIED.”***

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## **LARGE DIAMETERS & BREAKING WORLD RECORDS**

The final Cornell studies with the DOT in 2014 and 2015 supported the 100+ year service life of an active liner. That endorsement opened PPM to lining projects that were much larger in diameter. After lining a 30-inch gas main, we secured the first world record lining project of a 36-inch cast iron gas main in 2017 with Public Service Electric & Gas (PSE&G) in South Orange, New Jersey. See the final project documents here. Research & Development Program: Technology Transfer, Demonstrations and Post-Mortem Testing of Cast Iron and Steel Pipe Lined with Cured in-Place Pipe Liners (<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=502>)

Two years later, again with PSE&G in East Orange, N.J. we crushed our own world record for the largest size natural gas pipe to be rehabilitated with Starline liner. The 42-inch diameter cast iron gas main is in a highly congested area with multiple freeways, underpasses and a hospital. The gas line travels 80 feet directly down an embankment and then crosses under a major highway and back up the other side to street level.



*Overhead view of the 42-inch drum, pit and transfer hose*

There was no viable alternative for renewing these gas mains. In urban, historic and high-traffic areas where PPM is called in to solve a problem, the cost and disruption would be astronomical to dig up the old pipe and lay new pipe. To replace this section of pipe conventionally using open cut construction, would have cost millions of dollars and caused significant headaches and disruption.

## **SUPER-SIZED CHALLENGES**

The move to larger-diameter pipes required an entirely different mindset and new advancements. Once the excavation holes are dug, there are four stages of a lining project. The inspection of the pipeline is done by CCTV. Then the lines have to be cleaned and prepared to be smooth and free of dust and grit. The GMZ's Guzzler vacuum trucks have a throughput of 5,000 CFM (cubic feet per minute.) To scale up, we invested in three trailer-mounted dust-collection machines from Rapid Prep with a throughput of 25,000 CFM. The dust collectors offer 5X the capacity for the same footprint.

Lining and curing phases use a conversion drum developed with Karl Weiss GMBH in Germany, which owns the patent for Starline in Europe. Wetting out the liner involves mixing two-part chemicals. The mixed resin goes into the open end of the liner and spreads out through its full length by rollers while being pulled onto the pipe inversion drum. To handle the large diameter liners and be mobile enough to manage getting around city streets and intersections like the ones in New York City, we designed a mega sized drum.

## **SHIFT FROM QUICK FIX TO LONG TERM STRATEGY**

Lining has become a more accepted, day-to-day solution than just a one-off bridge crossing or something that's an emerging tech. It used to be a stop-gap, quick-response, band-aid fix for a specific situation like a bridge, a historic block or train crossing. We'd get the call from one of our gas clients, 'Hey, I've got 1,000 feet on this corner, give me a price, give me a proposal, come do it when you can.'

On the engineering side and planning, gas companies are looking at lining as part of their long-term strategy to manage leaking infrastructure. The cost savings with this technology compared to traditional replacement where you tear up a street and "rip and replace" is significant. Most of the big leaks and gas needs are in inner cities in the Northeast and metropolitan areas such as Chicago. They have limited resources which are getting more and more squeezed by inflation, price increases and budget cuts. Raw material availability is unpredictable.



*Super-sized drum for large diameter lining*

Price increases, inflation, choked shipping lines and supply chains are conditions outside of our control.

To mitigate that, we're shifting to a longer contractual arrangement with our clients to plan ahead for lining projects over the course of three years. Investing in the raw material and the lining material now allow them to have the goods in the country ready to roll. Otherwise, they are victims of erratic pricing and an unpredictable supply chain. We are seeing more long term planning and execution. For National Grid, one of our long-term partners, we are doing rehabilitation projects "Turn-Key", with PPM engineering, a contractor partner for the excavation and pipework, and PPM lining as an all-in package. This has streamlined the process and costs for the Utility, and we see this as an opportunity to use this model with our other Clients.



*Lining project in Chicago for 20-inch cast iron pipe dated 1861*

## EPA PIPES ACT REDUCING METHANE EMISSIONS

Important positive shifts are happening as the industry is serious about eliminating hazardous leaks and reducing greenhouse gas emissions. The PHMSA Pipeline and

Hazardous Materials Safety PIPES Act of 2020 came means tighter regulations on leaking pipes. Pipeline operators need to address leaks and releases of gas as well as address replacement or remediation of lines known to leak. Lining is a better and more cost effective way to fix leaks and includes a hundred year capitalization that goes onto the books as assets. Rehabilitating a cast-iron gas pipeline minimizes or eliminates greenhouse gas emissions while fixing leaks. The beauty of CIPL is that it not only addresses the leaks that our customers have identified, but eliminates the ones that have not been identified.

## TESTING HYDROGEN BLEND TO NATURAL GAS PIPELINES

Testing and R&D is underway to look at the effects of transporting natural gas and hydrogen blends in the same pipeline. AGA and DOT have work groups sponsored by PHMSA that include testing lining as a solution for hydrogen blend and transportation. The BTU value between natural gas and hydrogen is very similar. It could reduce and make the transportation of natural gas safer, more efficient and greener. Part of the testing will be what happens to a gas pipeline that has already been lined with Starline. We feel good about the capability of the liner to withstand hydrogen gas. The liner composition could be changed if needed. We are involved with testing this year to address if a lined pipe has more resistance to leaking hydrogen than a normal pipe, and the level of hydrogen/gas blend the liner can withstand.

## CONTINUOUS FINE TUNING – THE SMART BOX!

The first twenty years brought many changes, but our focus stays the same. We challenge ourselves every day to find ways to line faster, safer and more cost effectively. One aspect is to reduce project costs for our crews as well as the Utility crews. During the lining project gas is off line. To help us move towards that goal, we've developed a Wi-Fi system that allows us to remotely monitor pressure regulation during the curing of the liner. When we line a gas pipe, we monitor the curing, look at the pressure curing gauges and chart recorder in the hole. The old way was going back out for 2 hours of work with full crews to look at something that we typically know is fine. We do this for each day the liner cures, which may be 1 to 3 days or more depending on ambient temperature.

The "Smart Box" monitors the pressure of the line in real-time. Once we're in the curing process, we can remotely monitor the pressure in that line remotely. We can monitor pressure loss, temperature loss and can see the correlation between increases in temperature and decrease in temperature. It saves the client money, saves us money and time, and delivers better data. There are alarms and safeguards in place where we get a 9-1-1 code and an alert in the event of any anomalies. We are working closely with Honeywell and Verizon on the continued development of this powerful cost saving and data preservation tool.



## MANAGING GROWTH AND RETAINING TALENT

Our company has lined over a million feet of pipeline— around 200 miles – of gas pipelines in 18 different states. Our Clients continue to see the benefits of the technology that PPM offers and our work also grows within each Client. These are pressure pipelines and predominantly natural gas both cast iron and steel. The growth will continue, we just signed a 10-year exclusive license renewal with Karl Weiss and re-invested more than \$3m in capital equipment including two new CIPL pressure drums and replacing 70 percent of our fleet.

We have a strong and trusted team who have been with me all the way. These are folks who had kids after they started working at PPM (myself included!); then they were buying houses or moving to better homes to provide for their growing families. Now, their kids are going to college and they have maintained that PPM drive to continue to grow and achieve. Our employee retention remains very high, even throughout the pandemic. We are very proud of this achievement. It's a unique culture that we have fostered over the last 20 years and built a brand that our team and our clients are very proud of.

Finally, I would be remiss to not mention and remember Johnny Nelson, Ernest Woods, Phil Hoffer and Jean Rivard. Each played a critical role in our growth and development over the years and all left us much too soon. They remain a strong part of our PPM Family today and are with us in spirit on every project. God Speed boys. #PPMSTRONG. ✚



PPM has a strong and trusted team that maintains the PPM drive to grow and achieve. #PPMSTRONG!



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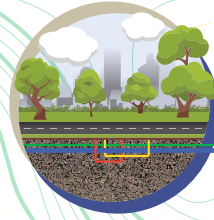
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*The No-Dig Show is owned by the North American Society for Trenchless Technology (NASTT), a not-for-profit educational and technical society established in 1990 to promote trenchless technology for the public benefit. For more information about NASTT, visit our website at [nastt.org](http://nastt.org).*

# NO MAN'S LAND: CROSSING THE SAVANNAH RIVER

By: Tyler Price, Underground Magnetics



**With a few techniques borrowed from oil diggers, Martin Cherrington may very well be the first contractor to bore under a river, and he did so without any electronic guidance.**

Cherrington and his crew did the unthinkable when they crossed the Pajaro River, drilling approximately 500 ft in one month. Jobs such as this paved the way for generations of HDD contractors to come. Fortunately, boring under a river is no longer considered “no man's land” and the introduction of electronic guidance systems like HDD locators as well as advancements in drilling equipment have made jobs like this more practical and efficient.

In July of this year, Sirman's Underground, out of Homerville, Georgia, was contracted to bore approximately 1800 ft across the Savannah River. Due to the reconstruction of the Houlihan Bridge in Port Wentworth, a new fiber line was required and going under the river was the best option. Faron, of Sirmans Underground, chose to use a combination of the Ditch Witch JT40 and the Underground Magnetics Mag 9 locating system paired with the Echo 90 transmitter to tackle the project. With that, they were able to

locate to depths of 65 ft, while also using the Underground Magnetics' “drill-to” function to track and guide the drill head from the receiver 90 ft out in front of the head.

Coupled with the expertise of the Sirmans crew, the Mag 9 locating system played a pivotal role in ensuring the accuracy and completion of this project. It enabled them to not only locate, but also adjust as needed to ensure a straight and efficient bore path. Trusting the capabilities of your equipment is one of the key components when considering taking on a project like this. While accuracy is a requirement, efficiency is what enables your business and the horizontal directional drilling industry as a whole, to grow.

With today's advancements, Sirmans drilled approximately 1800 ft and located to depths of 65 ft. The Savannah River crossing took roughly one week to drill and pull back a 2” steel pipe. We appreciate the opportunity to provide hard-working contractors like Sirmans Underground with state-of-the-art equipment and congratulate their crew on a job well done! Tyler Price is the marketing director at Underground Magnetics Inc.

## Job Details

Total length of bore: 1800 feet  
(1500 ft of water)  
Product pulled back: 2” steel

## Deepest depth: 60ft

Furthest distance out in front  
of drill to: 90ft  
Drill: JT40

## Locator: Mag 9

Transmitter: Echo 90  
Company: Sirmans Underground  
Contact: Faron Sirmans



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# HISTORY AND DEVELOPMENT OF GEONEX HORIZONTAL HAMMER BORING SYSTEMS

By: Paul Wilkinson, Kilduff Underground Engineering, Inc. (KUE)  
Kimmo Juvani, Geonex Inc, (GEO)

**E**ffective solutions for installing small diameter tunnels through, solid rock, broken rock and difficult soft ground are pretty thin on the ground however they do exist, and we discuss here the development of Horizontal Hammer Boring (HHB) technology in Scandinavia over the last 30 years.

Scandinavian ground conditions can be extremely onerous requiring utilities to be installed through hard rock and soft ground littered with boulders that has forced contractors to think out of the box to find reliable cost-effective solutions to install underground ducts.

Pneumatic hammer well drilling technology from the 50s commonly referred to as Down-The-Hole (DTH) hammers provided a solution. Driven by compressed air the hammer mechanism has a fairly simple rapidly reciprocating piston arrangement that percussively strikes a drill head assembly 2 to 10 times per second to generate massive percussive impact energy that disintegrates and drives through the ground. Exhaust air from the piston is directed through the drill head to flush spoil cuttings to the surface.

Pentti Juvani, father to sons Kai and Kimmo from Boreal Star Oy, a family-owned Finnish contracting company, adopted DTH technology in 1993 and converted hammers to run horizontally on their homemade rigs that when put to work also demonstrated the ability of the percussive energy to pull attached casing strings through the ground, providing cost saving benefits of not requiring shafts with thrust walls to pipe jack casings through the ground.

Boreal Star's initial small-scale enterprise expanded rapidly with the company transitioning to being a solely HHB business by 1997. The company was sold in 2006 but Kimmo Juvani remained to be heavily involved in HHB contracting to 2011 registering an achievement record of more than 10,000 bores extending to 650,000 feet in the ground!

Having mastered HHB contracting, Kimmo's attention moved to and refocused on developing, designing, and manufacturing state of the art plug and play HHB equipment that could be offered to the Scandinavian and world-wide trenchless market.

By 2012 the concept for 1) A pneumatically powered horizontal hammer that uses exhaust air and augers to return excavated spoil down the casing 2) A hydraulically powered rig with a rotary drive unit to guide casings and drive the augers 3) A system controlling



***“IN 2019 THE GEONEX SYSTEM  
RECEIVED NASTT’S INNOVATIVE  
PRODUCT OF THE YEAR AWARD.”***

power pack unit, had been devised and the company Geonex Oy was founded.

Designs were finalized, and supply chains formed allowing for production and sale of the first HZR 400 system in 2013.

Further designs to create four systems to cover casing installation in the range of 5.5 to 48 inches were completed by 2017:

- a) HZR 220 + PP 180HA for casings 5.5-to-8.625-inch,
- b) HZR 400 + PP 90 for casings 6.625 to 16-inch,
- c) HZR 610 + PP 180 for casings 10.75 to 28-inch &
- d) HZR 1200 + PP180 for 24 to 48-inch casings

Key system benefits include the ability to operate in all ground with the same cutter head. Installation rates of 7 feet per hour through hard rock and 20 feet per hour in mixed ground with boulders that are reliable and fast. Control via a wireless light-weight hand portable control unit, allows the operator to be safely positioned remote from the rig, where required. Low set up





Reliable cost-effective solutions to install underground ducts through solid rock, broken rock and difficult soft ground

costs, due to self-propulsion of the hammer shafts are not always required, which in turn allows for economical use of long 40-foot casing elements. Access for recovery is only required for removal of the ring bit and the short starter casing. Labor requirements are also low, typically systems up to 24-inch can be manned with 3 No operatives with 1 No. being a coded welder, for 30-inch and above it would be recommended to have 2 No. welders taking crew

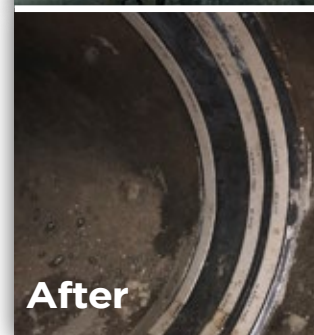
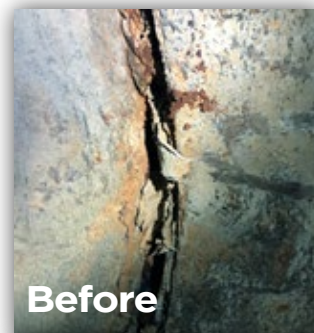
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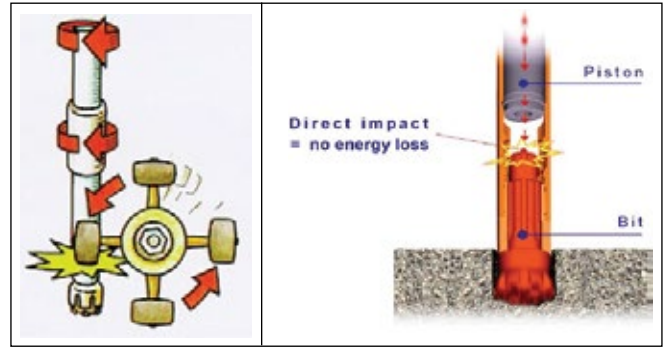
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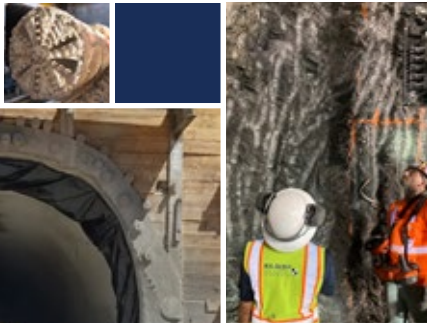
Pentti Juvani, father to sons Kai and Kimmo from Boreal Star Oy, a family-owned Finnish contracting company



Rapidly reciprocating piston arrangement percussively strikes drill head assembly 2-10 times per second to generate massive percussive impact energy

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requirements to 4 No. With remotely activated hydraulic legs for lateral and height adjustment rigs can be set up and ready to bore in half a day shift. All in all, a reliably robust efficient solution that can install 300-foot long bores within a week. The equipment is almost completely retractable, only leaving behind the peripheral cutter bit and starter casing allowing blind hole bores such as starter and receiving casings for horizontally drilled crossings to be undertaken.

Cased bores are limited to approximately 330 to 500 feet in length. Active steering is currently not available however when launched and correctly operated accuracy of approx. 0.5 percent over bore lengths is achieved. It is important to monitor that the hammer assembly and lead casing are installed on the designed alignment and use the hydraulically adjustable legs of the rig to make as required adjustments. Impact forces generated by the hammer disturb ground at the excavation face that trend to slight downward movement of the hammer along the bore. The "Rule of Thumb" is, the harder, denser, or better load bearing the ground the better the accuracy. Operators also need to adjust hammer impact frequency to suit project conditions and / or changed project conditions, higher than required frequency will induce greater downward movement trends.

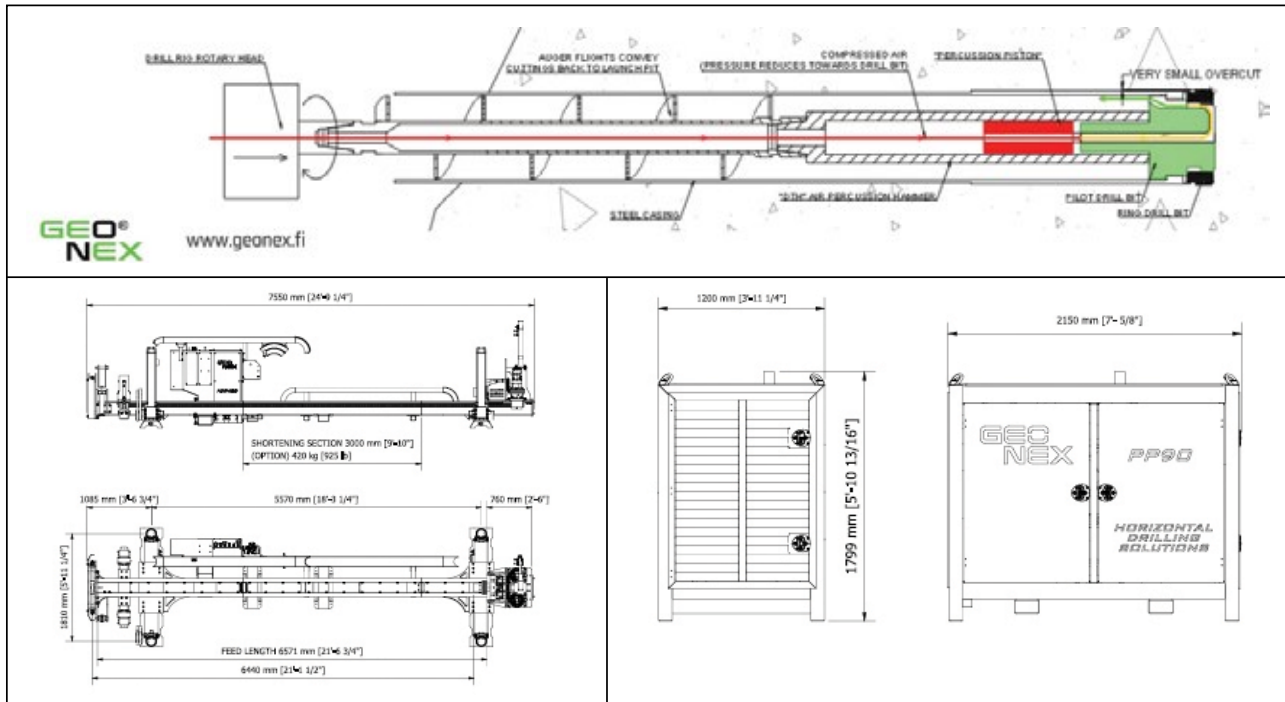
Uncased open hole bores in competent rock can extend 1000 to 1500 feet and have the ability to be steered via the initial 6-inch pilot bore using sonde detection equipment for guidance.

In 2019 the Geonex system received NASTT's Innovative Product of the Year Award and to date over 50 Geonex systems have been sold to Finland, Sweden, Norway, Israel, Switzerland, Austria, USA, Canada, Germany, Spain & Portugal. Scandinavia remains the most popular market where HHB is used for around 80 percent of 5.5-inch to 48-inch cased trenchless crossings < 500 feet in length, most bores are installed through terrain with frequent boulders. In Norway



2019 NASTT Innovative Product of the Year Award





By 2012 the concept had been finalized, with sale of the first HZR 400 system in 2013



In Norway bores mainly run through strong to extremely strong 50,000+ psi unconfined compressive strength rock

bores mainly run through strong to extremely strong 50,000+ psi unconfined compressive strength rock. In Switzerland the versatility of the system has been recognized and Geonex has been nominated for projects to minimize the risk of bore failure due to unforeseen natural ground conditions, it is also being unusually used to excavate catacomb graves in Israel.

The equipment from Finland is gaining traction and acquiring a reputation of “once used or seen never forgotten”. Orders are being placed without work in-hand and customers are moving to purchase additional units after delivery of the first.

For Kimmo, supported by Tuomas Lassheikki and an ever-increasing work’s team product development is not over. Whilst

writing the article a trial has been undertaken in Finland with an actively steerable 8-inch guided pilot casing that is to be reported under separate cover as is the factory test and field trial using mechanically interlocked steel casings that can offer an alternative to site butt joint welding of casings.

DTH and HHB hammers are not new to market, but the cleverly adapted Geonex package certainly is and offers ease of market entry to customers. For engineers and contractors, it puts on the table a “go to solution” for the installation of small diameter tunnels in the “rock and the hard places”. +

#### ABOUT THE AUTHORS:



**Paul Wilkinson** is a Senior Consultant who has been associated with Kilduff Underground Engineering (KUE) from its onset in 2014 and brings 31 years of Microtunnelling experience to the company. Formerly serving as General Manager for Iseki Euro Paul has personally overseen the installation of over 120 KM of micro tunnel, on over 200 projects in 27 countries.



**Kimmo Juvani** is the CEO / President of the Geonex Group. Kimmo has nearly 30 year career working with Horizontal Hammer Boring. He started as CEO of trenchless contracting company solely working with HHB in Scandinavia. Later in 2012 Kimmo transferred from contracting to manufacturing of Geonex Horizontal Hammer Boring solutions as CEO / President of Geonex Group. Kimmo holds records in HHB contracting of over 10,000 holes and 200,000m.

# BALTIMORE CITY TRENCHLESS: HOWARD STREET WATER LEAK INVESTIGATION & REPAIR

By: Richard Thomasson, P.E., Khalid Qadwai, P.E., PMP, EBA Engineering Inc.

## ACTIVE WATER LEAK ON HOWARD STREET

Baltimore City Department of Public Works was informed of an active water leak on Howard Street. The location of the leak caused concern and was designated for immediate repair. The immediate concern was due to the fact that the leaks were not surfacing but entering the CSX tunnel running under the Light Rail tracks in Howard Street. This leak caused a sink hole about 16 x 22 feet in area under the Maryland Transportation Authority (MTA) light rail tracks and goes all the way to the CSX tunnel running under the MTA tracks. The repair of water main was carried out over the CSX tunnel and under MTA light rail tracks.

Baltimore City had prepared in advance for emergencies with current on-call Contracts for engineering and repair. EBA led and coordinated the repair activities until complete. EBA provided engineering and inspection support to the City and worked directly with the Contractor for this emergency repair. . The foresight by Baltimore City to have on-call contractor and on-call consultant resulted in the most efficient identification of the leaks, extensive coordination, permit acquisition, urgent and durable design, and repair of the leaks. As you will see in this article there were many entities involved in the project, which required many site visits and numerous approvals to complete the project. Proper coordination and cooperation were essential to complete the project quickly and successfully.



## SIGNIFICANT WATER INFILTRATION

EBA received a call from the Baltimore City that water is leaking into the CSX tunnel and a site visit was scheduled to determine the issue. EBA arrived onsite to provide a visual evaluation of a portion of the Howard Street Tunnel where extensive water infiltration was occurring. Arriving onsite at approximately 7 PM at the intersection of Ostend and Warner Streets, EBA Engineers met with the response team. The response team was transported into the tunnel at approximately 7.30 PM by CSX Transportation. The response team arrived at the problem area which was located at Station 4500 in the tunnel. It was understood that this location corresponded to the area on the ground

surface along Howard between Lexington and Saratoga Streets.

There was significant water infiltration occurring within the problem area. The water infiltration consisted of extensive dripping, seeping and flowing water across a distance of about 200 feet of tunnel. The water infiltration was relatively equal over the entire tunnel section meaning water infiltration was occurring from the crown down to the base of each side. The areas of flowing water were generally located near the base on each side. The crown was dripping from many locations. The information indicated that water was impounded over the entire tunnel section. The water infiltration appeared to be occurring through cracks and gaps in the brick and mortar tunnel lining. Soil infiltration was limited but occurring



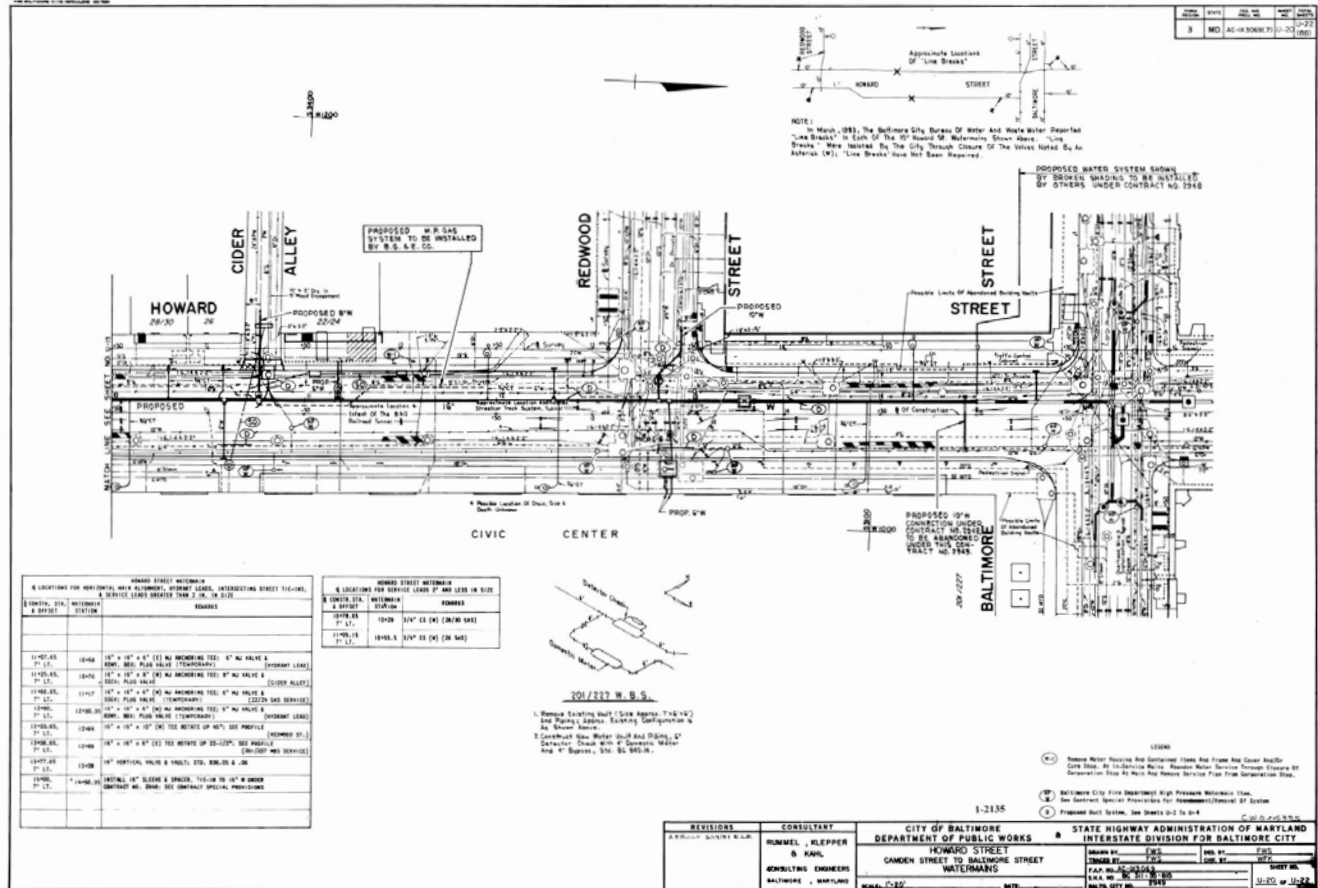


Figure 1: As-built plan view of leak area under Howard Street showing congestion of utilities

**“THE IMMEDIATE CONCERN WAS DUE TO THE FACT THAT THE LEAKS WERE NOT SURFACING BUT ENTERING THE CSX TUNNEL.”**

at some locations. The water was clear and did not have an odor indicating likelihood of potable water.

The area of water infiltration did not exhibit evidence of structural distress. Bowing, buckling or cracking of the walls was not observed in the area of water infiltration. The mortar was intact and did not appear to be eroded due to the action of flowing water. However, the impounded water around the tunnel envelope was contributing to increased hydrostatic pressure on the walls and crown. The source of the water had to be identified and controlled to reduce the pressure. The increased pressure had

potential to cause a failure of the tunnel envelope or blow out the tunnel bottom.

It was understood from discussion with CSX that the water infiltration had been occurring over a period of weeks or months and was steadily increasing. The problem had increased to the level where CSX notified the City of Baltimore and a response initiated. CSX indicated that the flow did not appear to be related to precipitation events. It had been relatively dry for a



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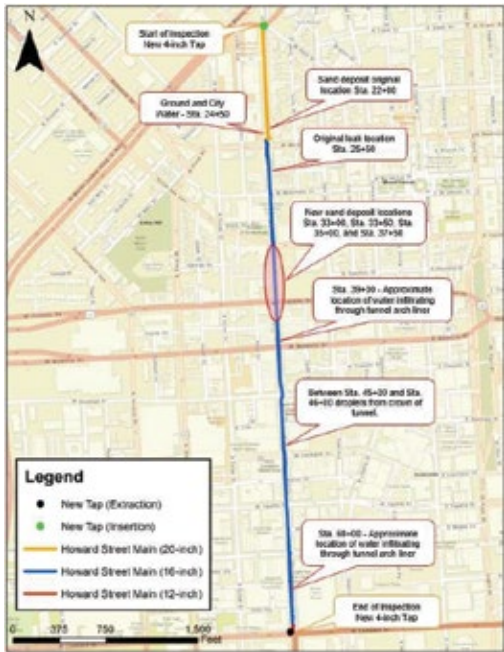


Figure 2: Plan of the SmartBall inspection



Figure 3: Installed entry port for the SmartBall was outside the special pad area of the light rail tracks

needed to be controlled in an urgent manner or additional measures taken to protect the tunnel structure. It was noted that there was active building construction underway on the ground surface in the vicinity of the problem area. That location could be the ultimate source of the problem.

Additionally, it was understood that the City of Baltimore had been previously aware of the issue since they had been attempting to locate the source of a potential water main break on the ground surface for several weeks, without success. It is not clear if the effort to locate the break was limited to inspecting the larger water mains in the area, or if this effort also included service connections or smaller lines.

It was understood that the City of Baltimore was going to continue these efforts. The area had a great deal of utilities and other structures which need to be exactly located when any repairs were undertaken.

## INSPECTION & ANALYSIS

It was not an easy task to find a water leak with unknown origin. Several utilities are present along Howard St including water, sewer, storm, steam, cable, electric, telecommunication, etc. Several utilities and structures were CCTVed, finally Pure Technologies was retained and performed analysis of the watermain by use of the trenchless technology inspection application, the Smart Ball. The location of the three leaks were identified and marked above ground on Howard Street. Normal procedures for locating the leaks were not applicable because of the Light Rail special pad along Howard Street. The installed entry point for the tool was just outside of this special pad area of the light rail tracks.

period of about two weeks but the flow had increased over this time. The collected water was being managed by a series of pumps in the tunnel, however, the flow was increasing to a level where the pumps could not manage the flow any longer.

It was advised that CSX inspect the tunnel after each train passed for evidence of structural distress. Evidence would include loss of bricks at the tunnel crown or buckling or cracking of the tunnel walls. There was also possibility of a bottom blowout. The source of the water



Figure 4: Dig Sheet showing location of Leak 1 under Howard Street



Figure 5: Dual use by vehicles and light rail was a complicating factor



Pure Technologies completed the SmartBall inspection on Sunday, August 8, 2021. The SmartBall leak and gas pocket detection survey used acoustic technology to detect potential leaks and any areas of trapped or entrained gas within the pipeline. The inspection spanned approximately 4,969 feet (0.94 miles) of the Howard Street Mall.

The analysis of the inspection data identified no acoustic events characteristic of entrained or trapped gas and three acoustic events characteristics of a leak. Based on the magnitude of the acoustic signature, the size of the first leak was estimated to be in the range of 2 - 10 gallons per minute (GPM). The size of the second and third leaks were estimated to be less than 2 GPM and were suspected feature-related leaks. This estimate was determined by comparing decibel levels of detected leaks with calibration data collected during test trials and validations. Pure Technologies' analytic process used tracking sensor data, along with the tool's internal rotational and heading data, to identify the location of each leak.

The first leak was located approximately 1,781 feet upstream from the 4-inch extraction tap at the intersection of Howard Street and West Lombard Street. Given the location and acoustic signature, Pure Technologies was uncertain whether the leak was located at the barrel or at the joint.

The second leak was located approximately 347 feet upstream from the 4-inch extraction tap at the intersection of Howard Street and West Lombard Street. Given its location near an 8-inch Combined Fire and Domestic Service outlet (Valve 030606V) and 0.75-inch Domestic Service Connection, this leak was suspected to be feature-related.

The third leak was located approximately 248 feet upstream from the 4-inch extraction tap at the intersection of Howard Street and West Lombard Street. Given the location, this leak was also suspected to be a feature-related leak, as it was nearby another 8-inch Combined Fire and Domestic Service (Valve 020463V) outlet.

## REPAIR PROCEDURE

The entire repair procedure and investigation was determined by the

location of the special pad for the Light Rail trains and the stipulation there was no cutting into the slab, which covered a good portion of the Howard Street width. Another complication was the dual use of Howard Street by vehicles and the Light Rail, with the tracks are on each side of the street and a travel lane in the center. The layout changed periodically through the 3 leak areas with a light rail stop in one area.

EBA chose to address the largest leak first that was releasing 2-10 gpm of water. The water main was located on the edge

***"SAFETY WAS A HIGH PRIORITY FOR THIS PROJECT."***

of the light rail slab and the road, so no tunneling was required. EBA prepared the design documents for the repair and obtained permit from MTA. Only night work was allowed to do the repair. EBA

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Figure 6: Light rail stops were closed during repairs



Figure 7: One of the largest voids discovered under the light rail slab

first did the 2-inch test holes in the area identified by leak detection to confirm the leak. Both the test hole results came out dry. Excavation was carried out at the identified location but no leak was found. So PURE did the correlation and listening by tapping to the 16-inch water main and using ground mic to mark the leak location at a different location nearby at a 2-inch water house connection off of 16-inch water main. When the contractor excavated that area he found a

leaking 2-inch galvanized water house connection. The house connection was turned off to stop the leak. Since this 2-inch water connection went under the MTA light rail concrete slab, large conduit in the road, and other utilities, it was decided to install the water house connection trenchless using the existing galvanized pipe as a casing pipe. So the new 1.5-inch water house connection was pulled inside the existing 2-inch pipe.

While the contractor was repairing the water house connection he discovered a large 16 x 22-foot sink hole that went all the way to the CSX tunnel. The leaking water from the house connection washed away all the soil into the CSX tunnel. MTA, Baltimore City DOT and CSX was immediately notified of the sink hole issue. Since the CSX tunnel inspection indicated there was silt entering with the leaking water, it was expected that there would be some voids under the light rail pad that would need to be filled. Train operation and

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Figure 8: Grouting of major void with flowable fill, with access just outside of light rail slab

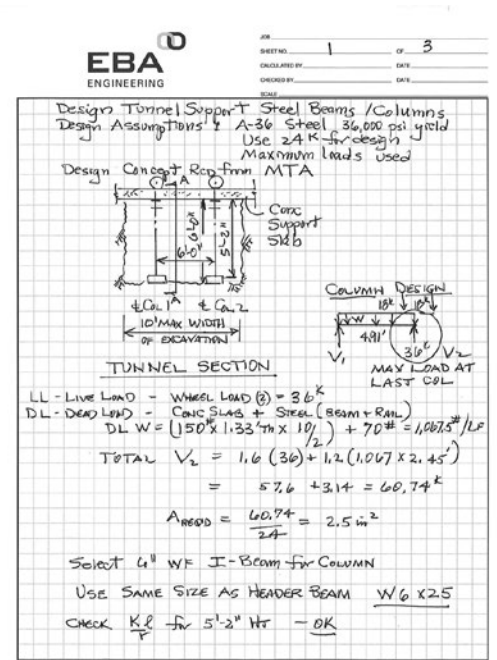


Figure 10: Sketch of tunnel design showing detail and calculations

all traffic was suspended, Right-of-Entry permit was obtained from MTA, workers were trained to work on MTA tracks, traffic control was placed and sink hole repair design was prepared and approved by all parties.

Controlled Low Strength Material (CLSM) was designed to fill the void and deliver at a rate so that it would not seep into the CSX tunnel underneath. Continuous monitoring of the CSX tunnel

and settlement survey of the MTA slab was performed during the void filling operation.

While these designs were being developed, and the Contractor scheduling employees and equipment, EBA obtained the required permits to carry out the work and coordination with MTA, CSX and Baltimore City. However, after the Contractor scheduled mobilization to the site, MTA stopped the entire repair

operation until full railroad safety training was performed and completed by all personnel working on or near the rails.

Railroad safety training was offered to the team, and a four-hour safety course was conducted on Dec 2, 2021. All Contractor and Engineer team members attended and obtained the required Certification. This delay was unforeseen, and added extra time and cost to the emergency repair. This event could have been avoided with foresight, since MTA



Figure 9: Location of leaking 8-inch valve. A tunnel was constructed to complete the repair





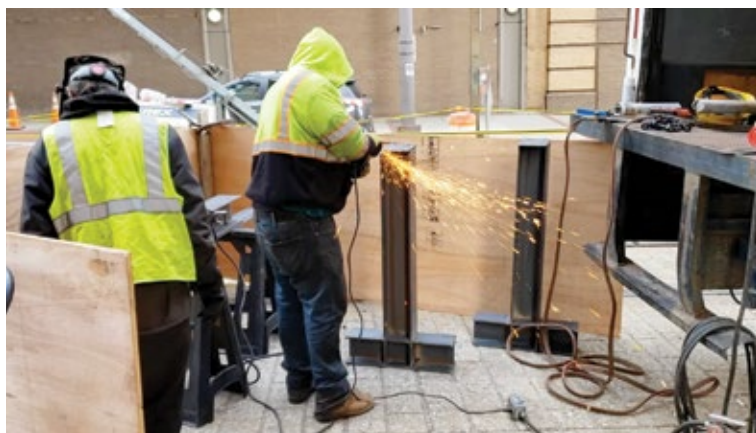
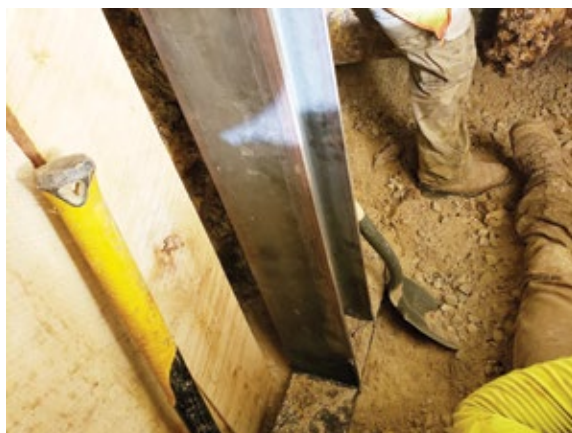


Figure 11: Construction of the steel tunnel system



closed down the tracks and bussed train passengers around the repair area anyways. There were no Light Rail trains on the tracks during the entire repair period.

Coordination with CSX, MTA and the City was necessary to determine a plan for the filling of the voids. Comments were received from each as to their requirements. The CSX tunnel was inspected and monitored while flowable fill was being installed to ensure no fill was coming into the tunnel. The mix was formulated to flow into the voids but thick enough to not infiltrate into the CSX tunnel.

All work was performed outside of the Light Rail special pad. Each of the three leaks involved differing requirements for repair. One leak was on a 1.5-inch service line. The corporation cock was outside of the Light Rail slab and able to be excavated to cut off the service.

The second leak was valve packing on an 8-inch valve on the 8-inch water service located at 10 S Howard Street between the North and South bound Light Rail tracks.

The plan was developed to construct an 8 x 24-foot tunnel to access the valve under the Light Rail tracks and replace the packing to stop the leak.

The normal method of replacing the packing could not be used because no excavation could take place on the special light rail slab. Therefore, the Contractor was required to build a tunnel from outside the light rail slab area to the valve in order to complete the repair. EBA designed the tunnel and submitted for approval by the MTA and CSX. It was a very challenging design as the tunnel was designed under the MTA light rail and over the CSX tunnel, with several crossing utilities. Trenchless options were considered but none worked out due to site condition.

When tunneling toward the valve the shoring used to install CSX tunnel was encountered. EBA immediately coordinated a site meeting with the CSX and briefed them about the problem and possible solutions. CSX allowed the contractor to remove the shoring up to the wood lagging.

This complicated the tunneling operation and caused additional delay in the repair of the 8-inch valve.

Safety was a high priority for this project. Excavation shoring was essential for any excavations as there was some vehicular traffic still allowed during some of the repair work. A lot of work was required to be done at night to avoid traffic delays and impacts on businesses. Proper lighting and signage was required to protect the workers and any pedestrians on sidewalks. All tunneling safety measures were taken to ensure that no workers would be in danger

while excavating the tunnel and installing the steel tunnel supports. Proper training and certification was required for all individuals involved in the work on Howard Street to repair the water leaks and to fill all voids and excavated areas.

These three leaks could not have been identified and repaired in such an efficient and quick manner without the use of trenchless technology equipment, methods and tunneling techniques. ✚

#### ABOUT THE AUTHORS:



##### **Richard Thomasson.**

**P.E.** has more than 52 years of experience working in the water and wastewater fields. He has been closely involved with trenchless technology for nearly his entire career.

While at the Washington Suburban Sanitary Commission, he directed many uses of new trenchless technologies, retiring after 31 years as the Director of Construction. He is currently a Senior Project Manager with EBA Engineering, Inc.



##### **Khalid Qadwai, P.E.,**

**PMP** is an Associate at the EBA Engineering, Inc. He joined EBA Engineering, Inc. in 2008 and has nearly 25 years of experience in water main design and rehabilitation.

He is currently managing several water and sewer projects in the Washington metropolitan area.



Figure 12: When tunneling towards the valve, a large gas line was encountered





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# PROMOTING TRENCHLESS TECHNOLOGY IN THE MID ATLANTIC REGION!

## MASTT Hosts Highly Successful Seminar in Baltimore

The Trenchless Technology seminars hosted by MASTT in locations across the Mid Atlantic region have been a mainstay of trenchless technology outreach and education efforts in the area for nearly two decades.

MASTT hosted a very successful one-day seminar Wednesday July 20 at the Hyatt Place Baltimore Inner Harbor Hotel, renewing optimism that in-person learning and networking events are back in full swing after a two-year hiatus due to Covid-19.

Held in conjunction with the ASCE Maryland Section, the MASTT Baltimore Trenchless Technology seminar featured a presentation on “Trenchless Technology in Baltimore” from Mr. Timothy Wolf, P.E., BCEE, Chief, Office of Engineering & Construction, Bureau of Water and Wastewater, Baltimore City

Department of Public Works. Baltimore is a shining example of a municipal jurisdiction which places Trenchless Technology at the forefront in decision-making in its underground infrastructure rehab and renewal programs. The article on the Howard Street Water Line Repair (pp28-34) is a good example of this.

In addition to this keynote presentation there were also eight other presentations by industry professionals on a wide range of trenchless technology topics, along with exhibits from industry suppliers.

Since 2003, MASTT has been hosting **Trenchless Technology, SSES and Buried Asset Management Seminars** in various cities across the Chapter’s six state area + DC. These seminars have engaged over 2100 underground infrastructure professionals over this time, facilitating meaningful direct networking between industry and owner groups.

As part of the MASTT mandate to “promote Trenchless Technology through education for the public benefit”, the seminar programs are designed to inform public officials, engineers, utility company personnel, designers, and contractors involved with the construction, rehabilitation, and management of underground infrastructure assets, in the Mid Atlantic. They are great venues for educating decision-makers on the many social and economic benefits of using trenchless technology in their infrastructure renewal and new construction programs.



*Mr. Timothy Wolf, P.E., BCEE, Chief, Office of Engineering & Construction, Bureau of Water and Wastewater, Baltimore City Department of Public Works, delivered an excellent presentation on the Trenchless Technology programs in his city*



*Use of trenchless technology applications by the City of Baltimore continues to grow annually*



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*Seminar delegates enjoyed a stimulating day of presentations, networking and refreshments*

With the success of the Baltimore seminar, MASTT is looking forwards to another well-attended and informative event in Atlantic City, NJ on Wednesday, September 14.

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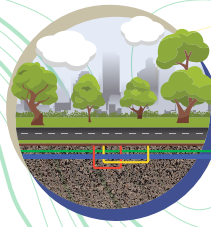
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