SOUTHEAST JOURNAL OF

TRENCHLESS TECHNOLOGY 2024

OFFICIAL PUBLICATION OF THE SOUTHEAST SOCIETY FOR TRENCHLESS TECHNOLOGY

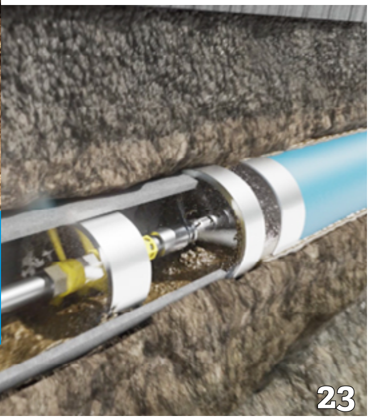
2024 Southeast Regional Trenchless Technology Conference

Wednesday October 23

Hotel Indigo Atlanta - Vinings

CONTENTS

Features:



Also:

Departments:

Dave Sackett
SESTT Chairman
813.397.7349
dsackett@brierleyassociates.com

Andrew Costa
SESTT Board
813.309.0385
acosta@azuria.com

PUBLISHER

A to B Publishing Inc.
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
your social media strategy & web marketing partner
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

Printed 10/24 in Canada.

SESTT CHAIRMAN MESSAGE 2024

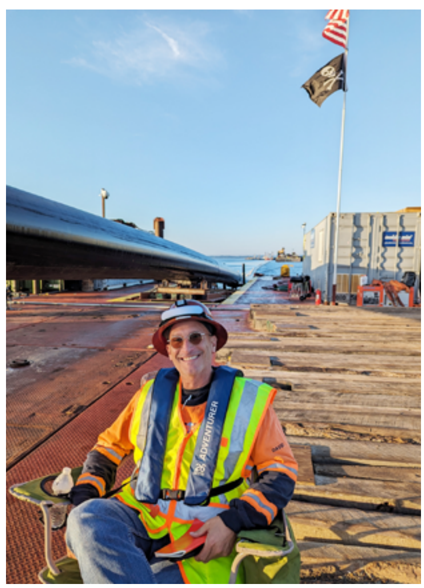
Dave Sackett, PG, SESTT Chairman

Moving Trenchless Technology Forward in Our Region

This year 2024 seems to be racing past us towards the finish line as quickly as possible. It feels like only a few weeks ago that we were in Providence, RI for the very successful No Dig show, where I was honored to accept the nomination to be the Chairman of our first all-volunteer Board in the SESTT's 24-year history. This year is one of transition for the SESTT, as we said goodbye and happy retirement to our founder and long time Executive Director Leonard Ingram and embarked on our own path to grow the outreach of our regional chapter across the Southeast Region. I want to take a moment thank all of the 2024-2025 SESTT Board members for their support and increased efforts during this period of change.

As part of this transition, we are hosting our first Annual Conference in the great city of Atlanta, Georgia in October 2024. The conference will bring trenchless professionals, speciality contractors, industry leaders, and aspiring students from throughout the Southeast region together for technical presentations and lively conversations on new trenchless installations as well as rehabilitation focused solutions. I am looking forward to seeing many of you there!

Just beyond the horizon is 2025, which will be a year of change for our industry and for our country as well. No Dig will be headed to Denver CO for the first time in 10 years. The participation within NASTT and the regional chapters definitely has been on an upward swing again after a few slower years during the Covid pandemic. During 2025 we plan to expand our footprint in the southeast region by growing our membership rosters, increasing our interaction with our student chapters (Louisiana Tech, Clemson University and the University of North Florida) while targeting to add a new student chapter in the region, and initiating local SESTT-sponsored events tied to key projects and/or important related conferences. We are always looking for volunteers to become more active in the society, join a committee, or even reach out to join our Board of Directors!



SESTT Chairman Dave Sackett in the field doing what he loves!

> ***"Our technology provides a unique and critical service."***

And so, as the days begin to grow shorter and the nights a bit more chilly, it is time again to refocus on why SESTT was created – to advance the trenchless technology industry, promote education and research within our field, and inform Utility Owners and the general public on the benefits of trenchless technology to convey water/wastewater/energy and other infrastructure in a environmentally friendly and safe manner. Our technology provides a unique and critical service to maintain safe, reliable and economical conveyance of utilities in diverse surficial and subsurface conditions – in this case out of sight should NOT mean out of mind!

I wish you and yours a happy remainder of 2024 and a smashing 2025!

Sincerely,

Dave Sackett, P.G.
SESTT Chairman

SESTT SITE

MESSAGE FROM NASTT CHAIR

Matthew Wallin, P.E., NASTT Chair

Hello Trenchless Champions!

> ***"This year's conference promises to be an exceptional gathering."***

Fall is here and I want to share some key updates and upcoming opportunities that are of importance to your chapter and our organization and industry. I hope you are joining us for the 2024 Annual SESTT Trenchless Conference being held on October 23 in Atlanta. This is an exciting event dedicated to advancing the field of trenchless technology in the region. This year's conference promises to be an exceptional gathering of industry experts, innovators, and professionals, offering a unique opportunity to explore the latest trends, technologies, and best practices in the trenchless sector. Attendees will benefit from insightful presentations and valuable networking sessions. Don't miss this chance to connect with peers, gain fresh perspectives, and contribute to the future of the industry. For more information on the conference, visit our Chapter's website: **https://sestt.org/upcoming-events**

I'd like to offer a big thank you to everyone who participated in this year's 2024 No-Dig Show held in Providence, RI. Your engagement and contributions made it a resounding success! The presentations were insightful, and the networking opportunities were invaluable. We are currently in the thick of 2025 planning and we hope you will mark your calendars for March 30-April 4 in Denver, CO! If you have any feedback or suggestions for future events, please do not hesitate to reach out to us at **info@nastt.org**.

We are now accepting applications for our municipal scholarship program for the 2025 conference. The NASTT No-Dig Show Municipal & Public Utility Scholarship awards employees of North American municipalities, government agencies and utility owners who have limited or no training funds with a Full Conference and Exhibition registration to the NASTT No-Dig Show. Hotel accommodations are provided for selected applicants. Recipients have full access to all exhibits and technical paper sessions. Applications received after November 1 will be added to the waitlist, so please spread the word to any eligible candidates who may benefit from this opportunity. Detailed information about the scholarship program and the application process can be found on our website at **https://nastt.org/no-dig-show/municipal-scholarships/**.

We are excited that the fifth edition of the Horizontal Directional Drilling (HDD) Good Practices Guidelines book has been released. And by popular demand, the book is now available in a digital format you can access online from any device, as well as a print-on-demand version coming soon! The fifth edition includes updated content reflecting the latest advancements and techniques in HDD. Alongside the book, we have also updated our HDD training course to align with the new edition. These courses are designed to provide both new and experienced professionals with the knowledge and skills needed to excel in their roles. Please check our website for more details on how to purchase the book and enroll in the courses.

Thank you for your continued support and dedication to our Chapter. Together, we are driving the future of trenchless technology forward. If you have any questions or need further information on any of the topics mentioned, please do not hesitate to contact me.

Matthew Wallin, P.E.

Matthew Wallin, PE
NASTT Board Chair

SOUTHEAST SOCIETY FOR TRENCHLESS TECHNOLOGY
BOARD EXECUTIVE 2024 - 2025

Dave Sackett - ***Chair***

Dave Sackett has throughout his 35+ year career been responsible for the management of geological interpretations, nearshore and landside site characterization, planning and execution of geotechnical investigations, preparation of geological and geotechnical reports and technical reviews for trenchless and tunnel projects. His expertise is within the application of geoscientific data to engineering projects constructed within soft soils to hard, crystalline rock. He has worked extensively in sedimentary and meta-sedimentary rock and has designed / managed geoscience projects on five continents. Mr. Sackett's experience with trenchless technology projects (including horizontal directional drill (HDD), pipe jacking and microtunneling includes field mapping, site characterization, preparation of project documents including Geotechnical Data Reports and Geotechnical Baseline Reports, and project/program management. Dave is the current Chairman of the SESTT and has been participating in the NASTT for several years. He is active in both presenting and moderating sessions at several No Dig conferences. He has a BS degree in Geology from the University of Tennessee.

Blake Wyatt - ***Secretary***

Blake has worked in support of contractors, municipalities, and engineers focusing on fluid handling solutions for 12 years with Sunbelt Rentals, Pump Solutions. His proficiency in hydraulics and specialized equipment have provided the opportunity to consult on a broad range of applications in the civil, environmental, industrial markets. His extensive experience in the efficient design, cost estimation, and construction of bypass pumping projects have allowed him to work closely with the trenchless industry throughout his career.

Blake is currently the East Region Sales Manager for Sunbelt Rentals, Pump Solutions; a region which stretches from the Carolinas to Maine. A member of NASTT for many years, Blake has served on the Technical Program Committee for the NASTT No-Dig Show since 2019. He holds a B.S. in Business Administration from The Citadel, The Military College of South Carolina and resides with his family in Charleston, SC.

Jimmy Stewart - ***Vice Chairman***

Jimmy Stewart has over 25 years' experience working in consent order driven cities, where he has been involved in the full-service environmental assessments, technical water/wastewater evaluations and rehabilitation processes for water, wastewater and storm water systems.

Vice President of AWWIS (Advanced Water/Wastewater Infrastructure Solutions). AWWIS provides and unbiased portfolio of technologies for inspections and rehabilitation for both Pressure and Gravity applications, asset management programs and digital solutions for utilities and engineers and across the United States. Jimmy is a past NASSCO Board Member, past WEF Collection System Committee Chair. Recipient of WEF and WEF Member associations Golden Manhole and 5S Society awards. He is currently Vice Chair of the Southeast Society of Trenchless Technology (SESTT) and Serves on the BAMI-I Board of Directors.

Troy Stokes - ***Treasurer***

Troy Stokes grew up in a construction family with a Land Developer/General Contractor for a Dad so his underground construction roots run deep. The last 30+ years of his career have been focused on trenchless technology.

Troy is Sales Manager for Akkerman Inc., a leading manufacturer of tunneling, microtunneling, guided boring, pipe jacking, and sliplining equipment. He is responsible for market development and support in North America along with Australia and New Zealand. Stokes is actively involved in many organizations including NASTT, SESTT, ASCE, and NUCA, has authored and presented several papers at their conferences, and participates in other forums to help further the education on the value of trenchless technology.

SOUTHEAST SOCIETY FOR TRENCHLESS TECHNOLOGY
BOARD EXECUTIVE 2024 - 2025

Dr. John Matthews - ***Past Chair***

Dr. John Matthews has over 20 years of experience in the installation, rehabilitation, and inspection of infrastructure systems. He is the Director of the Trenchless Technology (TTC) and Eminent Scholar Chair in Construction at Louisiana Tech. Previously, he served as the Program Manager at Pure. Prior to joining Pure, he served as Water Infrastructure Lead at Battelle for five years, and as a Researcher at the TTC for six years, where he led numerous research studies related to pipeline infrastructure. He also has experience as a field inspector on numerous trenchless projects. He has given over 200 conference presentations and authored more than 300 technical publications. He is an active member of NASTT and ASCE and currently serves on the ISTT Board of Directors. He has named the Trenchless Technology Person of the Year Award by Trenchless Technology magazine in 2023 and has won three ISTT Awards (2005, 2012, 2022).

SOUTHEAST SOCIETY FOR TRENCHLESS TECHNOLOGY
BOARD OF DIRECTORS 2024 - 2025

Chair –
Dave Sackett
Brierley Associates
Tampa, Florida
813-397-3749
dsackett@
brierleyassociates.com

Vice Chair –
Jimmy Stewart
JS Water/Wastewater
Consulting
Lafayette, Alabama
334-750-3208
jimmy@awwis.net

Secretary – Blake Wyatt
Sunbelt Rentals
Fort Mills, South Carolina
843-323-8027
blake.wyatt@
sunbeltrentals.com

Treasurer -
Troy Stokes
Akkerman
Fort Orange, Florida
507-993-6391
tstokes@akkerman.com

Past Chair –
Dr. John Matthews
Louisiana Tech University
Ruston, Louisiana
318-224-0141
matthews@latech.edu

Jon Cook
Ruby-Collins, Inc
Smyrna, Georgia
770-432-2900
jcook@ruby-collins.com

Andrew Costa
Insituform Technologies LLC
Tampa, Florida
813-309-0385
acosta@azuria.com

Chris Ford
Highfill Infrastructure
Engineering, P.C.
Cary, North Carolina
918-818-2470
cford@hiepc.com

Kim Hanson
Hazen and Sawyer
Raleigh, North Carolina
727-741-2263
khanson@
hazenandsawyer.com

Dr. John Kraft
Trenchless Technology Center
Ruston, Louisiana
318-257-2744
jkraft@latech.edu

Ed Paradis
BASF Construction Chemicals
Cornelia, Georgia
706-894-2133
ed.paradis@mbcc-group.com

Ron Thompson P.E.
Waggoner Engineering
Birmingham, Alabama
205-790-2262
ronald.thompson@
waggonereng.com

Jim Williams
Brierley Associates
Tampa, Florida
832-851-7876
jwilliams@
brierleyassociates.com

NEW HEIGHTS.
UNDER GROUND.

Join Us In

VIBRANT ATLANTA, GEORGIA

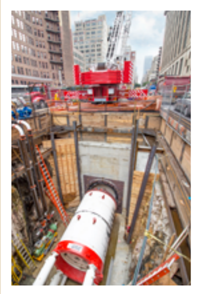
2024 Annual Southeast Regional Chapter Trenchless Technology Conference

October 23, 2024

Hotel Indigo Atlanta - Vinings
2857 Paces Ferry Rd SE, Atlanta, GA

Spotlighting the latest developments, cutting-edge case studies, pioneering research, and technological innovations in trenchless technology.

Don't miss this opportunity to stay at the forefront of trenchless technology. Join industry experts, network with peers, and gain invaluable insights that will propel your work forward.



For more information and to register:

https://sestt.org/upcoming-events/#price

Time	Event	
7:00 am	Exhibitor Setup	
7:30 am	Registration and Breakfast with Exhibitors	
8:30 am	Welcome / SESTT Introduction / SESTT and NASTT Updates **Dave Sackett, Chair of SESTT and Victoria Cox, NASTT Regional Chapter Coordinator**	
Time	**Track 1 - New Installation Methods**	**Track 2 - Rehabilitation**
8:45 am	Drilling in Paradise: The Race to Replace Aging Pipelines along Florida's Oldest Causeway **Josh Farmer, Hazen and Sawyer**	No Access, No Problem: Lessons Learned on a Limited Access Lining Project **Steve Loudermilk, SAERTEX multiCom**
9:15 am	Long Pull HDDs **Chad Andrews, Underground Solutions**	Trenchless Stormwater Rehabilitation - Design and Installation Methodologies **Alex Sherrod, Precision Pipe & Products**
9:45 am	**Coffee Break with Exhibitors**	
10:15 am	Highlights of the High Life: Miami Beach HDD Case Study **Shari Ramirez, Wade Trim** **Adrian Reid and Lou Gaudio, Quality Enterprises USA**	Introduction to Sliplinging with Case Studies from the SE Region **Nick Dross, Underground Solutions**
10:45 am	Design and Construction of World Record 7,650-foot FPVCP HDD in Florida, **Kate Wallin, Bennett Trenchless**	The City of Tampa's Westshore Water Main Rehabilitation 3.2 Mile Pipe Bursting Project **Alan Ambler, AM Trenchless**
11:15 am	**Key Note Address**	
12:00 pm	**Lunch in Exhibit Hall**	
Time	**Track 1 - New Installation Methods**	**Track 2 - Rehabilitation**
1:00 pm	Alternative Delivery and Trenchless Methods used to Install 60"-72" Pipe on the Bay Park FM Project **Carl Pitzer, Thompson Pipe Group**	Ice Pigging Improves Water Quality without Extensive Excavation: A Case History in August, GA **Paul Treloar, American Pipeline Solutions**
1:30 pm	Trenchless Pipeline Installation Methodologies for Intake and Outfall Applications **Maureen Carlin, Garver**	Utilizing AI to Support the City of Miami SESS and Biscayne Bay Water Quality Improvement Programs **Samer Alkhatib and Marya Jetten, AECOM** **Patricia Rendon, City of Miami Beach**
2:00 pm	Pipe Ramming and Conductor Barrels for HDD **Rick Melvin, TT Technologies**	Spiral Wound in New York City **Chris Lind, Sekisui SPR Americas**
2:30 pm	**Afternoon Break in Exhibit Hall**	
Time	**Track 1 - New Installation Methods**	**Track 3 - Project Planning**
3:00 pm	Choosing the Right Machine for New Pipeline Installation **Troy Stokes, Akkerman**	HDD Operations Noise Impact Management and Control **Matt Cott, Behrens Environmental Noise Control**
3:30 pm	Sanitary Sewer Projects Converted to Pilot Tube Method of Guided Boring **Steve Matheny, Logan Clay Products**	Break outs, Break ins, and Machine Interventions. Lessons Learned in Permeation Grouting **Andrew Taliaferro and Kirk Roberts, CJGeo**
4:00 pm	**Conference Wrap-Up in Exhibit Hall**	

SUCCESSFUL SHALLOW MICROTUNNELING

in Venice, Florida

New 24-Inch Parallel Forcemain under I-75

Microtunneling equipment set up in median to tunnel beneath the northbound lanes of I-75

By: Kim Hanson, PE, Hazen and Sawyer

Owner: City of Venice, FL
Engineer: Hazen and Sawyer
General Contractor: DeJonge Excavating Contractors, Inc.
Microtunneling Contractor: Vadnais Trenchless Services, Inc.

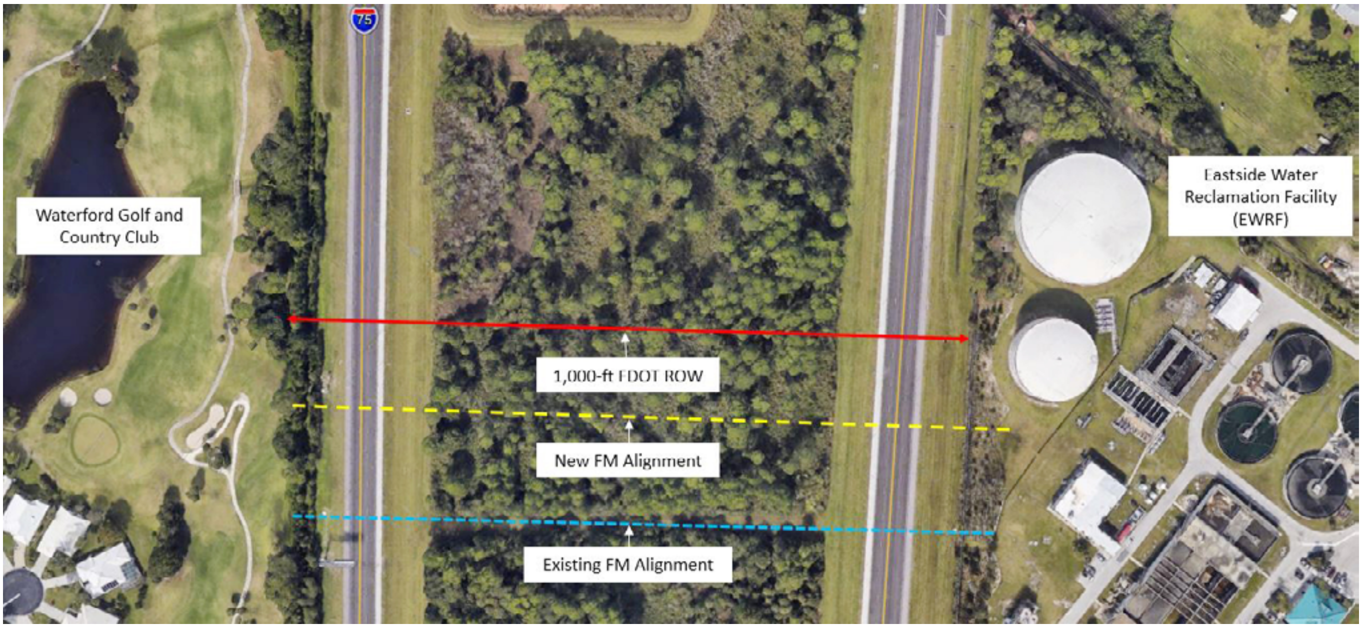
INTRODUCTION

The City of Venice (City), located in Sarasota County on the Gulf Coast of Florida, utilizes the Eastside Water Reclamation Facility (EWRF) to treat the wastewater collected in their system. Before the force main discussed in this article was constructed, flow collected on the west side of Interstate 75 (I-75) was conveyed to the treatment plant via a single 20-inch force main across the Interstate. If an issue were to arise that required taking the force main out of service for maintenance or repair, the City's ability to convey flow to the EWRF from the west side of I-75 would be interrupted. In addition to the need for redundancy, a planned development, which includes Sarasota Memorial Hospital, on the west side of I-75 would generate significant additional wastewater flows.

To expand capacity and provide redundancy to their sewer collection system, the City of Venice hired Hazen and Sawyer (Hazen) to design a parallel force main to convey flow across I-75. The aptly named Second Force Main Under I-75 project was initiated to add a 24-inch parallel force main, with tie-ins to existing infrastructure on either side and a provision for a future connection on the east side.

At the crossing location, I-75 is a controlled-access, divided highway managed by the Florida Department of Transportation (FDOT) with a 730-foot

> ***The City of Venice understood the complexities and risks associated with this project, and prioritized risk avoidance and risk management during all phases of this project.***



1,000 + LF wide FDOT right-of-way

wide median. The edge-to-edge distance between the western and eastern right-of-way (ROW) limits exceeds 1,000 linear feet (LF) at the crossing location.

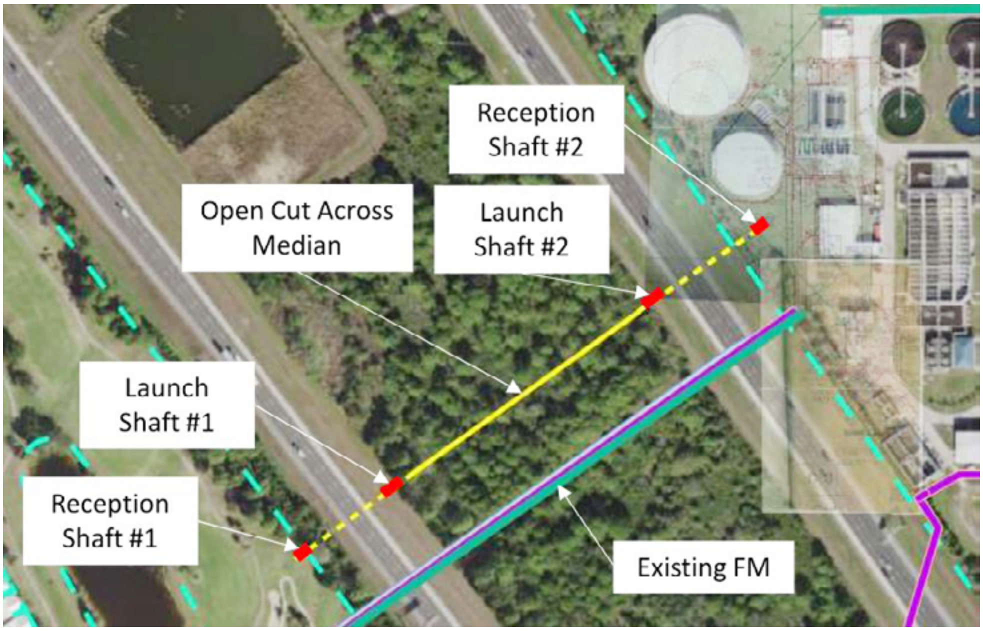
The property immediately adjacent to the edge of right-of-way on the west side of I-75 is the Waterford Golf and Country Club. The edge of the tee box for Hole No. 4 on this golf course was only 22 feet from the edge of the FDOT ROW. The EWRF borders I-75 to the east, with treatment plant infrastructure abutting the ROW. On both sides, there was limited space available for construction.

PLANNING AND DESIGN

During the planning phase of the project, both Horizontal Directional Drilling (HDD) and tunneling alignments were evaluated for the 1,000 LF trenchless crossing of the FDOT right-of-way.

The FDOT Utility Accommodation Manual (UAM) indicates that for trenchless methods other than HDD, a minimum of 36 inches of cover is required below the top of roadway pavement. For HDD, the UAM requires that when boring under roadway pavement, the utility should maintain a bore depth equal to 10 times the borehole diameter or greater as measured from the top of the pavement to the top of the bore. Alternatively, if a confining layer is present (defined by FDOT as ground with blow counts exceeding N=30), the bore depth may be reduced to two (2) feet below the top of the confining layer to the top of the bore. FDOT Standard Specifications for Road and Bridge Construction Section 555 requires the maximum borehole diameter for pipe diameters 24 inches and larger as 12 inches greater than the pipe outer diameter.

During preliminary design, a geotechnical investigation plan was developed to gather information on the subsurface conditions at the crossing location. A total of 10 borings were drilled to depths up to 30 feet. Geotechnical boring results indicated that a confining layer (limestone with N>30) existed 22 feet below grade, making the minimum required depth of installation 24 feet. To achieve the necessary setbacks to maintain the required depth below I-75 to satisfy both the UAM and Hazen's independent design criteria, installation by HDD



Proposed construction methods approved by FDOT

would increase the length of the drive to almost 1,300 LF.

As noted above, the Waterford Golf and Country Club maintains a tee box just over 20 feet from the edge of the ROW. With the setbacks described above, an HDD alignment would result in an entry pit further into the golf course, requiring a full shutdown of Hole No. 4 and significant damage to the course. This was deemed to be an unacceptable impact on the property owner. Additionally, the large setback with the HDD alignment created an unacceptable impact at the EWRF site with respect to operations and safety. Pipe string-out would require closing the entrance road to the EWRF and limiting structure and equipment access.

Once it was determined that an HDD alignment was not feasible, tunnel alternatives were evaluated. The geotechnical results indicated that above the limestone, ground conditions consisted of poorly graded sands with silt and shell fragments, with blow counts ranging from weight of hammer (WOH) to N=8, and a groundwater table only 2 feet below grade. Slurry microtunneling was selected for design to address the potential for running sands.

For a single full-length trenchless crossing (greater than 1,000 LF), a 60-inch diameter microtunnel boring machine (MTBM) was recommended. The increased drive length posed a higher risk of excessive axial jacking loads and created a greater need for internal space logistics to accommodate power and pumping equipment inside the MTBM. Additionally, the long bore length created a significantly higher risk of encountering an installation issue, failure of the trenchless method, or unacceptable roadway settlement.

The City and Hazen were not comfortable with the risk associated with this alternative and were wary of the increased cost of the project if it were pursued. The project team learned that in two other locations near the project site, FDOT had allowed shorter tunnels below the travel lanes, with open cut in the wide median. Hazen decided to pursue a similar variance for this project. FDOT approved this variance, and Hazen proceeded with the design of two separate 42-inch microtunnel installations, with 600 linear feet of pipe installed by open cut in the median. This design reduced the aforementioned risks significantly. Impacts to the golf course were also reduced, requiring only a minor temporary adjustment to the tee box for Hole No. 4. Tie-ins to existing infrastructure on the west side of I-75 were coordinated with Waterford Golf and Country Club to occur when the course was shut down for aeration and seeding.

Two vertical alignment alternatives were evaluated during design. Hazen first looked at an alternative with several tunnel diameters of cover to put the tunnel into stiffer material and reduce the risk of surface settlement. However, this resulted in a deep open cut installation in the median. This introduced more complex shoring requirements and dewatering needs. It was not possible to raise the elevation of the pipeline within the median between tunnels, as FDOT would not allow an air release structure within their ROW. The second alternative, which was carried forward in the design, was a shallow microtunnel installation below the travel lanes. The final design included two tunnels with a minimum of 7 feet of cover below the pavement, with open cut installation at a trench depth of less than 8 feet in the median.

During the encroachment process with FDOT, to add additional flexibility to the

> ***"The project was an unqualified success - the result of a combined effort by all members of the project team."***

> ***I-75 is a critical highway in FDOT's system - damage to the roadway caused by settlement or heave was considered intolerable.***

Excavated spoils being removed by the two-stage slurry separation plant

design and with a goal of obtaining more competitive bids, the design team provided 4 different allowable tunnel diameters on the drawings, ranging from a minimum size of 42 inches up to 60 inches. This gave a range of tunnel diameters to accommodate different machines owned by different contractors.

BIDDING

Interstate 75 is a highly traveled highway and is the main artery between Tampa and South Florida on the Gulf Coast. Any settlement or heave to the Interstate was viewed as intolerable. Although this was the first microtunnel to be designed within the City of Venice, their staff understood the technology and the risks, and also knew of the high prevalence of claims in this type of work. To ensure that a qualified and experienced microtunneling contractor was awarded the job, a request for proposals was posted for subcontractor prequalification, listing experience requirements for microtunneling contracting firms and their proposed staff. Hazen performed an extensive review of the qualifications submitted, and Q&A sessions were held between the Contractors and the City. As a result of this review, a total of 5 microtunneling contractors were prequalified for the project.

Another risk mitigation measure included in the design and bidding phase was the inclusion on the Bid Form of a contingency allowance for cellulose material. Although the geotechnical investigation did not suggest the presence of cellulose material, project experience and local knowledge indicated that during the construction of major roadways in Florida, felled trees were often used as backfill material to build embankments for roadways. The allowance in the bid specified that if encountered, the Contractor would be paid per hour of standby time spent by the Contractor to excavate and remove the cellulose material incurred in the tunnel alignment, including cleaning and maintenance on the slurry system. By including this allowance on the Bid Form, the Contractor did not have to include this risk in their bid, and it provided a method of payment without needing to submit a claim, which lowered the Owner's risk of receiving claims during construction. The contingency allowance was a stipulated amount reserved for use by the Owner to cover unanticipated costs and resulted in a competitive price on the Bid Form.

Bids were received on April 14, 2023. The City negotiated with the apparent low bidder, and the Contract was awarded to DeJonge Excavating Contractors, Inc. (DeJonge) on July 3, 2023, for a construction cost of $6,580,063. Vadnais Trenchless Services, Inc. (Vadnais) was included in DeJonge's bid as the microtunneling subcontractor. Notice to Proceed was given on July 24, 2023.

CONSTRUCTION

Vadnais mobilized their equipment to the site at the end of February 2024. Vadnais selected the Iseki 900 microtunneling machine to perform the work of excavating a 42-inch tunnel. Although an older machine, it met the contract's equipment performance requirements and had been used successfully by Vadnais Trenchless for years. The crew was familiar with the equipment and knew the ins and outs of its specific performance.

The Down2Earth Herrenknect jacking frame and extension allowed for the use of 20-foot steel casing and had a capacity of 320 tons. A two-stage slurry separation plant was employed, using a coarse screen in the first stage, with hydrocylones and a fine screen in the second stage.

For steel casing pipe, the contractor elected to use Trinity Product's Tri-Loc 42-inch interlocking joint casing. The pipe joints were manufactured using Trinity's in-house equipment to cut the teeth directly into the end of the pipe joint, instead of traditional V-notch welded joints.

Tunneling of the northbound lanes was scheduled to be performed first, and after dewatering was set up, the launch shaft was excavated and the microtunneling equipment set in place. The first microtunnel was launched mid-afternoon on March 19 and advanced 12 feet. The tunnel was completed in the afternoon on March 23, just 4 days later, with Vadnais achieving production rates

Vadnais personnel line up the Tri-Loc steel pipe

Carrier pipes included 24-inch DIP and 4-inch PVC conduit for a fiber optic line between 60 and 80 feet per day. When just looking at active mining time, the average advancement rate of the machine was 3.6 inches per minute.

Tunneling of the southbound lanes was undertaken next. After relocating all the equipment to the other side of the median and setting up, Vadnais launched the machine for this second tunnel on the afternoon of April 8. The tunnel was completed 3 days later on the afternoon of April 11, advancing at a rate of 80 feet per day. The average advancement rate of the machine during mining was 3.75 inches per minute. Dewatering operations lowered the groundwater sufficiently so that an exit seal was not required for either tunnel.

As previously stated, I-75 is a critical highway in FDOT's system, and damage to the roadway caused by settlement or heave was considered intolerable. A settlement monitoring plan was developed during design in cooperation with FDOT to monitor both surface and subsurface movement above the tunnel. Discussions with FDOT indicated they did not want active survey crews within the travel lanes of the interstate due to the required traffic control. In this location, the interstate had wide shoulders, which allowed two rows of surface settlement monitors (PK nails) to be installed at the edge of pavement and the edge of the closest travel lane on either side of the crossing.

PK nails were installed at centerline, and also at an offset 10 feet to the left and right of the alignment centerline. There were also three subsurface settlement monitors installed within the unpaved areas between the roadway and the tunneling shafts for each tunnel. These monitors consisted of a steel rod embedded in crushed stone within a buried sleeve to within two feet above the tunnel crown. The settlement monitors were surveyed by a 3rd party licensed surveyor (Levine Surveying), who was onsite daily before 7:00 am to record the elevation of all settlement markers.

Daily measurements while tunneling indicated that all surveyed locations recorded less than 1/8th of an inch of settlement (less than 0.01 feet). All monitoring points were surveyed again 90 days after the completion of the tunnel to confirm no long-term settlement. Again, all points were recorded as showing less than 1/8th of an inch of settlement. During construction, excavated material consisted primarily of sand and shell fragments, with the occasional occurrence of wood chips resembling mulch. Neither tunnel encountered any widespread cellulose material that indicated the presence of a downed tree which would have triggered the contingency allowance.

Once the tunnels were complete, 24-inch DIP and a 4-inch PVC conduit for future fiber optic cable installation were installed within the tunnels on casing spacers, and the annular space was backfilled with low-density cellular concrete. The general contractor then

Microtunnel launch shaft

Breakthrough of the 42-inch microtunnel machine into the reception shaft

installed 24-inch PVC by open cut methods within the median and made tie-ins on either side of the interstate. The project was completed and the force main was placed into service in June 2024.

SUMMARY

The City of Venice understood the complexities and risks associated with this project, and prioritized risk avoidance and risk management during all phases of this project. Vadnais Trenchless sent a top-notch crew, who were hard-working and professional, taking great pride in their work. DeJonge Contractors managed the project to ensure proper communication and work sequencing. Levine Surveying was on site daily to survey the settlement monitors amidst heavy traffic to track road surface movement. In addition to design and bidding assistance, Hazen and Sawyer provided full-time construction observation for the tunneling work as the City's representative to track production, monitor the excavated material, and develop extensive documentation to facilitate claim resolution between the parties if needed.

The project was an unqualified success in terms of meeting the goals of crossing the Interstate lanes without significantly impacting the EWRF, golf course, or Interstate. This success was the result of a combined effort by all members of the project team. ***More details about the design and construction of this project will be presented at the NASTT 2025 No-Dig Show in Denver, Colorado, March 30 – April 3, 2025.***

ABOUT THE AUTHOR:

Kim Hanson, PE *is a Senior Associate with Hazen and Sawyer in Raleigh, NC, specializing in tunnel and trenchless design and construction management. She is currently on the National NASTT Board of Directors and serves on the board of the Southeast NASTT chapter.*


Underground Magnetics
simple. powerful. affordable.
BORE-TO
STEERING MODE
AUTOMATED
DATA LOGGING
REBAR
FREQUENCIES
UMAG
MAG
X
PRO
12:30
+0.0%
WARNING
Please read the manual before operation
WARNING
Please read the manual before operation
UMAGHDD.COM | 515.505.0960

THE LEADER IN

CURED-IN-PLACE LATERAL REHABILITATION

Service Connection Seal + Lateral (SCS+L)

Why BLD?

- Full-wrap one piece liner installed from the main line
- Hydrophilic material provides a water-tight gasket seal
- Extends up to 80+ feet with no cleanout/ access point required
- Manufactured and installed by BLD
- Independent 10K hour product testing

BLD SERVICES, LLC

bldllc.net | info@bldllc.net | 504-466-1344

2424 Tyler St, Kenner LA 70062

The largest CIPP service lateral contractor in the U.S.A.

WHAT TO KNOW ABOUT CIPP LATERAL REHAB

Municipalities who have adopted this approach are reaping the benefits of reducing I/I

By: Nicole Little, BLD Services LLC

Half a century has passed since Cured-in-Place Pipe (CIPP) entered the U.S. market in the early 80's to rehabilitate sanitary sewer mainlines. Over time, the popularity of CIPP has steadily increased due to the effectiveness of this technology's reduction of Inflow & Infiltration (I/I) by constructing a new pipe-within-a-pipe, while also significantly lengthening the life cycle of the renewed pipe. This form of trenchless rehabilitation was found to reduce I/I by approximately 50 percent (dependent on the condition of the host pipe).

After the success of this technology with mainline sewer, the market has branched out to using CIPP for sanitary laterals. The latest statistics show that there are over 76 million service laterals in the United States equaling 500,000 miles of pipe, the majority of which was installed alongside the main line pipe, and now, both are reaching the end of their life cycle across the country. Data gathered by numerous studies throughout the U.S. has shown that a substantial amount of infiltration can be reduced by taking a holistic approach when forming an I/I program, to include mainline, manhole, and service lateral renewal.

THE ONGOING FIGHT AGAINST I/I

While a 50 percent +/- reduction is acceptable in many sewer systems, some owners found this to be insufficient as infiltration would simply travel through any annular space that may be present between the host pipe and the main line CIPP, only to enter the newly rehabilitated pipe typically occurring at the manholes and service laterals. A comprehensive study within the Oak Valley basin by Metropolitan Nashville was conducted in the early 1990s to determine the effectiveness of a holistic approach to rehabilitation including main line CIPP, lateral rehab, and manhole rehab in efforts to reduce the amount of I/I entering the system.

The study used flow monitoring to determine flow levels before any rehabilitation commenced to determine an accurate baseline reading. Subsequent readings were then taken which showed slightly more than a 50 percent reduction in I/I following only mainline CIPP. However, that number increased to a total of 85 percent reduction after completing the service lateral rehabilitation portion of the project. The service laterals were addressed using either trenchless methods or conventional "dig and replace."

Many feel the Oak Valley study was the catalyst… which ultimately kickstarted the service lateral rehabilitation industry.

While the mainline CIPP rehabilitation resulted in a significant amount of I/I reduction, the Oak Valley study identified service laterals as a significant source of infiltration into the system. Many feel the Oak Valley study was the catalyst in identifying the impact that service laterals have as a source of I/I which ultimately kickstarted the service lateral rehabilitation industry.

THE LATERAL MARKET TODAY

The market is witnessing a shift in the philosophy among municipalities planning sewer rehabilitation work. Recent trends in rehabilitation include a more holistic approach, evident by the types of sewer projects municipalities are publicly soliciting. Utility Managers, Public Works Directors, and Engineers in this sector have realized that they must adopt a comprehensive methodology to their rehabilitation efforts and include all aspects of sewer collection to mitigate I/I in their system. Data has consistently shown that groundwater will eventually find the path of least resistance into the pipe at manholes and service laterals when there is only rehabilitation of the main lines. This has created a surge in the service lateral renewal market, and municipalities who have adopted this approach are reaping the benefits of reducing I/I by lower treatment levels, energy savings form reduced pump station activity, and elimination of sanitary sewer overflows (SSO). Additional reduction in I/I by addressing the service laterals also results in EPA and DEP compliance of consent orders.

WHO IS RESPONSIBLE?

A major question when addressing service laterals is, "Who owns the lateral and who is financially responsible for fixing it?" The short answer is that it depends on the municipality. "We have seen multiple ideologies regarding this issue after working with nearly 1000 municipal customers over the past 15 years" said Jacob Trapani, VP of BLD Services LLC. "Some owners take no responsibility over the service lateral, including the connection point, while others have declared eminent domain to the structure in order to perform rehabilitation and then relinquish ownership back to the resident," Trapani added. In most cases, municipal ownership extends to the right-of-way. This is a substantial portion of the pipe where issues can be addressed without the concern of private ownership. Trenchless renewal of service laterals from the connection at the main to the property line significantly reduces I/I that may otherwise have entered the system.

Each sewer system is unique, and it is up to the discretion of the owner to determine how CIPP lateral lining can best be utilized to achieve their goal of successful rehabilitation and I/I reduction. The costs associated with only installing the connection seal inside the main vs extending the CIPP to the property line are minimal and can increase the return on investment for the owner.

IDENTIFY THE PROJECT SCOPE

What are the municipality's ultimate goals for performing sewer rehabilitation? If the main goal is to reduce I/I within the system, then it's important to measure the

Recent trends in rehabilitation include a more holistic approach to include mainline, manhole, and service lateral renewal success of the rehabilitation. Implement a comprehensive rehab solution, to include mainline, manholes, and laterals so that the maximum amount of I/I can be mitigated. In some cases, removing excess water out of a sewer system could preclude expensive lift station and treatment plant upgrades.

During the planning stages, choose a manageable area that can be measured before and after the comprehensive rehab, either through flow monitoring, pump run times, etc. This will give stakeholders quantifiable data on the effectiveness of their sewer rehab efforts. Also, determine the length of the lateral to be rehabilitated. Even if the municipality owns only the connection at the main, there will be better results in reducing I/I with longer lateral shots, up to the property line for example.

Another important component that should be performed during the investigation stage of the work, is to CCTV every lateral line congruently with mainline clean and TV, before rehabilitation. This will ensure that capped or dead lateral are not reopened after mainline CIPP, possibly causing another avenue for I/I to seep into the line. The expense for gathering this information on the front side is much less than the expense to perform a spot repair to close off the capped lateral after mainline CIPP rehab.

Is cleanout installation part of the scope? There are differing ideologies on this subject depending on which municipality you ask. Some feel that cleanouts should be installed at the property line for lateral CIPP, and others have experienced issues with this; homeowners removing the caps to let their yards drain (increasing inflow), legal issues of stepping or running over the caps with their lawnmowers, and the list goes on. The answer to this question ultimately lies with the system owner, however there are full-wrap lateral CIPP technologies performed from the mainline on the market that do not require cleanouts to be present, that can reach up to 90+ feet in one installation, such as BLD's Service Connection Seal + Lateral (SCS+L). No cleanout is required, and long lengths are installed daily across the country.

> ***"It is important to continue to educate the public on the benefits of trenchless."***

Important to measure the success of the rehabilitation

PUBLIC EDUCATION

With the continued acceptance of trenchless methods of rehabilitation by owners and engineers, it is important to continue to educate the public on the benefits of trenchless as opposed to traditional dig and replace methods to extend the life of their sewer lateral. Public outreach programs have shown to garner homeowner support for municipal sewer rehab programs and engage public interest in their environment.

Education is important but so is having a competent workforce to complete the installations. "To continue the growth, there needs to be qualified contractors who can do the work. It's a niche industry and I liken laterals to snowflakes everyone is a little different," says Trapani. "We need to make sure we don't ruin the lateral rehab market by having unqualified contractors doing lateral work and creating a bad image that does not fix the problem."

ABOUT BLD SERVICES, LLC:

__BLD Services, LLC__ leads the US market in CIPP Lateral Rehabilitation, with over 35 crews throughout the eastern half of the United States and more than 1000 years of combined staff and field experience in trenchless sewer construction. BLD manufactures and installs its own product, providing customers with one point of contact for CIPP Lateral Liner installation and product.

EMERGING TECHNOLOGY:

Close Tolerance Pipe Slurrification (CTPS) for Asbestos Cement Pipelines

By: Andrew Costa, Insituform Technologies

> ***Municipalities have long sought an EPA approved trenchless method to address the billions of feet of AC pipe.***

There are over 630,000 miles of Asbestos Cement pipe buried across the United States that have reached or will reach the end of their estimated design and useful lives. Like most of our buried infrastructure, the time has come to renovate or replace these systems. Naturally, the focus is on how to accomplish the work most efficiently and economically with the least disruption to the public as necessary. Removing and replacing Asbestos Cement pipe has the additional burdens of complying with NESHAP and OSHA requirements which govern the handling, removal, and disposal of any material containing asbestos.

On June 10, 2019, the EPA approved a request for an alternative work practice (AWP) called Close Tolerance Pipe Slurrification (CTPS) to replace, rehabilitate, and repair existing buried Asbestos Cement (AC) pipe systems. Subsequently, the EPA has determined that CTPS is an equivalent work practice to open cut pipe replacement for replacing, rehabilitating, and repairing Asbestos Cement (AC) pipe. Consequently, any AC pipe replaced by the CTPS method would not be required to meet the NESHAP requirements regarding Active and Inactive Waste Disposal Sites, as would be the case with the pipe bursting method.

Close Tolerance Pipe Slurrification (CTPS) is a proven "trenchless technology" method used to remove and replace an existing pipeline with minimum amounts of excavation. The CTPS method removes the existing pipe by pulling a rotating cutting head through the existing pipe while simultaneously injecting a bentonite-based lubricating fluid. The cutting head rotates at sufficient speed to grind the existing pipe, surrounding soil, and bentonite-based lubricating fluid into a slurry. This slurry is squeegeed or forced out of the ground into a receiving pit by the new pipe that is being pulled in behind the cutting head as the entire process is running concurrently. As a result of the CTPS process completion, the existing pipe is removed, the new pipe is installed through the subsequent tight-fitting void, and the slurry containing the existing pipe fragments, soil, and bentonite-fluid is removed from the ground.

When the patented CTPS process is used to remove and replace Asbestos Cement pipe systems, there are several important components of the process that match extremely well with regulations surrounding AC pipe work. First, the patented process requires the injection of bentonite-based fluid at critical points. This fluid maintains a wet-cutting environment, which is an important requirement for cutting Asbestos Containing Material (ACM). Second, the "close tolerance" sizing of the cutting head, in relation to the new pipe being pulled into place, facilitates the removal of the Asbestos Containing Material (ACM) from the ground. This "close tolerance" sizing creates a scenario where the new product pipe, along with the injection of additional drill fluid, will pressurize the slurry, which is expelled at excavations. The slurry containing the ACM is then removed from the site. Third, any remaining trace amounts of asbestos fiber are encapsulated in the skim coat of slurry remaining around the pipe. This skim coat has the consistency of a light-weight concrete material commonly known as "excavatable flowable fill".

Applying the CTPS technology to the removal and replacement of Asbestos Cement pipe systems has the potential for several advantages over the alternatives currently available to the municipalities and utility owners charged with replacing AC pipe systems at the end of their design and useful life cycles. The primary methods currently being implemented for replacing AC pipe systems are "open cut" replacement in the same ditch or "open cut" replace in a new trench location.

> ## *CTPS is a proven "Trenchless Technology" method used to remove and replace an existing pipeline with minimum amounts of excavation.*

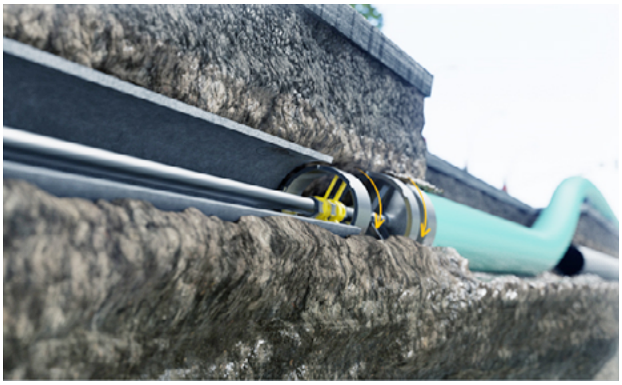


Figure 1. The CTPS process simultaneously grinds the existing host pipe while pulling in new pipe

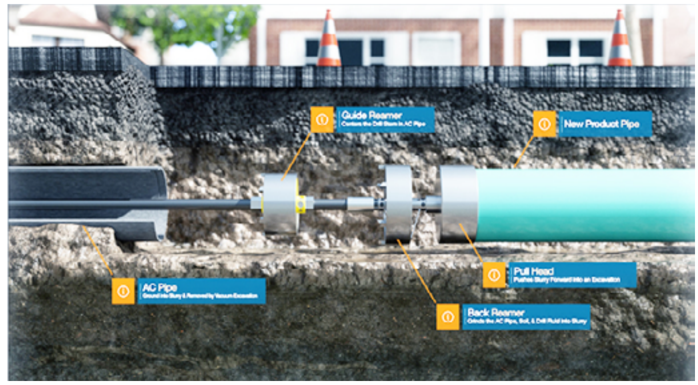


Figure 2. Guide Reamer, Back Reamer (cutting head), and Pull Head components of CTPS installation process

The CTPS method removes the existing pipe by pulling a rotating cutting head through the existing pipe while simultaneously injecting a bentonite-based lubricating fluid. The cutting head rotates at sufficient speed (240 RPMs minimum) to grind the existing pipe, surrounding soil, and bentonite-based lubricating fluid into a slurry. This slurry is squeegeed or forced out of the ground into a receiving pit by the new pipe that is pulled in behind the cutting head. After completion of the CTPS process, the existing pipe is removed, the new pipe is installed through the subsequent tight-fitting void, and the slurry containing the existing pipe fragments, soil, and bentonite-fluid is removed from the ground. Figure 1 represents a visual overview of the process.

The CTPS process starts with two excavations at either end of a pipe segment to be removed and replaced. The horizontal directional drill (HDD) rig sits at the machine pit where the existing pipeline is used as a pilot hole. The horizontal directional drilling (HDD) rods are pushed through the existing pipe from this excavation to another where the cutting head and pipe are attached and pulled into place. The back reamer, or cutting head, is held centered in the existing pipe by a guide reamer so that the back reamer cuts uniformly over the existing pipe as shown in Figure 2.

> ## *CTPS process matches extremely well with regulations surrounding AC pipe work.*

Thus, the CTPS process will keep the alignment and grade of the existing pipeline. CTPS does not displace the existing pipe fragments into the surrounding soil, but rather cuts the soil ½ inch more than the outside diameter of the new pipe being installed and then blends the soil and existing pipe fragments into a slurry that is squeegeed (forced) out by the new pipe being pulled into place. The slurry (consisting of the soil and pipe fragments) is pushed or squeegeed to access points in front of the pipe being installed where it is removed by a vacuum excavator and hauled to a landfill.

KEY COMPONENTS OF CTPS

Bentonite-Based Drill Fluid for "Pipe Slurrification"

The patented process requires the continuous injection of a bentonite-based fluid at critical points throughout the duration of the process. This drill fluid serves several important functions in the CTPS process. Bentonite-based drill fluid is one of the key components of achieving slurrification of the AC pipe and enabling the ability to move the unwanted material to the pits for removal.

First, the drill fluid's lubricating properties are key to mixing the existing pipe and soil into a slurry when the cutting head is rotated at sufficient speed; much

Figure 3. Grinding of AC pipe and mixture with drill mud creates the slurrification during the process

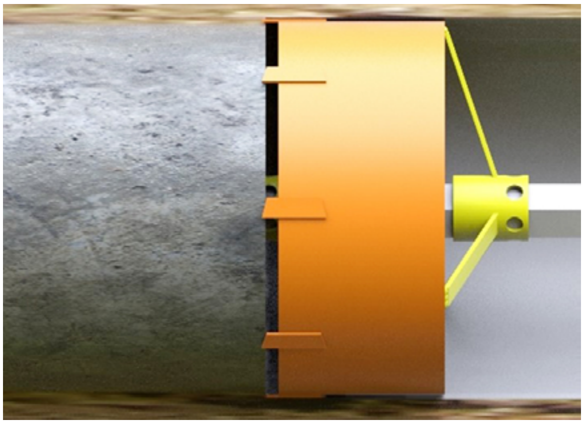


Figure 4. Close Tolerance of ½-inch is one of the important keys to the slurrification removal

like a blender would mix cake batter and water to create a semi-liquid slurry. The "blending' of the existing pipe material, soil and drill fluid is the essence of the "pipe slurrification" process. Figure 3 shows the slurry created from the mixture of ground AC pipe and drilling fluid.

Fourth, the drill fluid (turned slurry) lubricates the tight-fitting void or opening so that the new pipe can be pulled through the void from one excavation to the other. This lubrication keeps the new pipe from becoming stuck in the tight-fitting void due to surface friction.

Finally, the "pipe slurrification" process grinds and reactivates the cementitious properties of the AC pipe; whereas these cementitious particles combine with the slurry to harden into a material with the consistency of a light-weight concrete material commonly known as "excavatable flowable fill".

This material fills the ½-inch annular space between the new pipe and virgin soil, forming what the EPA describes as a skim coat around the new pipe. Consequently, any remaining trace amounts of asbestos fiber not removed are encapsulated in this skim coat of slurry remaining around the pipe. Again, this skim coat has the consistency of a light-weight concrete material commonly known as "excavatable flowable fill".

Figure 5. The slurry mix is vacuum excavated from the access pit and hauled away for disposal

The Importance of "Close Tolerance"

The term "close tolerance" refers to the fact that the cutting head is sized only ¼ inch larger than the outside diameter of the new pipe that will be installed behind the cutting head. Consequently, the cutting head creates a tight-fitting cavity or void only slightly larger than the new pipe being pulled into place. This "close tolerance" of ½ inch is critical so that the pulling head that attaches the new pipe to the cutting head will squeegee or force the slurry that contains the soil, pipe fragments, drill fluid out of the tight-fitting void while it is pulled through. See Figure 4.

Excavations

As described, the injection of bentonite-based drill fluid, "pipe slurrification, and "close tolerance" sizing of the cutting head creates a scenario where the slurry becomes pressurized when the new pipe is pulled into place. This pressure facilitates the eventual removal of the slurry at strategically located excavations. Often, these are excavations that would have occurred naturally at bends, tees, wyes, valves, etc.

"Close Tolerance" differentiates from traditional HDD practices where the cutting head is sized to 1.5 times larger than the outside diameter of the new pipe to be installed; for example, a 12-inch void would be created to pull in an 8-inch pipe. Consequently, the larger void of traditional HDD allows the new pipe being pulled in place to float through the slurry rather than squeegee the material into an excavation where it can be removed from the site. Thus, with the traditional HDD method the bulk of the slurry is not removed from the underground cavity.

Variance from the combination of "close tolerance" and "pipe slurrification" process in any way will significantly diminish the ability of meeting the intent of the approved Alternative Work Practice (AWP) for Using CTPS for Removing Asbestos Cement Pipe, so it is critical that the CTPS process as a whole incorporates both of these key components.

Safety

To date, two federal agencies have been principally responsible for generating regulations for asbestos control; the U.S Occupational Safety and Health Administration (OSHA) and the U.S. Environmental Protection Agency (EPA). The EPA regulates asbestos through the National Emissions Standards for Hazardous Air Pollutants (NESHAP)

To comply with the Alternative Work Practice (AWP) for Using Close Tolerance Pipe Slurrification (CTPS) to Replace AC Pipe, the pertinent NESHAP and OSHA regulations that affect and govern the removal and replacement of AC pipe must be recognized, understood, and followed. While the EPA regulations are generally concerned with notification, air quality, and disposal requirements that effect the long-term impact of asbestos fibers on the public and the environment, OSHA regulations are generally related to the immediate and long-term safety of the employees working with and around asbestos containing material. Expansion on these regulations as they pertain to CTPS and the handling of AC pipe will be discussed in future papers.

Applications

While it would be possible to use the CTPS method on deeper applications, the excavation where the drill stem enters the pipe would be elongated in relation to the depth of the pipe. This is due to the limited bending radius of the drill stem. Consequently, the economy and value of the method diminishes with depth. For this reason, the CTPS method would be most favorably applied to shallower pipes where long segments of pipe can be replaced in one pull such as in the rehabilitation of potable water mains and force mains. The technical envelope for the application is from 4- to 24-inch asbestos cement pipelines. Particular use cases within the technical envelope revolve around projects whereby the removal/replacement of AC pipes is not cost effective, carries higher social costs, and instances where a faster project is preferred. Additionally, open cut projects that are using a new pipe route or alignment involving land or easement acquisition, additionally permitting, etc. are excellent fits for the CTPS method, since it utilizes the existing pipe alignment.

Industry Implications

Currently, the only EPA approved solution for replacing an existing AC pipe is dig and replace or abandonment. Pipe bursting, unfortunately, is not currently approved by the EPA as a replacement method for AC pipe. Therefore, municipalities have long sought an EPA approved trenchless method to address the billions of feet of asbestos cement water mains and force mains that have systematically begun to fail. With an EPA Alternative Work Practice (AWP) and a cost advantage over open cut replacement, CTPS instantly becomes the most viable option in these AC pipe replacement projects.

ABOUT THE AUTHOR:

***Andrew Costa** has worked in the trenchless water/wastewater industry since 2006. His experience includes positions in the contracting, manufacturing, and distribution sectors. His expertise in the water/wastewater markets includes cementitious/polymer manhole rehabilitation, specialty coatings, cured-in-place pipe (CIPP) rehabilitation, carbon fiber remediation, geopolymer solutions, and concrete corrosion. He is currently a Vice President of Sales for Insituform Technologies - the leading worldwide provider of CIPP and other technologies/services for the rehabilitation of pipeline systems. He is currently on the National NASTT Board of Directors and serves on the board of the Southeast NASTT chapter.*

MARCH 30-APRIL 3 | DENVER, CO

NO-DIG SHOW 2025

THE NASTT 2025 NO-DIG SHOW **MUNICIPAL & PUBLIC UTILITY**

Scholarship Program

The NASTT No-Dig Show Municipal & Public Utility Scholarship Award has been established to **provide education and training** for North American municipalities, government agencies and utility owners who have limited or no travel funds due to restricted budgets.

Selected applicants will be awarded **complimentary full conference registration** to the NASTT 2025 No-Dig Show in Denver, CO, March 30 - April 3, 2025. One day conference registrations will also be available. Registration includes **full access to all exhibits and technical paper sessions**… all you have to do is get yourself to the conference! Selected applicants will also be eligible to receive **overnight accommodations**. Selection based on responses to the application as well as need.

APPLY TODAY! Application deadline is November 1, 2024.

NETWORKING EVENTS | EXHIBIT HALL | TECHNICAL SESSIONS

Visit **nastt.org** to learn more

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.

PPI

Plastics Pipe Institute

MUNICIPAL & INDUSTRIAL

HDPE Pipe - Your Best Solution

With a 100-year design life, zero allowable leakage, the largest flow capacity and fatigue life, resistance to corrosion, freeze/thaw events, wet/dry cycles, ground movements and earthquakes, HDPE piping is superior for trenchless installations.

Recognized by the AWWA C901 & C906 and ASTM F1962, F585 & F3508 Standards plus the AWWA M55 and M28 Manuals.

For more details, visit www.plasticpipe.org/MABpubs

HDPE MUNICIPAL ADVISORY BOARD

Find out more:

A not-for-profit association, the Plastics Pipe Institute, Inc. has the technical information, data, field reports plus professional engineers to help in the design and selection of the proper components for your system.

LARGE-DIAMETER SUBAQUEOUS MICROTUNNELING IN DENSELY URBANIZED DOWNTOWN TAMPA, FLORIDA

By: David M. Sackett, Brierley Associates Corporation

INTRODUCTION

Tampa, Florida has increased in population by over 40 percent since 2000, and downtown Tampa is one of the fastest growing metropolitan sectors. The wastewater transmission from the downtown area is via an existing force main pipe installed in 1951. More than 15 million gallons (more than 30 percent of the city's total) is transported daily by the forcemain to the Howard F. Curren Wastewater Treatment Plant (WTP) located on Hookers Point about 1.5 miles to the southeast.

Since 1976, the City of Tampa has replaced and relocated various segments of the original forcemain and has performed renovations of the downtown Krause Street Pumping Station. However, almost 9000 linear feet of the original pipe in the sector of the Port of Tampa was still in service as of 2020, well past its design life and at risk of major failures. The City of Tampa contracted a Design-Build team to replace the forcemain with a new minimum 54-inch carrier pipe. The Design/Build team of Wade Trim of Tampa, FL (designer) and Kimmins Contracting Corporation of Tampa, FL (general contractor) were awarded the project including several trenchless crossings and thousands of feet of surface trenched installation. The D/B team in turn hired Brierley Associates of Tampa, FL as microtunneling specialist and Primoris Services Corporation of Dallas, TX as microtunneling contractor.

The new forcemain installation includes a subaqueous component that extends from the east side of the Port of Tampa, trending westward beneath the Ybor Turning Basin of the Port of Tampa shipping channel, terminating within Fort Brooke-Cotanchobee Park (Figure 1). For this subaqueous crossing, the pipe was installed via a two-pass method. The casing pipe was installed using microtunneling techniques consisting of 78-inch OD, 1-inch wall thickness steel pipe. Subsequent to the microtunnel installation, the Contractor installed 54-inch ID Hobas fiberglass carrier pipe with minimum wall thickness of 1.34 inches, centered within the casing pipe.

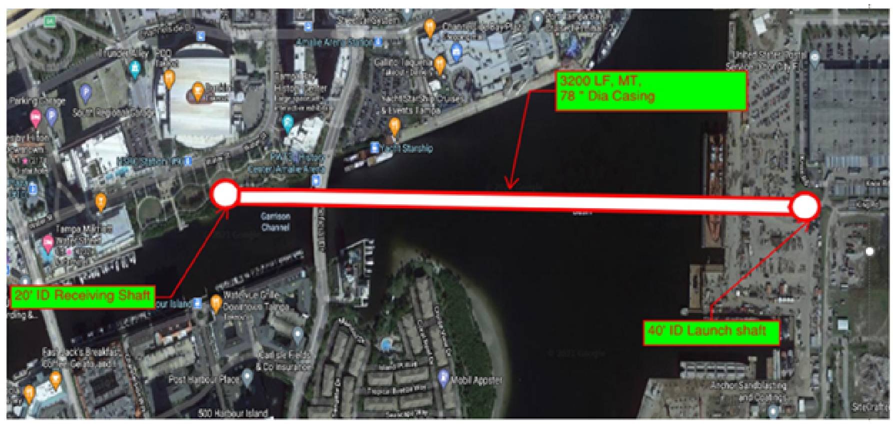


Figure 1: Location and dimensions of microtunnel and shafts between the Port of Tampa (right) and downtown Tampa (left). Image provided by Primoris Services Corp

REGIONAL GEOLOGY AND GEOMORPHOLOGY

Tampa Bay is a shallow bay that has formed since the end of the latest Ice Age about 11,000 years ago when global sea levels were as much as 400 feet lower, and the coast was up to 60 miles west of the modern shoreline. At that time the Tampa area was a low-lying swampy river valley draining southwestward towards the coast. As global sea levels rose the valley became inundated by seawater to form the modern-day Tampa Bay. This relatively rapid change of depositional environments has resulted in the surficial sediments overlying bedrock being composed of variable amounts of fat clays to coarse sands. These sediments are underlain by a complex sequence of weak to moderately strong carbonate rock with a dip to the southwest towards the coastline at a very gentle angle (note that Figure 2 is depicted at a highly exaggerated vertical scale).

Extensive man-made alterations to the waterfront have occurred in recent times, including the periodic dredging of the Upper Sparkman Channel of the

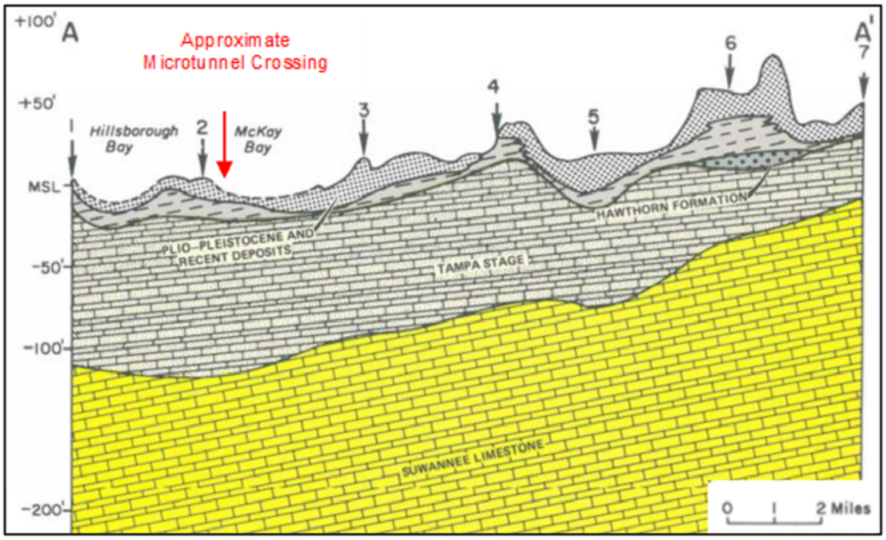


Figure 2: Shallow Geological Formations in the Vicinity of the Project Area (modified from Wright, 1974)

Ybor Turning Basin to 30-40 feet below sea level. Figure 3 shows the extent of modifications of the waterfront in the downtown Tampa area during the period of swift expansion in the early 1900s. This was a period when Tampa was reclaiming large swaths of land while widening and deepening the waterways surrounding the downtown area to accommodate the rapidly increasing ship traffic related to import and export of tobacco, petroleum, and food stuffs. Construction records of infilled areas are scant, and the depths and materials that make up the zones of reclamation are highly variable. Although the microtunnel was at a depth below this zone of man-made modifications, the shafts were constructed within thick sequences (up to 20 feet for the receiving shaft) of variable Fill material.

GEOTECHNICAL AND GROUND CONDITIONS

A project-specific geotechnical investigation was performed during the preliminary design consisting of three onshore and five offshore borings. Borings were advanced to a minimum depth of 1.5x the tunnel diameter, or at least 10 feet, below the tunnel invert. The three onshore borings were located near to the shaft locations while the offshore borings were drilled from a spud barge and were typically spaced on 500- to 600-foot centers within the Ybor Turning Basin. The subsurface profile (Figure 4) prepared along the crossing shows the subsurface materials consisted of highly variable soils and rock layers, without a zone that was clearly advantageous for the microtunnel. Therefore, the tunnel

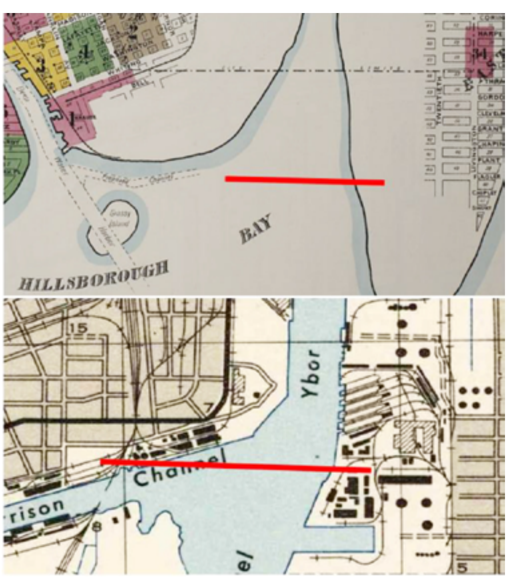


Figure 3: Microtunnel Alignment Overlay of Historical Sanborn Fire Insurance Map (1903) and USGS Topographic Map (1944) showing significant modifications of the shoreline and ship channel in the downtown area during the early 1900s (Note images are at different scales for clarity)

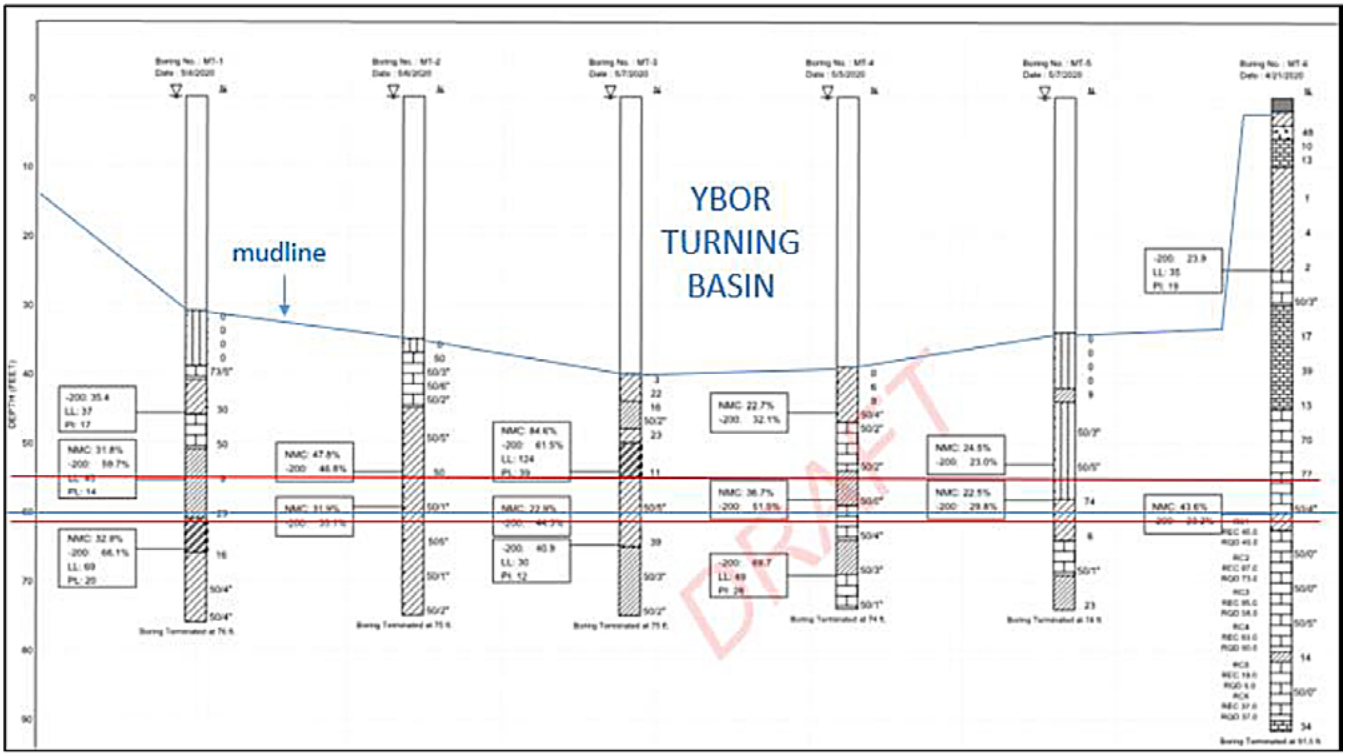


Figure 4: Microtunnel Profile (in RED) Superimposed on Geotechnical Cross Section prepared by MC Squared (2020)

alignment was designed to advance on a flat gradient and be as shallow as possible, while still maintaining at least 2x tunnel diameters of overburden material.

Although the borings indicated that the initial portion of alignment on the east side would be advanced through rock substrate, the opposite actually occurred during mining for the microtunnel. The majority of the soils encountered through the first half of the microtunnel were clayey SAND to sandy CLAY with little rock. The middle of the tunnel alignment was dominated by FAT CLAY with sand, within minimal rock. However, the westernmost portion of the alignment typically included 15-30 percent limestone fragments within a dominantly clayey SAND. Groundwater was encountered at close to Mean Sea Level at both shafts, as might be expected from porous soils within about 200 feet of the waterline.

During the excavation of the shafts, the conditions were frequently different than those indicated by the borings. At the Launch Shaft on the east side of the crossing, only limited rock was encountered during excavation, and the shafts encountered stiff to hard, fat clays near the invert depths. At the Receiving Shaft on the west side, the opposite occurred and more dolomite and chert nodules were encountered near the shaft invert compared to what was indicated by the single nearby soil boring. Figure 5 shows examples of the dolomite and chert materials excavated from the receiving shaft at the west end of the microtunnel.

"One of the most important steps is to prepare a geologic model."

SELECTION OF MTBM SYSTEM

Due to the casing pipe design requirements and the anticipated subsurface conditions, the Microtunneling Contractor elected to use a slurry type microtunnel boring machine (MTBM).

Figure 5: Dolomitic-Limestone Boulder and various chert nodules to 300 mm diameter excavated within the Receiving Shaft

Slurry microtunneling provides continuous face support and transports the excavated ground back to a separation plant via a recirculating slurry system. Slurry microtunneling machines are advantageous for tunneling projects that include:

- Variable geologic conditions from soil to weak rock,
- Difficult subsurface conditions with high groundwater levels,
- Long distance tunnels of larger diameter,
- The materials can be excavated into fragments small enough to be transported within the slurry system.

The MTBM utilized for the project was the MTS Perforator, fabricated in Germany. The rated capacity of the MTBM was 2000 tons. Due to the potential for interventions that could be needed to access the face from within the microtunnel, the Contractor was required to include a hyperbaric chamber for pressurized work. Therefore, the microtunnel train consisted of five modules including the Cutting Head, Secondary Steering Joint, Hyperbaric Chamber, Operations Stand, and Power Pack. The total length of the train was 53.1 feet.

DETAILS OF LAUNCH/ RECEIVING SHAFTS

Construction of the Launch and Receiving Shafts commenced in March 2021 and was completed in early July 2022. Ground elevation at each site was El +6 feet. Due to the high ground water tables and high permeability rates at each location, both shafts were constructed using watertight secant pile designs. The inner diameter of the Launch Shaft was designed for 40 feet, and the Receiving Shaft was designed for an interior diameter of 20 feet.

The Contractor installed a series of vertical 46-inch diameter secant piles (Figure 6). Concrete mix specifications for the secant piles called for a minimum of 4000 psi after 28 days. Due to the presence of rock layers in the shaft interiors, they also destructively drilled a series of 16-inch diameter holes throughout the shaft footprint inside the secant piles to break up the subsurface materials and improve daily excavation quantities. Once the secant piles were installed and destructive holes through the shaft interior were drilled, the excavation of the shafts commenced "in the wet" (with the shafts filled with groundwater). A long reach excavator was used to a depth of about 15 feet, and marine clam shell dredging was employed thereafter to at least 78 feet below grade.

The excavated ground encountered at the Launch Shaft consisted of limey clays and sands, with only limited quantities of limestone. At the Receiving Shaft, the excavated material was dominantly limestone rock with dolomitic layers, with occasional cobble-sized chert nodules and lenses up to 12-inch diameter (Figure 5).

Divers worked extensively in the water filled shafts to confirm that they were

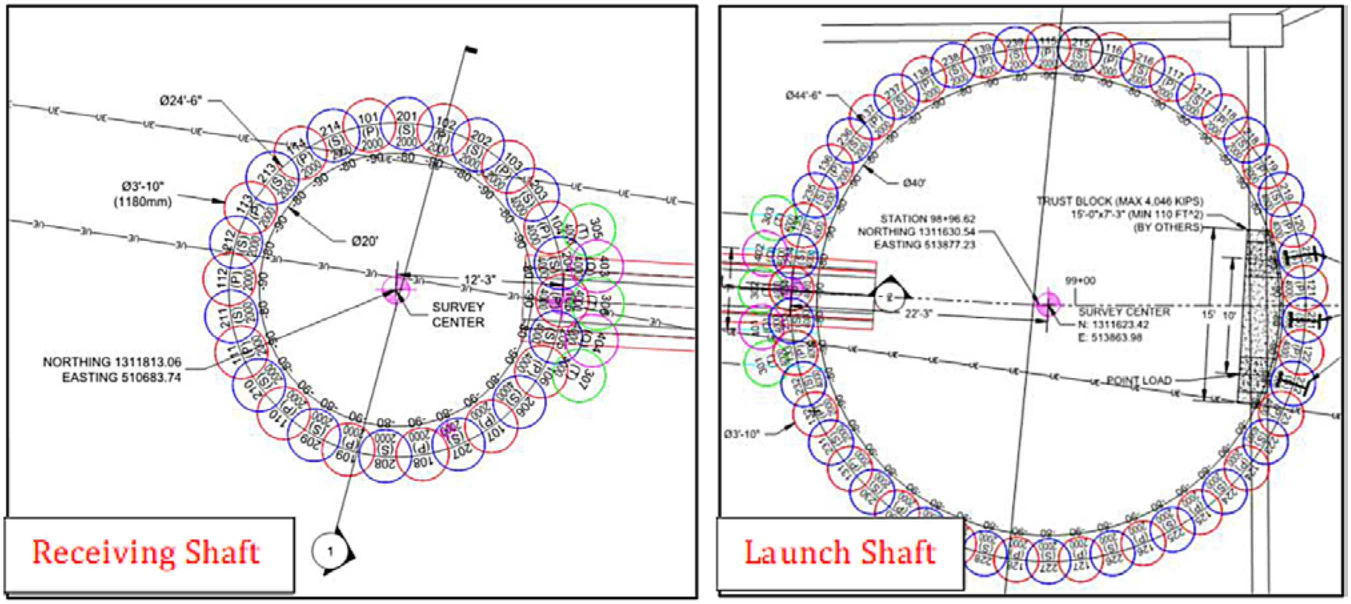


Figure 6: Plan Views of Secant Pile Wall Designs for Receiving and Launch Shafts (Excerpt from Primoris submittals, 2021)

being excavated to plan geometry. Once the shaft had been excavated to design depth, tension anchors were installed to approximate EL -83 feet prior to pouring a 6-foot-thick concrete tremie slab in each shaft. Due to problems with leakage of groundwater into the shaft along the edges of the tremie slab, the shafts were not initially watertight. Supplemental chemical grouting was then performed by a local specialty grout contractor. The chemical grouting eventually diminished the leaks, and the installation of the entry seal and microtunneling equipment was performed in July-August 2022.

DETAILS OF STEEL CASING PIPE AND INTERMEDIATE JACKING STATIONS

The steel casing pipe selected for the project was Tri-Loc Pipe from Trinity Products of St Louis, Missouri. Pipe was fabricated in 20-foot lengths with 78-inch OD x 1-inch wall thickness (Figure 7, left side photo). The allowable jacking load for the steel pipe was 2200 tons accounting for a Factor of Safety of 2.0. One grout port was installed per joint for lubrication and annular grouting. A total of 157 Tri-Loc pipe joints were delivered to the project site. Leakage through the joints due to the high hydrostatic pressures was mitigated by performing a full exterior circumference bead weld on each pipe joint, which was not accounted for during design and scheduling.

Six Intermediate Jacking Stations (IJS) were installed, each with an additional 1030 tons of thrust capacity (Figure 7, right side photo). The IJS units were fabricated by Lowers Welding & Fabrication, Inc, of Santa Fe Springs, CA. Fully extended, each IJS was designed to expand by an additional 27.5 inches.

Ultimately, jacking forces only exceeded 80 percent of allowable pipe jacking loads

Figure 7: Tri-Loc pipe joint being lowered into shaft (left) and Intermediate Jacking Station being built out (right)

(approximately 1770 tons) once the MTBM had reached within approximately 6 feet of the exit seal and was advancing through the concrete secant piles. Therefore, the utilization of the IJS units was limited to the last few days of the tunnel construction during final advancement of the MTBM into the exit seal.

CHALLENGES & LESSONS LEARNED FROM THE HARBOUR ISLAND MICROTUNNEL PROJECT

1) The Tremie Seal did not initially achieve watertightness, particularly at the Launch Shaft, due to presence of stiff to hard clays at the invert which were not successfully removed during shaft excavation – this issue caused both a scheduling delay of several months and required significant remedial work and chemical grouting to seal leaks and eventually achieve a watertight shaft for tunneling.
2) The presence of sticky, limey clays encountered during mining was a constant challenge to maintaining slurry mud weights below 9.5 lbs/gal, which were considered optimal for transporting tunnel spoils through the slurry system. The Microtunneling Contractor brought in extra frac tanks and a second centrifuge system to deal with the thickened slurry, but still struggled to maintain optimal mud weights and lost time occasionally as the slurry fluid had to be cycled several times through the slurry system. The issue was partially mitigated by using several polymer

TUNNEL CONSTRUCTION METRICS

Key tunnel construction metrics based on the full tunnel excavation include:

- Tunnel total length - 3172 linear feet.
- Total 162 pipe joints, including 6 IJS.
- Total field days to complete tunnel: Approximately 180 days.
- Maximum advancement rates – About 2.6 inches / minute.
- Average production – approximately 23-26 linear feet / day.
- Interventions performed – none.
- In-tunnel positioning surveys - Performed every ~300 to 500 feet, with the final survey performed ~130 feet before tunnel breaking into Receiving Shaft.
- Final Position – Entered exit seal on horizontal line and vertical grade within 2 inches of target.
- Contact Grouting – Entire tunnel exterior sealed, maximum pump pressure 5 bar / grout port.

> ***The tunnel was successfully installed without environmental incidents or accidents.***

mud additives used to control mud viscosity and slurry velocity properties.

3) The Microtunneling Contractor used full exterior circumference bead welds on all pipe joints to mitigate leakage problems. This additional effort delayed the schedule and added to project costs.
4) The Microtunneling Contractor used an online data management program to allow the Project Team and Owner to observe tunnel advancement in real time. The information provided in the program included tunnel metrics and visual aids such as map views of tunnel advancement. The use of the program improved communication and reduced downtime due to uncertainties with tunnel progress and assessing line and grade relative to design.

APPLICATION OF LESSONS LEARNED TO MICROTUNNELING IN DENSELY URBANIZED AREAS

The completion of the Harbour Island microtunnel was successfully installed despite many challenges. These challenges and unanticipated conditions led to a delay in substantial completion of the microtunnel of a period of many months. A review of the lessons learned from this project can be applied to other microtunnel projects in other locales within dense industrial or brownfield areas with limited site access. These lessons learned can apply throughout the project, from preliminary design to construction. However, it is important to emphasize that in general the earlier in the project schedule that these lessons are applied, the greater their potential impact can be on cost/schedule savings, or reduction of project risk.

1. Understanding of Current and Previous Land Usage. In many urban areas, successive generations of structures have been constructed, only to be later abandoned and partially- to fully-demolished. This is especially true in historical downtown areas adjacent to water bodies, where early residents and businesses relied on the water for both a source of potable water as well as a food and/or an energy source, constructing piers, mills and dams. Early reclamation projects along the waterfront frequently used whatever materials might be available to fill the voids including boulders & cobbles, surplus concrete, and metallic debris.

Over decades, abandoned structures are often removed at or just below the ground surface, but frequently their associated below grade foundations are left in place and can represent unexpected hazards for microtunneling. Historical maps and aerial photographs, if available, can reduce risk by identifying man-made structures and modifications in the vicinity of the microtunnel alignment. In the United States, historically accurate land use maps are available for the period since about 1867 via the Sanborn Fire Insurance map series that continued through approximately 1970 covering over 12,000 towns and cities in the United States, Canada and select cities in Mexico. The maps generally provide sufficient details regarding street names, property boundaries and lot lines such that they can be scaled. Today, these maps are an invaluable guide to inner-city history, land use, and potential obstructions. International cities outside North America may have similar, historical databases of land use in the form of maps or utility records.

2. Preparation of Project-Specific Geological Model. Despite performing reconnaissance assessments and a high-quality field investigation, tunneling is among the riskiest of construction projects. Unlike conventional construction projects, the site conditions for microtunnel projects cannot be directly observed by the designer or contractor prior to construction. The use of separate preliminary and detailed design geotechnical investigations can allow early identification of subsurface conditions that can represent potential project risks. Typical preliminary design level geotechnical studies include vertical borings performed at shaft locations and along the tunneled portion of the project on 1500-foot or greater spacing. Typical detailed design level geotechnical investigations include vertical or angled borings performed on regular intervals often with 500-feet or lesser spacing. Since the borings are typically between 4 to 6 inches in diameter, ground conditions can only be directly observed from recovered samples in less than 1 percent of the actual material excavated along the tunnel alignment. Given that high degree of uncertainty, one of the most important steps is to prepare a geologic model specifically for the microtunnel project.

In preparing the geologic model, for subaqueous crossings in urban areas near the coastline it is important to remember that during the maximum extents of the last Ice Age (about 12,000 years BP), global sea levels were lowered by more than 330 feet. Therefore, much of the surficial soil materials that today underlie water bodies (bays, estuaries, mouths of rivers) are geologically recent, poorly consolidated materials that are prone to settlement and susceptible to fracouts during microtunneling operations.

3. Modification of Construction Techniques for Observed Ground Conditions. Constructing watertight shafts is critical for moisture sensitive equipment and the safety of tunneling personnel working within the shaft and tunnel. Due to the presence of clayey materials that were not fully excavated prior to placement of the tremie seal, the shafts initially could not be sealed. Divers working in near zero visibility conditions could not distinguish hard clay packing the sidewalls from the concrete secant piles. The resulting leakage from the tremie seal edges resulted in costly delays to the project. However, employing geophysical techniques such as scanning sonars allows a complete 3-D image of the shafts that can show areas of excessive materials that should be removed from the sidewalls prior to placement of the tremie slab. These scanning sonars are portable, relatively inexpensive to use, and provide a more detailed image of the shaft invert and sidewalls than divers can achieve manually.

CONCLUSIONS

The Harbour Island subaqueous microtunnel project involved installing a large diameter steel casing pipe beneath the Tampa Bay shipping channel within a densely urbanized area of the city. Careful planning went into assessing the subsurface conditions and optimizing the tunneling methodology for the anticipated conditions. Geotechnical explorations provided samples of materials for laboratory testing and characterization of the subsurface conditions to be encountered during tunneling. Although tunnel advancement rates were slower than anticipated, the tunnel was successfully installed without environmental incidents or accidents. Several of the lessons learned from the project can and should be applied to other microtunnels in similar settings within other major urban areas.

REFERENCES

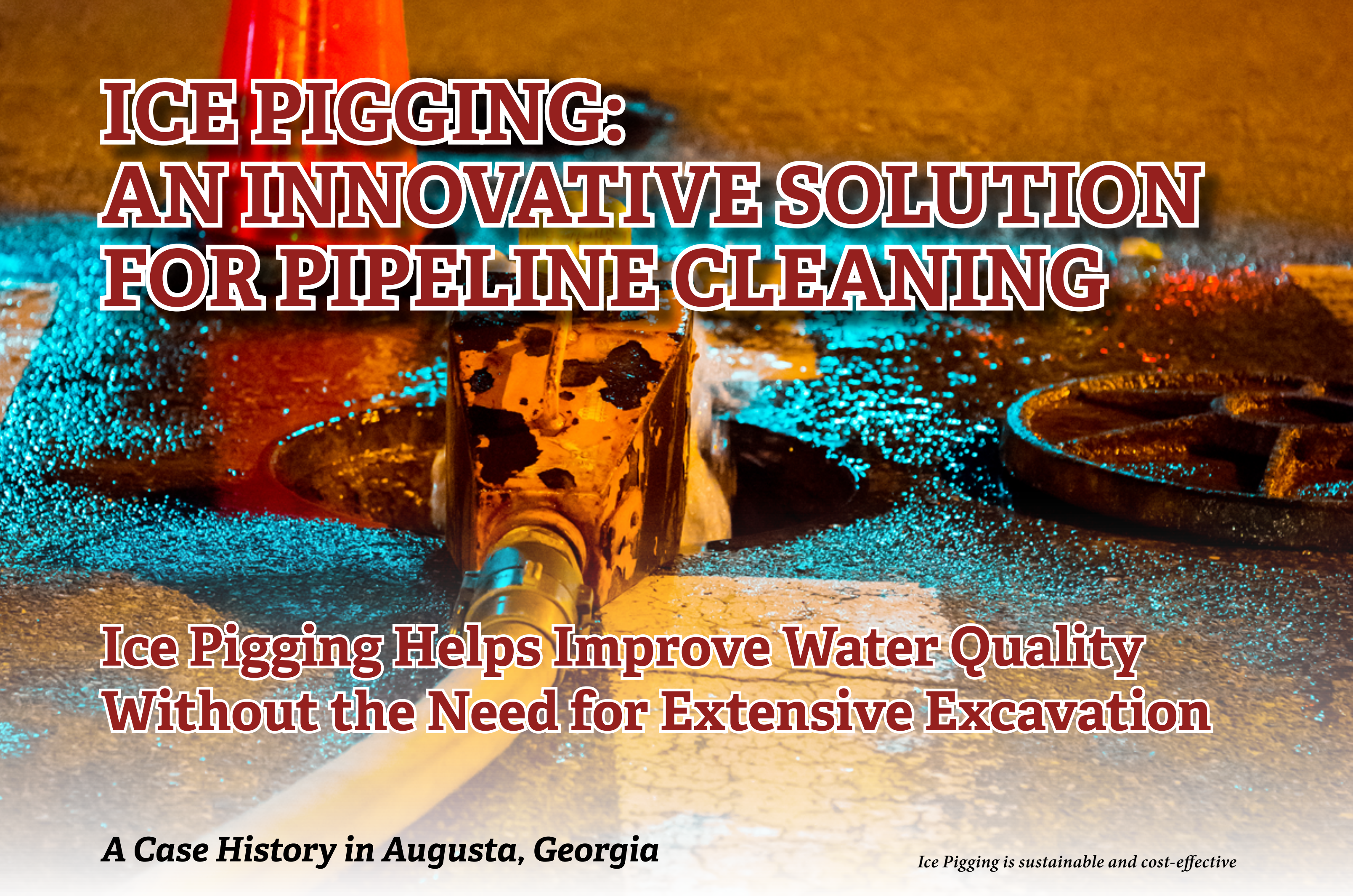
MC Squared, Inc. (2020), *"DRAFT - Geotechnical Engineering Services Report, Harbour Island Force Main Replacement, City of Tampa, Hillsborough County, Florida,"* MC2 Project No. T021905.032, dated June 12, 2020. Report for Wade Trim, Tampa FL, 92p.

Primoris Services Corporation (2020-2022), various technical submittals for Harbour Island Force Main Replacement Project, microtunneling equipment and shaft construction.

Wright, Alexandra P. (1974), *"Environmental Geology and Hydrology, Tampa Area, Florida,"* Bureau of Geology Special Publication No.19, Florida Department of Natural Resources, Tallahassee, FL, 94p.

ABOUT THE AUTHOR:

***Dave Sackett** has been involved throughout his 35+ year career in the management of geoscientific data including geotechnical investigations, geological assessments and project site characterizations for projects on five continents. He is the current Chair of the SESTT.*



ICE PIGGING: AN INNOVATIVE SOLUTION FOR PIPELINE CLEANING

Ice Pigging Helps Improve Water Quality Without the Need for Extensive Excavation

A Case History in Augusta, Georgia

Ice Pigging is sustainable and cost-effective

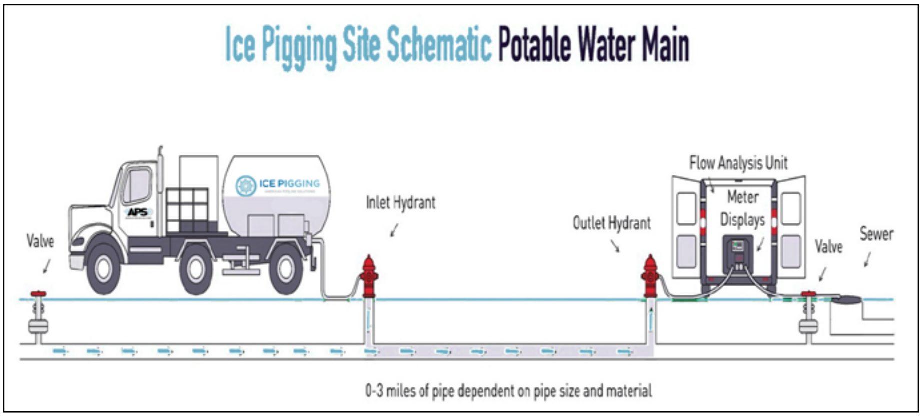
By: Jimmy Stewart, AWWIS, in collaboration with American Pipeline Solutions

INTRODUCTION

Columbia County recently conducted a project to reduce manganese levels in problem areas of their water distribution system. The County had previously performed multiple ice pigging operations on other parts of the distribution system with great success and so a budget was set for another project in 2024.

WHAT IS ICE PIGGING?

Ice Pigging has redefined the maintenance and cleaning of potable water distribution, wastewater force mains, and industrial process lines. The revolutionary technology was developed in the United Kingdom and later introduced to the United States in 2012. The method provides highly effective, low-impact, and sustainable solutions for removing sediment and biofilm from pipelines. With over 500 successful projects conducted across 44 states in the



Ice Pigging Process Schematic

Columbia County also reported improved customer relations.

U.S., Ice Pigging has become one of the best practices for municipalities, utilities, and industrial facilities.

Utilizing existing fittings, such as hydrants or other small-diameter fittings, a slurry of ice made from a brine solution is injected into the pipe, then, the pressure of the host water system is used to push the ice downstream. The ice slurry pig fills only 20-30 percent of the pipe's volume and unlike traditional, solid, mechanical pigs which can potentially get stuck, there is no risk of it sticking due to the melt factor. This allows for flexibility, and the slurry freely flows through bends, diameter changes, broken gate valves, and in-line butterfly valves without the risk of becoming lodged.

With shear forces up to 1,000 times greater* than water alone, the ice slurry effectively removes contaminants from pipeline walls. This happens as the ice moves through the line, where it captures and incorporates the impurities, which are then removed upon exiting the system through existing fittings.

ADVANTAGES OF ICE PIGGING

With its unique properties, Ice Pigging offers several advantages over traditional pipeline cleaning methods, it also uses significantly less water compared to conventional flushing techniques, which is particularly beneficial in regions where water conservation is critical.

Discharge slurry from pipeline

Comparative results of water discharge showing both contaminated and treated samples

Ice Pigging is at the top of the field regarding its ease of application. Since the technology rarely requires excavation with the use of existing fittings, the otherwise costly specialized launch and retrieval stations are not needed. In addition to the low risk of blockage, service interruption is minimized.

COLUMBIA COUNTY, GEORGIA: PROJECT OVERVIEW

The Columbia County project involved cleaning several miles of pipeline with varying diameters and materials, including:

- Two miles of 12-inch ductile iron pipe (DIP).
- Six miles of 10-inch PVC and DIP.
- One mile of 8-inch PVC.
- Three miles of 6-inch PVC.

The planning for the project was a collaborative effort between Columbia County staff and the Ice Pigging experts from American Pipeline Solutions (APS). Drawing on past projects, experiences, and local knowledge, the team devised strategies to maximize cleaning efficacy while minimizing disruptions and costs.

The team identified suitable locations for insertion and discharge points for the slurry, all while leveraging the existing fittings. This approach saved both time and money for the County, allowing the project to proceed without the need for extensive preparatory work.

Ice Pigging process utilizes existing fittings such as hydrants

RESULTS AND OUTCOMES

Samples of the discharged ice slurry were collected and sent to a laboratory for biological, mechanical, and chemical analysis of the sediments. Once results were received, they were

> ***Provides highly effective, low-impact, and sustainable solutions for removing sediment.***

compiled into a comprehensive report, provided to Columbia County to assist with future water quality control efforts.

The Ice Pigging process successfully removed the manganese buildup, restoring the water quality. Columbia Country also reported improved customer relations due to the proactive approach of maintaining water quality through such minimally invasive technology.

COST AND EFFICIENCY BENEFITS

The decision to utilize Ice Pigging instead of traditional cleaning methods offered several significant advantages such as cost savings, operational efficiency, and environmental benefits. With the use of existing infrastructure, additional time and budget allocation were saved, all while keeping water consumption low and customers happy.

CONCLUSION

Offering its sustainable, cost-effective, and efficient method for cleaning potable water distribution mains and wastewater force mains, Ice Pigging has the ability to remove impurities with its food-grade ice slurry. Being minimally invasive, it is a valuable tool for municipalities and utility companies which require marginal

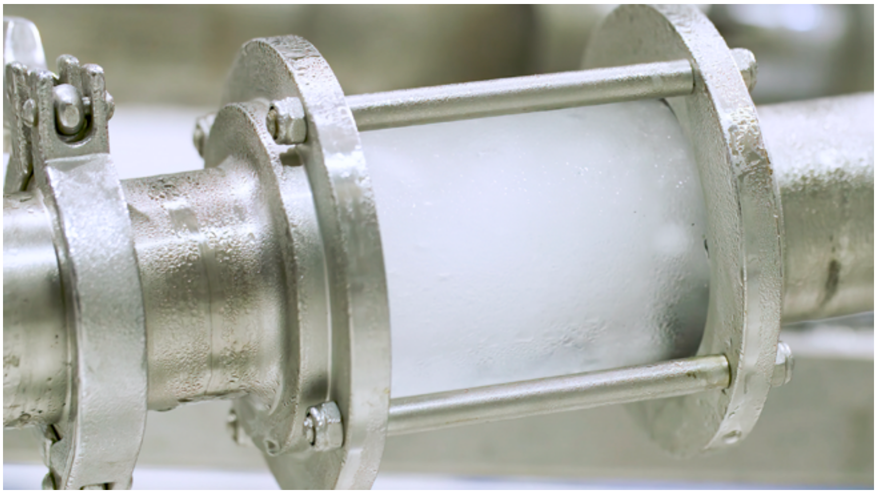
Specialized machinery is used in Ice Pigging operations

Ice Pigging is a minimally invasive technology with small surface footprint

disruptions to meet consumer demand. In Columbia County, Georgia, the technology was successfully used and improved their water quality, reduced costs, and enhanced customer relations. Columbia County shared that there were initial concerns about potential service interruptions, traffic control, manpower, and project design, however, prior experience with the Ice Pigging team allowed for smooth execution. The process effectively navigated smaller lines and fittings, reducing the need for additional infrastructure. While technology evolves, Ice Pigging will likely become requested more often, providing cleaner, safer, and more efficient ways to maintain critical water infrastructure.

The ice has shear forces up to 1,000x water

A valuable tool for municipalities and utility companies



Ice slurry effectively removes contaminants from pipeline walls

FUTURE OF ICE PIGGING TECHNOLOGY

Ice Pigging continues to gain recognition as a best practice for pipeline maintenance and management. Ongoing research is focused on enhancing its capabilities. Future improvements aim to increase daily ice production capacities, allowing for larger-diameter pipes to be cleaned more efficiently. These advancements are expected to become available in 2025, allowing municipalities to extend lengths of pipeline cleaned daily without using excavation.

REFERENCE

* Investigation and development of an innovative pigging technique for the water-supply industry:

1. Department of Mechanical Engineering, University of Bristol, Bristol, UK (G Quarini, E Ainslie, M Herbert, T Dean, D Ash & D Rhys)
2. BristolWater PLC, Bristol, UK (N Haskins, G Norton, S Andrews, & M Smith)

ABOUT THE AUTHOR:

Jimmy Stewart *is Vice President of AWWIS (Advanced Water/Wastewater Infrastructure Solutions) and has over 25 years' experience working in consent order driven cities. He has been involved in full-service environmental assessments, technical water/wastewater evaluations and rehabilitation processes for water, wastewater and storm water systems. A results-oriented professional, Jimmy can successfully identify when and where proven technologies and analytics are most effectively used.*

GEOPOLYMERS IN TRENCHLESS TECHNOLOGIES TODAY

By: Richard Goodrum, GeoTree Solutions

All of us remember the report card from our school days. Some of us eager to receive it and bring it home to show our folks our grade point average (GPA), happily expectant of the accolades they would bestow upon us for a job well done. Others of us maybe less than eager because we knew we had not put forth our best effort and now we would be found out! Our own historical educational GPA notwithstanding, it is that season of anticipation once again.

Since 1998 the American Society of Civil Engineers (ASCE) Committeeon American Infrastructure has been publishing the quadrennial "Report Card for America's Infrastructure" and the next issuance is due out in the Spring of 2025. The most recent (2021) report card celebrated an improved Infrastructure GPA of C- for the first time in 20 years, up from D+ in 2017. (We're encouraged to think this is good?)

> ***"Trenchless technologies have been providing cost-effective alternatives to open cut."***

While the tutorial assistance America needs to improve our infrastructure GPA may come in the form of public policy and funding, it can also be realized through knowledge-based technology and innovation by those of us offering guidance and stewarding the improvement efforts – and as the saying goes, every little bit helps. This article is intended to provide a little bit of help toward your technology and innovation knowledge and stewardship.

Over the last century engineers and contractors have been developing trenchless technologies to help rehabilitate pipe insitu in an effort to extend the water and wastewater infrastructure and more recently to up our GPA. From sliplining and pipe bursting to cured in place pipe (CIPP), horizontal directional drilling (HDD) and spray applied pipe lining (SAPL), trenchless technologies have been providing cost-effective alternatives to traditional dig and replace methods. In the last decade one particular material utilized in the SAPL method that has proven performance in structural

Use of geopolymers in modern industrial applications has become increasingly popular.

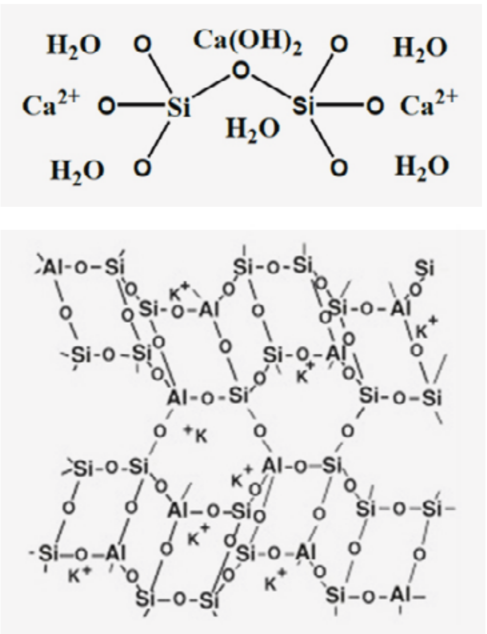


Figure 1. Molecular structure of ordinary portland cement (top) vs. geopolymer (bottom)

Figure 2.Geopolymer is used as a SAPL either by hand spraying or spin casting

rehabilitation and has been found to be extremely cost effective, especially in large diameter pipe, is geopolymer.

Geopolymer is a term originally put forth in the 1970s and assigned by French researcher Joseph Davidovits to describe a class of inorganic polymeric cement formed from aluminosilicates. While ordinary portland cement (OPC) relies on the absorption of water to create its strength – commonly referred to as curing by hydration – geopolymers cure by forming much stronger covalent bonds between the molecules in the presence of a basic or alkaline environment.

The structure of a geopolymer is a cross-linked inorganic polymer network consisting of covalent bonds between aluminum, silicon and oxygen molecules that form an aluminosilicate backbone with associated metal ions. The materials that react to form the geopolymer are also commonly referred to as pozzolanic materials. Geopolymers have been commonly referred to in the industry as "alkali- activated cement" or "inorganic polymer concrete."

In contrast, OPC is a hydrated complex of small molecules that are not covalently bonded but associated and held together by the hydrogen bonding power of the water molecule. This is done with no long chain covalently bonded backbone

Figure 3. Geopolymer SAPL provides a true structural rehabilitation

or network structure. The difference in chemistry of typical OPC material as compared to a geopolymer is illustrated in Figure 1.

Geopolymers provide comparable or better performance to OPC in terms of physical properties, such as compressive or tensile strengths, but with the added advantages of significantly reduced greenhouse emissions (by more than 70 percent compared to OPC), increased fire and chemical resistance and reduced water utilization. The use of geopolymers in modern industrial applications has become increasingly popular based on their intrinsic environmental and performance benefits.

For trenchless technology geopolymer is produced as a powder and packaged in bags (think mortar mix), delivered to the project site where it is mixed with water and pumped, to be utilized as a SAPL either by centrifugally casting (aka Spincasting) or hand spraying via a shotcrete nozzle onto the walls of the existing structure, regardless of shape.

Over the last decade the cost data points towards notable economic advantages for geopolymer SAPL when compared to competitive trenchless technologies for what might be termed “large diameter” pipe (ie, ≥ 36-in) – and installed cost differentials increase significantly with increasing pipe diameter – meaning the bigger the pipe, the bigger the potential savings. Compared to OPC lining materials, geopolymer chemistry is inherently resistant to typical microbial induced corrosion found in sanitary sewers and physical properties provide for better abrasion resistance equated with storm sewers, thereby making geopolymer a reasonable alternative for both.

The robust physical properties of geopolymer, like compression strength, tensile strength and flexural strength along with validated design procedures present a real means to show that geopolymer SAPL provides a true structural rehabilitation. As a result, the industry has developed some standardization regarding specifications and the standard of practice throughout the world. In the USA many state DOTs have adopted geopolymer into already established “cementitious” lining specifications or stand-alone special provisions.

AASHTO’s Product Evaluation and Audit Solutions Technical Committee

Figure 4. Twin 60-inch CMPs were rehabilitated with minimal neighbourhood impact and no road closures

(formerly NTPEP) have been developing testing and guidelines for SAPL systems. NASSCO's Pipe Rehabilitation Committee has developed and published a Performance Specification Guide that is also proving helpful to industry stakeholders. Additionally, a number of prominent water/wastewater and stormwater utilities have likewise written standard specs, all of which is contributing to the proper use and wider acceptance of geopolymers SAPL systems.

Geopolymer SAPL systems are widely used in Georgia, particularly in the surrounding cities and counties around Atlanta. In Gwinnett County alone more than 30,000 LF of pipe culverts of varying sizes have been structurally rehabilitated using geopolymer SAPL over the last several years. A good example of the typical project that would employ geopolymer SAPL is this one on Gravel Springs Road in the Atlanta suburbs. These twin 60-inch corrugated metal pipes (CMPs) were installed at the only entrance and exit to a small neighborhood community of less than a hundred homes, so dig and replace was not an option.

Working with the county and homeowners, the contractor (Puris/Inliner) decided to use geopolymer SAPL because of several factors. Using this method allowed the contractor to repair the corrosion within the pipe with a more robust and abrasion resistant lining while addressing separation issues at the joints and headwalls all at once, as shown in Figure 4. Additionally, the small equipment footprint minimized the neighborhood impact with no road closures.

An LADOTD project near Sibley, LA required structural rehabilitation of twin 74-inch X 96-inch Arch Plate CMPs. The culverts had been damaged by floods from a recent hurricane and the inspection revealed that the invert was badly corroded, as shown in Figure 5. The situation required the contractors (Insituform Technologies & Lewis Concrete Restoration) to clean the pipe, repair the invert with a flowable fill material and use geopolymer SAPL applied via hand spraying the lining into place, basically building an entire new pipe inside the old pipe.

> ***"The bigger the pipe, the bigger the potential savings."***

Figure 5. Structural rehabilitation of twin 74-inch X 96-inch Arch Plate CMPs – an entirely new pipe built inside of the old pipe

The versatility of geopolymer SAPL technology was on display on this project to repair dual 72-inch reinforced concrete pipe (RCP) storm drains in Palm Bay, FL. The project included cleaning, sealing, utilizing grout injection where needed and applying SAPL to a total of more than 1900 linear feet of RCP that runs underneath the westbound lanes of Malabar Road. The small construction footprint required to install a geopolymer SAPL meant minimal lanes closures on a very busy thoroughfare

Figure 6. Geopolymer is becoming the preferred application for manhole rehabiliation due to its versatility and resistance to corrosion

not far from the Interstate 95 interchange.

The contractors (Insituform Technologies & NuPipe) faced several challenges related to weather, labor shortages and equipment issues that caused delays in the prosecution of work, creating several stops and starts. These issues were minimized because of one interesting property exclusive to geopolymer known as self-bonding. The unique chemistry of geopolymer produces one monolithic structure with no cold joints, regardless of starts and stops.

Figure 7. Geopolymer if often applied by spin casting in large diameter sanitary and combined sewers, manholes, wet wells and other related structures

Figure 8. More than 30,000 LF of pipe culverts of varying sizes have been structurally rehabilitated using geopolymer SAPL

As mentioned earlier in this article, the complex chemistry that provides all of the covalent bonding within the geopolymer mortar makes it ideal for use in typically corrosive environments where historically OPC mortar is less likely to be preferred. Geopolymer SAPLs are being utilized in large sanitary and combined sewers as well as manholes, wet wells and other related structures. One reason geopolymer has a preferential trend in manhole applications is again the inherent resistance to corrosion and the versatility of the material. See the before and after photos in Figure 6.

Geopolymers are not a "fix all" no-dig solution, but the performance characteristics, installed cost economics and growing acceptance make it a viable option in many traditional trenchless technology applications. Having this tool in the engineering toolbox offers one more option for asset owners that may well help stretch their rehab budget. Real savings are being realized on many larger (>54-inch) diameter projects and value engineering on some projects have put real money back in the pockets of both the owners and the contractors.

But it's worth a consideration even on "smaller" diameter projects. Recent bid tabs for a relatively small project that had twin 36-inch and triple 48-inch CMPs that total just less than 500 LF showed a $300/LF savings for geopolymer SAPL compared to traditional CIPP (UV) and as per the earlier statement, every little bit helps – and maybe it will up your infrastructure GPA.

ABOUT THE AUTHOR:

***Richard Goodrum** is the Southeastern Region Manager for GeoTree Solutions (formerly Milliken Infrastructure Solutions), responsible for sales and business development of GeoSpray geopolymers, which includes hands on assistance to asset owners, engineers and contractors. He has more than 30 years of progressive experience in the civil engineering sales, project management and the construction industry.*

ANNULAR SPACE GROUTING

Balancing Strength, Permeability, Density, and Carrier Buoyancy with Cellular Grouts

By: Kirk Roberts, CJGeo

THE PROJECT

The City of Clarksville, Tennessee's new water treatment plant will ultimately provide up to 36 million gallons per day of increased capacity to support anticipated population growth. The Cumberland River, just downstream of downtown Clarksville, will be the source of the plant's raw water.

To access the river, an 80-foot deep, 80-foot by 50-foot jacking shaft was sunk behind the river bluff. Huxted Trenchless then mined a 470-foot microtunnel using 87.5-inch diameter PermaLok casing. The microtunneling machine was then retrieved underwater from a receiving platform constructed on the floor of the Cumberland River. A pump station will be constructed in the shaft and connected to the water treatment plant by pipeline.

The tunnel was designed to carry four different pipes held in position with spacers: a 48-inch DIP raw water intake pipe, two 1.5-inch steel chemical pipes, and a 10-inch ductile air pipe. Huxted contracted with CJGeo to perform the annular space grouting using CJFill cellular grout.

The annular grout for this tunnel needed to provide a long-term, watertight seal.

ORIGINAL GROUTING DESIGN

In addition to the typical criteria of providing adequate strength and long-term dimensional stability, the annular grout for this tunnel needed to provide a long-term, watertight seal to protect the pump station from hydrostatic pressure from the river. To meet these requirements, the designer specified low-density cellular concrete (LDCC) with the following properties, capable of filling all annular voids and displacing water:

- Minimum 28-day compressive strength (ASTM C495) of 300 psi
- Minimum 56-day compressive strength (ASTM C495) of 350 psi
- Target wet density of 80 lb/ft³, with an allowable variance of +/- 5 lb/ft³ in the field

An 80-foot deep jacking shaft was sunk behind the river bluff

PROPOSED ALTERNATIVE

CJGeo's primary concern with the grout specification related to managing carrier pipe buoyancy during grouting. Managing buoyancy of carrier pipes during grouting is crucial for both trenchless new installations and trenchless rehabs. This can be achieved in several ways individually or in combination, including

Three 4-inch sacrificial grout lines were installed in the casing

The annular space grouting was completed in just over two days in two lifts

splitting pours into multiple lifts, filling the carrier pipes with water, tying down carrier pipes, and significantly reducing grout density. Due to the multiple carriers at different invert elevations, splitting the placement into multiple lifts for each carrier was impractical. Additionally, it wasn't practical to enter the annulus to install tie-downs after the carriers had been installed.

The most practical solution for managing buoyancy of the various carrier pipes during grouting on this project was to:

- Fill each of the carrier pipes with water, and
- Reduce the density of the grout to below the density of water, 62.4 lb/ft³.

Reducing the LDCC annular space grout to less than 62.4 lb/ft³ required approval from the designer, Hazen & Sawyer. Generally, the physical property of cellular grout that controls density requirements is compressive strength. In this case, to achieve the required 56-day unconfined compressive strength of 350 psi, LDCC as light as 35 lb/ft³ could be used. CJGeo requested lowering the density of the annular space grout to as low as 40 lb/ft³.

The engineering team responded that reducing the grout density was allowable, provided a water management plan was implemented to address any water in the annulus prior to grouting, and that the in-place cellular grout had a coefficient of permeability less than 10^{-6} cm/sec. These two factors were crucial because the engineer wanted to ensure that the pump station structure was isolated from the river. If water were trapped in the annulus, it could create flow channels, and if the cellular grout was too permeable, it could slowly build pressure and allow water to pass through.

A general concern with grout lighter than water is that it may not displace water effectively. In smaller diameter, single placements, low-density grout can easily displace water, similar to blowing water out of a straw. However, the volume for this project was large enough to require two lifts of grout from a logistics perspective. Therefore, pressurizing the annulus to expel any water wasn't an option. The Huxted team was confident that nuisance water in the annulus wouldn't be a problem due to the nature of the PermaLok joints. Any potential infiltration would also be mitigated by the contact grouting program.

Cellular grouts are lightweight because they replace fine aggregate with small, preformed air bubbles. The paste component typically weighs between 110 lb/ft³ and 120 lb/ft³. As density decreases, air content increases, reaching nearly 80% at 25 lb/ft³. The higher the air content, the more likely it is that individual bubbles are in contact with adjacent bubbles, allowing water to flow through the solid cured mass. Factors other than density that affect the permeability of LDCC include the preformed foam used, water-to-cement ratio, paste mixing method (ready mix, paddle, or colloidal), and cement type.

Some foaming agents are formulated to cause the preformed bubbles to clump together during placement, which increases the permeability of the cured material. The water-to-cement ratio can interact with cement type to affect permeability. Paste generation is important because if low-quality ready mix or paddle mixing is used, material consistency can vary, reducing the ability to accurately determine permeability. The transition from Type I/II cement to Type IL cement has had a significant impact on the historical relationships between density and other physical properties of cellular grout, such as compressive strength and permeability. Generally, the increased fineness of Type IL cement decreases the permeability of any specific mix of cellular grout. However, because Type IL cement allows for a wide variety of limestone contents, permeability can vary greatly between different sources.

For this project in Clarksville, CJGeo had historical permeability and compressive strength testing using production equipment with locally available cement. To meet the maximum permeability requirement of 10^{-6} cm/sec, CJGeo proposed using a 58 lb/ft³ CJFill-Standard cellular grout mix, which has a compressive strength significantly higher than the 350 psi 56-day unconfined compressive strength requirement.

The second lift of grout was pumped through the longest sacrificial pipe

PERFORMING THE WORK

Due to a relatively high contact grouting compressive strength requirement, CJGeo performed the contact grouting using onsite batching with colloidal mixing. High shear mixing of paste is the first step in making high-quality cellular grout. For the contact grouting, CJGeo added anti-washout admixture to the paste instead of foam.

By using a very uniform, well-mixed paste, communication across multiple grout ports was possible. Generally, the more times you move or lifts you have, the greater the likelihood of trapping voids or water during grouting. Therefore, this contact grouting method helped ensure a completely uniform grout encasement of the casing pipe.

After contact grouting was completed, CJGeo demobilized from the site, and Huxted installed the carrier pipes, installed the bulkhead at the launch shaft, and filled the carrier pipes with water. In addition to the carrier pipes, three 4-inch sacrificial grout lines were installed in the casing: one to the backside of the underwater bulkhead, another terminating approximately two-thirds of the tunnel length in, and the last terminating approximately one-third of the tunnel length.

CJGeo performed the annular space grouting over two days, in two lifts. The CJFill-Standard cellular grout was generated directly from bulk cement onsite using a mobile cellular grout batch plant. To ensure that no pockets of air were trapped, the second lift of grout was pumped through the longest sacrificial pipe, discharged just behind the bulkhead, and then traveled towards the shaft bulkhead, venting out air as it moved. Grouting was stopped when uniform cellular grout vented out of the shaft bulkhead through a 12 o'clock vent port.

LESSONS LEARNED

Few designers and owners want large pockets of trapped water within their annular grout or highly permeable annular grout for water intakes. However, it is important to acknowledge that very heavy grouts are not the only way to achieve this, and high-density annular grouts can present numerous challenges and risks during construction. Performance-based water management criteria tied to allowable grout densities can be very helpful in addressing concerns related to non-nuisance water and allow contractors flexibility to solve one problem without introducing risks associated with high-density grouts.

The transition from Type I/II cement to Type IL cement has had a variable, and at times, significant impact on the historical relationships between density and other physical properties of cellular grout, such as compressive strength and permeability. When considering or specifying cellular grout, it is wise to consult with contractors who specialize in cellular grouting to confirm the compatibility of specifications and locally available materials.

ABOUT THE AUTHOR:

Kirk Roberts *is Vice President of CJGeo, a second generation specialty grouting contractor based in Richmond, Virginia and serving the Eastern United States. Kirk focuses on special projects, most of which involve addressing unanticipated water and soil control challenges in the underground & civil markets.*

INDEX TO ADVERTISERS

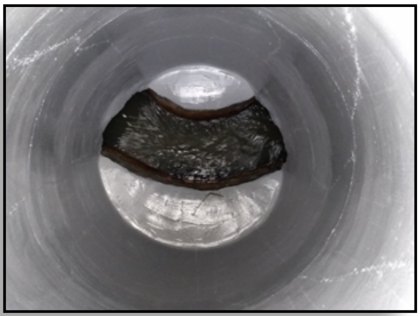
ProtectiveLinerSystems

Infrastructure Rehabilitation

Since 1984

Before

After



Perpetu*Wall*™

Cured-In-Place Fiberglass Reinforced Epoxy Liner (CIPM)
(Structural Strength Beyond Coatings)

The most versatile cured-in-place rehabilitation solution for manholes, lift stations and underground structures.

Advantages:

- Cured-in-place structural composite liner
- Stops I & I and corrosion
- Monolithic - epoxy / fiberglass liner
- Bonds 100% to host structure
- Excellent for outfalls
- 100% Solids, no VOC's, no isocyanates
- Conforms to any size or shape structure

Other Products:

Perpetu*Coat* - Ultra High Build Epoxy Coating
Perpetu*Crete CA* - Calcium Aluminate Cement
Perpetu*Crete MSC* - Microsilica Cement
Perpetu*Set* - Fast Setting Epoxy Resin
Perpetu*Wall CS* - Fiberglass Reinforced Chimney Seal
Perpetu*Seal Flex* - Novolac/Urethane Hybrid Chiminey Seal

770-482-5201 ***ProtectiveLinerSystems.com***

Manhole Cutters Available

***Protective Liner Systems** is a distributor for Stehr manhole cutters.*

StehrUSA.com