Western Regional Trenchless Review

2021

WESTT Virtual Seminars

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Browns Valley Trunk in Napa CA

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MESSAGE FROM THE WESTT CHAIR

Brian Avon, P.E., Chair, WESTT

Although the past year has continued to be challenging for many due to COVID-19, the WESTT Chapter Board of Directors (BOD) has been working hard on key initiatives that will benefit our membership.

Last year the WESTT BOD launched WESTT's Trenchless Technology Webinar Series. These three free webinars provided last year were designed to provide our membership with quality education during the COVID-19 pandemic. The webinars were attended by members and nonmembers, all across the country and internationally. With the success of last year's events the WESTT BOD hosted an additional two free webinars in 2021.

On January 20, 2022, we will be holding a Virtual WESTT Chapter Meeting. Attending the Chapter Meeting is a great way to get involved. We will discuss the various WESTT committees and plans for the upcoming 2022 No-Dig Show. Please see our webpage for registration details.

WESTT will be holding elections for new board members soon, so keep an eye out for an email announcing the details. If you wish to get more involved in the organization, I encourage you to run. Nominations close on November 19th. Even if you miss the nomination period there are other ways to get involved. The current board is filled with passionate individuals who work to advance the practice of Trenchless Technology through education, training, and research. I am truly honored to get to work with this very talented group of individuals. Interested parties should contact our Election Chair, Devin Nakayama, at devin@yogikwong.com.

As I finish up my last year as Chair, I would like to thank the WESTT Board of Directors, committee chairs, and other member volunteers for their continued involvement. These have been a couple of challenging but rewarding years with all the work that has been accomplished. It has been an honor to work with so many passionate individuals who share the goal of advancing the practice of Trenchless Technology through education, training, and research for public benefit. A special thank you to Kate Wallin as my Vice Chair, she has worked tirelessly to push forward with the webinars and other key initiatives that will benefit our chapter members.

"Thank you for your continued support of WESTT."

To stay connected and hear about upcoming events, visit our website (**www.westt.org**) or LinkedIn account (WESTT NASTT). If you want to get involved in WESTT activities, please reach out to me or any of our Board members.

Thank you for your continued support of WESTT.

Brian Avon

Brian Avon P.E., Chair, WESTT
Carollo Engineers

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MESSAGE FROM NASTT CHAIR

Alan Goodman, NASTT Chair

Our Chapter Members and Volunteers are Crucial to our Society

Hello WESTT Chapter Members. The trenchless industry grows stronger every year. Even in the pandemic our membership and regional chapters are moving forward to educate the public. It's amazing when you look back at what we have done in 2021. We had an in-person and virtual No-Dig Conference in Orlando this past March, leading the industry in safely meeting face to face once again.

Our Regional Chapters are holding their fall conferences and virtual networking events all over North America. And, of course, this year the WESTT Chapter hosted a very successful pair of well attended virtual seminars August 12 and October 21! These provide excellent networking opportunities to remain in ongoing contact with those industry colleagues you've missed over the last two years and make new connections as well.

The value of networking with NASTT members and industry folks is truly priceless. Our members and volunteers are innovative and creative thinkers, always looking for ways to improve technology and infrastructure and protect our environment.

NASTT's mission and vision are "to continuously improve infrastructure management through trenchless technology" and "to be the premier resource for knowledge, education, and training in trenchless technology." With education as our goal and striving to provide valuable, accessible learning tools to our community, one of the things of which we are most proud at NASTT is that even during uncertainty we have been able to grow.

Recently, we welcomed our latest Regional Chapter to the NASTT family and completed our representation of the entirety of North America. NASTT is so excited to announce that we now have our first chapter in Mexico - MEXTT!

Looking ahead, we are currently planning the NASTT 2022 No-Dig Show to be held in Minneapolis, Minnesota, April 10-14 next spring. We are anticipating over 2,000 attendees and over 200 exhibitors. There are many new features we plan to roll out including enhanced educational forums, more networking opportunities and expanded exhibit hall time. Our industry is constantly growing in innovative ways and the No-Dig Show is a representative of our industry. We are excited to bring new value and educational experiences to you in April. Visit www.nodigshow.com for all the latest details and to register or exhibit today.

> *We are a Resilient Industry!*

The 2023 No-Dig Show will be held in Portland OR in the vibrant Pacific Northwest, and we have recently decided to host the 2024 No-Dig Show in Providence, RI! Both regions on opposite coasts of the United States are great locations to host our flagship conference, and bring together industry professionals from all over North America to join this premier event.

For more information on our organization, committees, and member benefits, visit our website at nastt.org and please feel free to contact us at info@nastt.org.

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

Alan Goodman

NASTT Chair

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HDPE MUNICIPAL ADVISORY BOARD

ELECTED OFFICERS:

BRIAN AVON – CHAIR
Carollo Engineers

bavon@carollo.com

Brian Avon is an Associate Vice President and Trenchless Technology Practice Lead at Carollo Engineers, Inc. Brian earned his B.S. in Business Administration and Management from the University of Southern California and his B.S. in Civil Engineering from the University of the Pacific. He has more than 15 years of experience in the planning, design, and construction management of water and sanitary sewer pipelines, with extensive experience in the condition assessment of pipelines and design of CIPP, pipe bursting, horizontal directional drilling, auger bore, and microtunnel projects.

KATHRYN WALLIN – VICE CHAIR
Bennett Trenchless Engineers

kate.wallin@bennetttrenchless.com

Kate Wallin is a Senior Scientist with Bennett Trenchless Engineers, located in Folsom, CA. She has been involved with trenchless design since 2005 and has provided design and construction management services on projects using horizontal directional drilling, microtunneling, pipe ramming, guided boring, and earth pressure balance pipejacking. Kate has cultivated relationships with owners, engineers, permitting agencies, contractors, and manufacturers for new installations using trenchless technology to improve the standard of practice in the field. She is a coauthor on the 2017 revisions of the Horizontal Directional Drilling Good Practices Guidelines and Presentation as well as the 2018 Trenchless 101 – New Installations course and book. Kate was very honored to be the recipient of the 2011 Trent Ralston Young Trenchless Achievement Award.

TIM TAYLOR – TREASURER
Carollo Engineers

ttaylor@carollo.com

Tim is currently the National Infrastructure Practice Director and a Senior Vice President with Carollo Engineers. He has been working on water and wastewater infrastructure projects for over 35 years. Tim has been heavily involved in the planning, design, construction and project management of projects for water distribution systems, wastewater gravity sewer collection systems, large and small pump stations, storage reservoirs, as well as incorporating trenchless construction techniques for projects across the nation. He has also worked on pipeline condition assessment and rehabilitation projects for many clients.
Tim is registered to practice Civil Engineering in multiple states and has been working for Carollo Engineers for over 26 years.

GREG WATANABE - SECRETARY
GHD

greg.watanabe@ghd.com

Mr. Watanabe is a Civil Engineer registered in California, Hawaii, Idaho, Oregon, and Guam and has more than 20 years of engineering experience of which the last 9 years have been largely focused on trenchless technologies for both rehabilitation and new construction. During this time he has planned, assessed, and designed over 100-miles of pipelines up to 96" for public utility systems. His project experience includes alternative construction and rehabilitation methods including horizontal auger boring, burst and insert, HDD, point repairs, CIPP, PCIPP, and microtunneling.
He currently manages the Linear Infrastructure business (which includes the Tunneling and Trenchless services sector) for GHD's US West region consisting of California, Arizona, Oregon, Washington, Hawaii, Guam, and Saipan. He is also GHD's managing Principal for the firm's NASTT No-Dig participation across North America.
Mr. Watanabe manages a dedicated team of trenchless engineers throughout the US West who have been involved in over 100 trenchless construction projects installing over 250,000 feet of pipelines throughout North America.

BOARD OF DIRECTORS & OFFICERS 2021-2022

ELECTED OFFICERS:

LISA ARROYO - PAST CHAIR Carollo Engineers

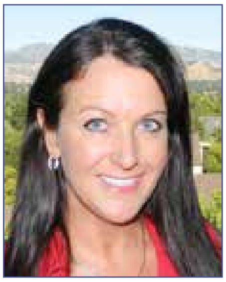
LArroyo@Carollo.com

Lisa Arroyo is a Project Manager in the Utility Advisory Services Strategic Management group for Carollo Engineers. She has more than 17 years of municipal experience and has served as President of a General Engineering Construction Corporation.

During her 17-year tenure with the City of Santa Barbara, Lisa oversaw the operation and maintenance of the City's wastewater treatment plant, collection system and laboratory. She managed a multi-million dollar Capital Improvement Program and a $20 million operating budget. Lisa has experience with both CIPP and directional drilling methodologies and has long been a champion of trenchless technology, as it is an effective and economical solution for improving wastewater collections systems.

Lisa holds Bachelor of Science degrees in mathematics and civil engineering, and she is a licensed professional civil engineer in California and Florida. Lisa was elected to the Board of Directors for the WESTT Chapter in 2016, and was elected to the NASTT Board of Directors in 2018.

DIRECTORS AT-LARGE:



MICHELLE BEASON, PE – National Plant Services Inc.

mbeason@nationalplant.com

Michelle received a BS in Civil Engineering from Purdue University, and is a registered California PE with almost 29 years of water and wastewater experience. She has worked as a Project Engineer for Black &Veatch, as an Asset Management Engineer with the East Bay Municipal Utility District, she owned her own Engineering & Construction firm for 5 years, and for the last 12 years has specialized in CCTV and multi-sensor inspections and trenchless rehabilitation of sewer, storm, and water assets. She is currently the Regional Manager for National Plant Services, Inc., covering the 12 Western States, including Hawaii and Alaska.

Michelle is also active in many industry organizations. In addition to serving as a Board Member of WESTT, she is a Board Member of NASSCO, and is Chair of the NASSCO Infrastructure Assessment Committee which manages all revisions to NASSCO's PACP/MACP/LACP coding.

DIRECTORS AT-LARGE:

JENNIFER GLYNN Woodard and Curran Inc.

jglynn@woodardcurran.com

Jennifer Glynn is a Senior Technical Practice Lead and Principal for Woodard & Curran out of their Sacramento, California office. Jen has over 25 years of experience in Project Management and Infrastructure Design, with an expertise in Condition Assessment and Trenchless Rehabilitation.

Jen has been authoring papers and presenting at conferences both domestically and internationally for the past 20 plus years. She is a past Executive Board Member for NASTT and is currently an NASTT training course instructor for two classes: Introduction to Trenchless Rehabilitation and Pipe Bursting Good Practices. She is also a member of the AWWA Water Main Rehabilitation and Water Main CIPP Standards Committees.

JACQUIE JAQUES – Sekisui SPR Americas

jacquie.jaques@sekisui-spr.com

Jacquie Jaques is the Regional Manager for Sekisui SPR Americas for the Western US. Jacquie has over 25 years of industry experience working with manufacturers and contractors specializing in pipeline condition assessment and trenchless rehabilitation solutions. She started her career working for a technical services company specializing pipeline cleaning and CCTV condition assessment. During that time, she worked with municipalities, FEMA and OES on post-earthquake pipeline condition assessment inspection that enabled agencies to obtain federal funding for projects. With a high demand for cost effective solutions to repair our infrastructure, she became involved with cutting edge trenchless technologies that could meet stringent industry design and performance standards. Jacquie has been actively involved in numerous industry committees over her career. Early on, she was a member and recording secretary for the "Green Book Pipeline Rehabilitation Task Force" which evaluated new trenchless technologies that

BOARD OF DIRECTORS & OFFICERS 2021-2022

DIRECTORS AT-LARGE:

JACQUIE JAQUES – CONT'D

were germane to public works construction. This task group wrote the first Part 5 of the "Green Book" "Pipeline System Rehabilitation". Jacquie is still active on the committee today and works with the subcommittee to ensure that the specifications are current and still relevant to public works construction. As a WESTT Board Member, she is the Education Liaison for the university members and conducts the outreach on behalf of the committee. Jacquie has also authored several industry papers and presented at national and regional conferences including NASTT, WESTT, Pipe Users Group and HWEA. She has also authored or contributed to several magazine articles including NASSCO and Trenchless Technology.

DEVIN NAKAYAMA – Yogi Kwong Engineers, LLC

devin@yogikwong.com

Devin has over 20 years of geotechnical engineering experience, and has served as a Geotechnical and Trenchless Engineer on projects requiring microtunneling, horizontal directional drilling, and guided bore methods, as well as deep foundations, rockfall investigation, and shoreline protection. He is a licensed Professional Civil Engineer in Hawaii, and obtained his Bachelor and Master's Degree in Civil Engineering from the University of Hawaii at Manoa. For the past 16 years, he has been at Yogi Kwong Engineers, a geotechnical engineering and construction management firm in Honolulu, Hawaii, where he worked his way from Project Engineer to Principal of the company.

COMMITTEE CHAIRS:

WESTT Mini No-Dig Conference Committee:
Lisa Arroyo

WESTT Trenchless Review Magazine Committee:
Michelle Beason

WESTT Board Elections Committee:
Kate Wallin

Student Chapter Liaison Chair:
Jacquie Jaques

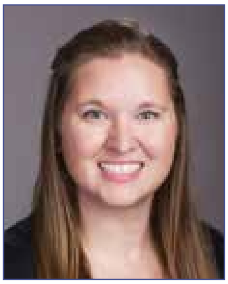
SASHA MESTETSKY – Central Contra Costa Sanitary District

smestets@centralsan.org

Sasha Mestetsky is a Senior Engineer in the Capital Projects Division at Central Contra Costa Sanitary District (Central San) located in Martinez, California. He manages Central San's Collection System Program with an annual fiscal budget of approximately $40 million. Sasha is responsible for the design and construction management of all sewer system replacement and renovation capital improvement projects. Most of these projects utilize various trenchless technologies.

Sasha has over 25 years of experience in design and construction of collection systems projects. He holds a Bachelor of Science degree in Civil Engineering from California State University, Sacramento and is a California-licensed Civil and Mechanical Engineer.

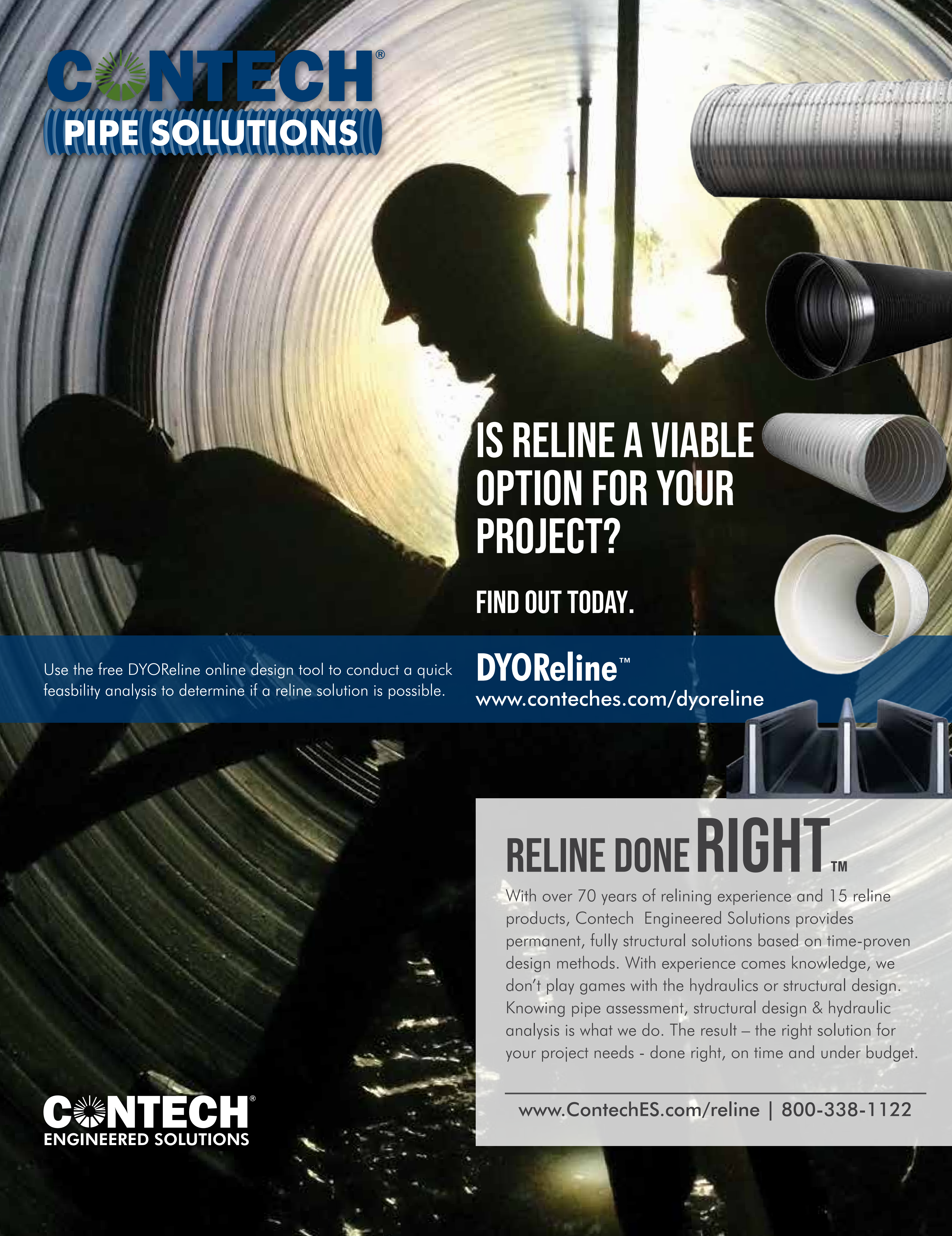
Sasha serves as the At-Large Representative of WESTT Chapter Board of Directors. He is a long time member of Water Environment Federation (WEF), North American Society for Trenchless Technology (NASTT), and Northern California Pipe Users Group (PUG). Sasha is passionate about everything trenchless, enjoys sharing his experiences, and actively promotes trenchless technology education.



RACHEL MARTIN - McMillen Jacobs Associates

martin@mcmjac.com

Rachel Martin has 20 years of experience in design and construction management on civil projects focused in the fields of water, wastewater, and hydropower. Her experience includes trenchless and tunnel design, development of contract drawings and specifications, construction management, design and constructability reviews, project controls, quality management, and cost estimating. Rachel has developed designs for microtunneling, pipe jacking, HDD, and sliplining projects throughout the US, Canada, and New Zealand.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WESTT Continues Webinar Series in 2021

By: Kate Wallin, WESTT Vice-Chair, Bennett Trenchless Engineers

The Western Chapter of NASTT continues to be committed to its mission of educating engineers and contractors about trenchless technology and the benefits it can provide to pipeline construction and rehabilitation projects. With the ongoing uncertainty regarding company travel restrictions, funding constraints, and a sense of responsibility toward maintaining a safe environment, the Board of Directors chose to forego a traditional conference this year and instead continued with the virtual webinar series started in 2020. Although in-person events provide unique networking opportunities, the virtual webinars offered an opportunity to reach a much wider audience, especially for those with limited travel allowances. Over 300 registrations were received for both webinars!

The chapter hosted two webinars this year, on August 12 and October 21. Each webinar included three presentations and covered a variety of trenchless construction methods, including both rehabilitation and new installation methods. The WESTT Board of Directors is very thankful to all the authors for sharing their time and expertise. Their contributions were the key to allowing WESTT to continue to provide educational opportunities. An overview of the authors and the projects they presented during the two webinars is included below. The full papers associated with each presentation can be found at NASTT.org/products/NoDigShowPapers/

AUGUST 2021 WEBINAR

Trenchless Construction of the Browns Valley Trunk in Napa, California

Su Pyae Sone Soe
Project Engineer
McMillen Jacobs Associates

The Browns Valley Trunk project consisted of 3 miles of 15- to 48-inch-diameter gravity sanitary sewer pipeline to divert flow from existing overcapacity sewer pipelines in Napa, California. The project design included two microtunneling crossings of State Highway 29 and Freeway Drive. The subcontractor submitted a request to substitute pilot-tube guided auger boring (PTGAB) to install the Freeway Drive crossing. The request was accepted, and the Freeway Drive crossing, which consisted of 256 feet of 15-inch polyvinyl chloride (PVC) pipe inside 30-inch steel casing was installed using PTGAB. The State Highway 29 crossing, which consisted of 260 feet of 30-inch PVC pipe inside 48-inch steel casing was installed using an Iseki TCC1000 MTBM. Both segments are geologically located within alluvial fan deposits, consisting of laterally and vertically variable swelling clays to fast-raveling silts and flowing/running sand and gravel. Challenges for these two segments included shallow groundwater, the potential for cobbles, and mixed-face and change-in-reach ground conditions. A more detailed article on the design and construction of the Browns Valley Trunk project can be found on page 22 of this magazine.

AUGUST 2021 WEBINAR

Recycling Water AND Pipelines:
Repurposing an Abandoned Pipeline via Sliplining for Non-Potable Water Distribution

HydroScience

Chris Dodge
Senior Project Manager
HydroScience Engineers

HydroScience

Cindy Preuss
Former Principal and Vice President
HydroScience Engineers

THE CITY OF BRENTWOOD
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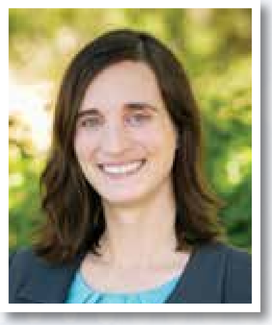
Meghan Laporta
Associate Engineer
City of Brentwood

As part of the effort to expand its citywide non-potable water distribution system, the City of Brentwood acquired an abandoned steel gas pipeline from the utility owner for the sole reason of repurposing it as a host pipeline to house non-potable water mainlines. Approximately 9,100 linear feet of 12-inch and 16-inch fusible PVC pipeline was sliplined within this abandoned 22-inch host pipe. HydroScience assisted the City in assessing the existing host pipe for sliplining suitability and preparing contract documents for construction. Assessment involved identification of access points along the pipeline for CCTV inspection, review of opportunities and constraints for sliplining pit and pipe layout locations, and selection of pipe material with consideration for anticipated maximum pulling force and fittings/deflections in the host pipe. Hydraulic modelling efforts determined the required pipeline diameters and operating pressures. Project specifications included requirements for procuring and fusing pipelines, CCTV inspections, pressure testing and contact grouting. The project was bid in May 2020 and is anticipated to be completed in November 2021.

AUGUST 2021 WEBINAR

Highs and Lows: Construction of a 2,900-foot HDD Pipeline with 510 feet of Elevation Difference in Griffith Park



Mary Neher
Senior Project Engineer
Bennett Trenchless Engineers

The Los Angeles Department of Water and Power has made water recycling a key strategy of their Urban Water Management Plan. The Griffith Park South Water Recycling Project expanded recycled water use to new areas of the park and consisted of approximately 6,700 feet of 12-inch transmission pipeline, installation of a new pump station, and installation of a new 1M gallon storage tank. One of the primary challenges was the approximately 510-foot elevation difference between the pump station and storage tank through steep and challenging terrain. Alternative construction methods were considered to install the pipeline including open cut, conventional tunneling, microtunneling, and horizontal directional drilling. HDD was selected as the most cost effective and technically feasible. The presentation discussed the design and construction of approximately 2,900-foot 12-inch diameter steel pipe installed by HDD. Significant design and construction challenges were discussed. Unfortunately, despite the highly skilled construction team, the recycled water line became stuck during pullback. The presentation addressed the troubleshooting methods used to successfully complete the pipeline installation.

OCTOBER 2021 WEBINAR

Success on San Patricio – Structural Manhole Rehabilitation in Albuquerque

Jeff Maier
Water Infrastructure Practice Leader
Garver USA

The Albuquerque Bernalillo County Water Utility Authority (ABCWUA) successfully completed the San Patricio Avenue Sanitary Sewer Manhole Rehabilitation project in Albuquerque, NM in 2020. Ten severely corroded and structurally-compromised concrete sanitary sewer manholes ranging in size from 48-inches to 96-inches in diameter, all located in a critical part of ABCWUA's wastewater conveyance system, were proactively rehabilitated through fully structural no-dig techniques. Design focused on use of polymer concrete manholes, pre-fabricated fiberglass inserts, and hybrid PVC materials in lieu of open cut removal and replacement. Severe corrosion and significant infiltration issues were problems that needed to be addressed in these manholes, with hazardous atmospheric environments, structural deficiencies, significant flows, and installation challenges encountered throughout the project. The highest risk manholes were also located in front of the local TV station, adding additional pressure to make sure the project was done right. In addition to the case study, the differences between methods that are considered to be non-structural, semi-structural, and fully structural manhole rehabilitation technologies were briefly explained from an engineering perspective.

OCTOBER 2021 WEBINAR

Progressive Design Build Tunnel Procurement in Silicon Valley

Mike Jaeger
Principal and Co-Founder
Tanner Pacific

The Silicon Valley Clean Water Gravity Pipeline (SVCW) is among the first tunnel projects in the United States to be procured using the Progressive Design Build (PDB) method. PDB was selected by SVCW to provide cost certainty after the 60% design level and to allow greater coordination of the design with operations and maintenance. The PDB process has facilitated collaborative working between owner, contractor and designer to agree on design direction, align scheduling, manage risk, and ensure designs incorporate SVCW's RESCU program success factors, as well as contractor means and methods. The flexibility of PDB has allowed early milestones to be achieved during Stage 1, prior to negotiation of the Stage 2 lump sum construction contract. These include placement of the TBM order, 100% design for the precast concrete segmental lining and TBM launch shaft, all of which have significant project schedule impacts. Project successes and challenges of the PDB process are discussed from the Owner, Contractor and Designer perspective.

OCTOBER 2021 WEBINAR

Alternative Delivery Enables "Slip-Burst-Ram" for 72-inch Pipeline Rehab

Dan Buonadonna
Global Technology Leader
Jacobs

The Incline Creek is a culvertized stream beneath the Diamond Peak ski resort and is maintained by the Incline Village General Improvement District in northeast Lake Tahoe. An inspection of the 72-inch culvert identified buckled portions with lobes protruding over 14 inches, 25% deformation, and missing inverts, directly beneath a brand new multi-million dollar skier services center. Due to the level of risk, the remote location, and the limited pool of qualified contractors, IVGID exercised the alternative delivery model of construction manager/general contractor (CMGC) to resolve the situation. An innovative sliplining/pipe-bursting/pipe-ramming concept was developed that used a conventional jacking frame to advance a 60-inch casing into the culvert, with a custom conical attachment (like a bursting head) at the leading edge. Where the head encountered the buckled portions, the conical shape would re-round the culvert and allow the casing to pass. If needed, a more powerful pipe ram would be substituted for the jacking frame to provide added kinetic force. Construction of the slip-burst-ram was completed in less than two months and provided a savings of nearly 40% over other alternatives.

Northern California Pipe Users Group (PUG)

Pipe Users Group (PUG) of Northern California is a non-profit organization founded in 1992 comprised of local agencies, municipalities, consulting engineers, product suppliers, and industry related professionals. PUG's mission is "**Sharing Technologies Together**" and is dedicated to providing its members with current technical information and training opportunities to stay up to date with industry news and technology.

After nearly two decades of monthly in-person meetings, PUG has been having virtual meetings since April 2020 and even completed our first virtual Sharing Technologies Seminar in February 2021 using a simple live Zoom format that featured breakout rooms, live presentations, and opportunities to talk with vendors.

Coming up on February 17, 2022, we are working to bring everyone back together for an in-person event for our 30th Sharing Technologies Seminar, but only time will tell if that becomes a reality. No matter the format, the seminar is a great opportunity for us to share both our successful construction experiences and our lessons learned with others in the industry.

Although we're still missing the face-to-face interactions, our ongoing virtual meetings have allowed those working outside of typical driving range the opportunity to attend our meetings, as well as allowed us to attract speakers from further away. This has helped us to further our group's main goal which is to share information; the more participation we have, the more effective our group can be.

Join us for an Upcoming Meeting

- **December 8th:**
  Sewer AI will describe their NASSCO AutoCoding and Inspection Management Software

For more information, check out our website: **www.norcalpug.com**
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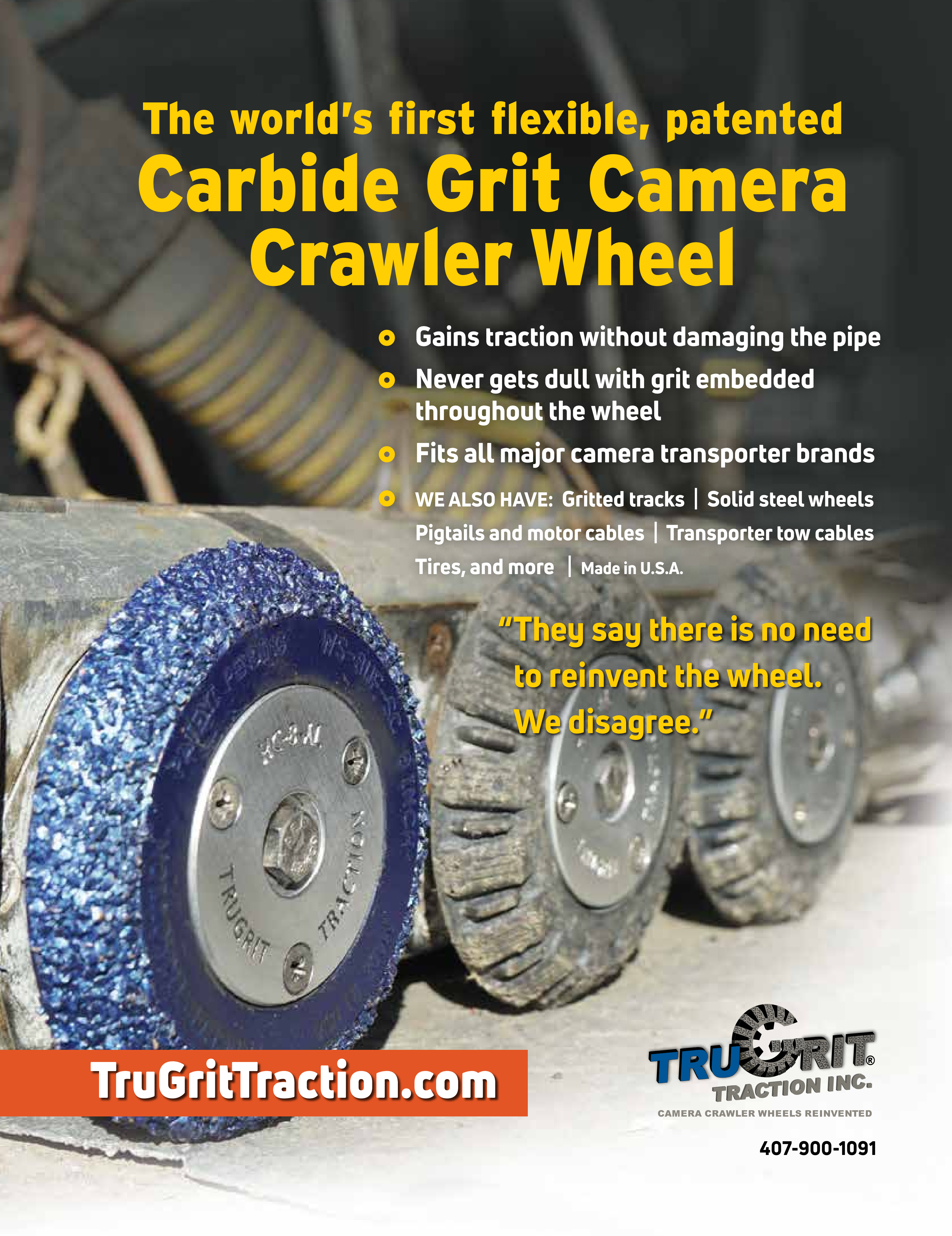
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Two Trenchless Installations Keep California Highway One Open

By: Steven Gallyer, Pacific Boring

BIG SUR, CA.

In late January 2021, a massive downpour caused a section of Highway 1 on California's Central Coast to collapse into the Pacific Ocean. A period of heavy rain accompanied by a flow of debris, trees, boulders, and mud caused severe damage near Rat Creek, ultimately washing a portion of the highway over the cliffside. This devastated the local economy, impacting residents, tourism, and businesses.

Caltrans prioritized the re-opening of Highway 1 and phased construction accordingly. Phase one involved the expedited rebuilding and opening of the highway. Phase two included the

Slope was designed at 30.56 percent downhill which is nearly 80-feet of fall over the 250-foot drive. The culvert was a 1-inch wall steel casing in 16-foot lengths

Because the tunnel started inside a depressed basin, there was no jacking pit excavated

> *Recovery of the machine presented an even bigger challenge.*

installation of a new 10-foot diameter culvert that would improve drainage beneath Highway 1 into the Pacific Ocean. Caltrans entered into an emergency contract with Papich Construction to rebuild the Highway.

Since the re-opening of Highway 1 was the priority, trenchless installation of the new culvert was selected so that that work could be performed after the highway was already open. Papich Construction contracted with Pacific Boring, Inc. to install the new 10-foot diameter culvert.

The project presented many challenges, but just 86-days after the start of construction, cars were driving along the highway. Highway 1 was opened approximately two months ahead of schedule because of the decision to go trenchless and great collaboration among the project partners.

Additional solder piles were installed at the front of the pit to pin the 800-ton capacity jacking frame back, preventing it from sliding forward as the rams were retracted

PROJECT DETAILS

The installation required the team to overcome many obstacles including the setup, slope, and recovery of the machine. The culverts slope was designed at 30.56 percent downhill which is nearly 80-feet of fall over the 250-foot drive. The culvert was a 1-inch wall steel casing in 16-foot lengths and was furnished by Vector Steel.

To speed up installation, bands were installed outside the joints, and welds were partially made on the inside during pipejacking operations. After the pipe was to station, the welds were completed. The joints were welded using an internal single bevel butt weld. Setting up the equipment at this slope required a significant amount of planning, especially with respect to safety. Conceptual drawings were made using 3D modeling, and the equipment was setup to design slope in Pacific Boring's yard prior to mobilizing. Because the tunnel started inside a depressed basin, there was no jacking pit excavated. Pacific Boring and Papich partnered with J.M. Turner Engineering to design a thrust block using a series of soldier piles and import backfill for the jacking frame to thrust off. The solder piles were installed plumb, then concrete was poured between the jacking frame and thrust wall. The thrust block wall was designed with a maximum allowable load of 639-tons, with an ultimate load of 959 tons. The estimated jacking force was 589 tons. Additional solder piles were installed at the front of the pit to pin the 800-ton capacity jacking frame back, preventing it from sliding forward as the rams were retracted.

Standard lasers used to guide tunnel machines cannot be dialed into such a steep slope. Therefore a custom guidance system

Brad Gardner, Superintendent.

Thrust wall was capable of withstanding an ultimate load of 484-tons

Highway 1 was opened approximately two months ahead of schedule because of the decision to go trenchless

Hugo Ferrer, Laborer

manufactured to guide the machine and inclinometers was installed inside the machine.

Conventional haul equipment on rails could not be used due to the extreme slope. Instead, the dirt buckets had to be removed using a large hydraulic winch. A safety device was fabricated and installed on the haulage equipment that would prevent "run-away" if the winch failed. An Akkerman Excavator Tunnel machine was utilized to excavate the tunnel. Prior to mobilizing the tunnel machine, it was set up at Pacific Boring's yard to confirm the conveyor could load a dirt bucket at the required slope.

Recovery of the machine presented an even bigger challenge. Since Highway 1 weaves along the edge of the Pacific Ocean, the machine would have to come out the side of a cliff with no access down to the machine. For the machine to be recovered, it had to be split into three pieces. The excavator arm and tower were pulled back through the tunnel. This was achieved by modifying a smaller tunnel machine, adding wheels to the bottom, then inserting it within the 10-ft casing, sliding the excavator tower into the smaller tunnel machine and removing it with the hydraulic winch. Columbia Helicopters was then contracted to hoist the two tunnel machine sections using a chinook helicopter. The heaviest pick was just under 25,000-lbs. Pacific Boring

The project was successful and completed in such a safe and timely manner because of the great partnership among team members, start to finish. Left to right, Brad Gardner, Hugo Ferrer, Jonathan Estrada, Jesus Aguila, Dallas Cline. Brad is Pacific Borings superintendent and was also the Tunnel Shield Operator. Hugo and Dallas worked the Jacking frame and dirt bucket and Jonathan worked trailing end of the shield. Jesus Aguila was the 100-ton Crane Operator.

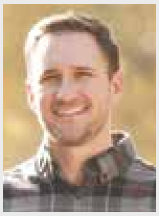
A Chinook helicopter was used to hoist the two tunnel machine sections. The heaviest pick was just under 25,000-lbs.

began mobilizing on May 20th and recovered the machine with the helicopter on June 22nd. The jacking force required to install the tunnel was 190 tons less than what was estimated.

Following the Rat Creek drive, Pacific Boring moved approximately 1-mile North on Highway 1 and installed 260-lf of 60-inch steel casing using a Michael Byrne 72-inch auger boring machine. This crossing's slope was 14.85 percent downhill and was replacing an existing failing culvert that was abandoned with lightweight grout. Auger boring was selected since the crossing was passing through an old fill area. It was suspected that large boulders could be encountered, and auger boring would allow for better face access. This proved to be the correct method selection as a large portion of the crossing had to be carried out requiring drilling and blasting boulders for removal. This location also presented access issues because it was located within a ravine. To bring spoils to the surface, a mini excavator loaded a conveyor that brought the spoils to the surface where they could be off hauled. Like the other crossing, J.M. Turner designed a thrust wall capable of withstanding an ultimate load of 484-tons. The casing was 60-inch outside diameter with ¾-in wall. The joints were welded using a standard single bevel butt weld from the outside. Pacific Boring began drilling on July 19th and daylighted on August 12th.

Both locations have since been completed ahead of this year's wet season. Caltrans made quick decisions while working with Papich and Pacific Boring, relying on their expertise to carry out the work with excellence. The project was successful and completed in such a safe and timely manner because of the great partnership among team members, start to finish.

ABOUT THE AUTHOR:



Steven Gallyer*, Pacific Boring, Inc. started working for Pacific Boring 19 years ago out of High School. He worked in Pacific Boring's shop while attending Fresno State and earning his Bachelor of Science in Construction Management.*

Trenchless Construction of the Browns Valley Trunk in Napa, CA

By: Su Soe, PE, McMillen Jacobs Associates

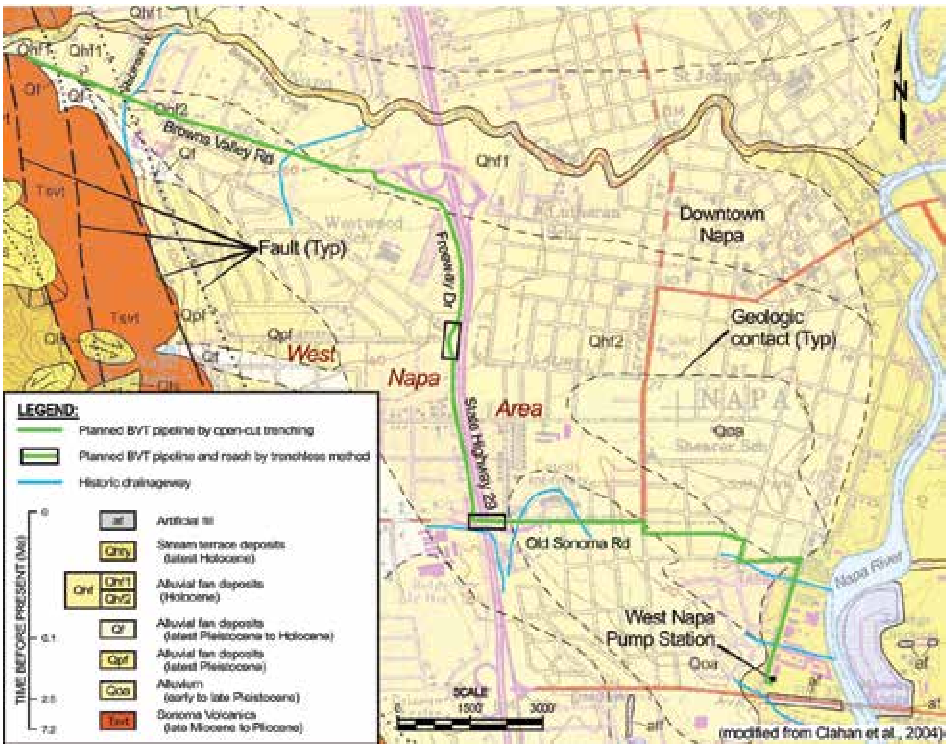


Figure 1. Geologic map and trenchless crossings for the BVT project

INTRODUCTION

The Browns Valley Trunk (BVT) Project consists of the design and construction of 3 miles of 15- to 48-inch-diameter gravity sanitary sewer pipeline to divert flows from existing overcapacity sewer pipelines in Napa, California (see Figure 1). The project is part of the Napa Sanitation District's need to address hydraulic deficiencies in portions of its sewer system located west of Napa River, and in its downstream infrastructure. McMillen Jacobs Associates provided geotechnical and trenchless design services and engineering services during construction as a subconsultant to GHD for the project. The new trunk sewer was installed parallel to the existing sewer system in most locations to divert flow from the existing sewer, which had reached its capacity. The new sewer consists of one open-cut section and two trenchless crossings, and was completed in August 2021. This article focuses on the trenchless crossings: a 260-foot microtunnel crossing of State Highway 29, and a 256-foot crossing of Freeway Drive using pilot-tube guided auger boring (PTGAB) technology.

The design and planning for the BVT project was near completion when the Magnitude 6.0 South Napa Earthquake occurred on August 24, 2014. This was the largest earthquake in the San Francisco Bay Area in over 25 years. The earthquake, which is part of the large San Andreas Fault Zone (SAFZ), caused extensive damage to utilities throughout the Napa area, including 241 water leaks reported by the City of Napa and 11 sewer main breaks reported by the District. The project was put on hold as the District and the community recovered from the damage.

Planning for the project resumed in 2016, and the design was revised to minimize the impact of BVT construction on the earthquake-recovering community. The District suggested that it may be more cost effective and less disruptive to extend the planned trenchless crossing of State Highway 29 to include the entire length of Old Sonoma Road instead of excavating the road section by conventional open-cut trench. However, the contractor, JMB Construction, opted to open cut the Old Sonoma Road section. Consequently, the as-built project only includes the trenchless reaches below State Highway 29 and Freeway Drive.

GEOTECHNICAL CONSIDERATIONS

McMillen Jacobs Associates performed a geotechnical investigation for design of the BVT project. This included review of published maps and documents, and reference exploration borings and monitoring wells. McMillen Jacobs also performed 28 exploration borings along the alignment with depths of up to 50 feet below ground surface. One of these borings was completed as a groundwater-level piezometer.

Areas near the trenchless installation locations are underlain by Holocene alluvial fan deposits consisting of clay, silt, moderately to poorly sorted sand, and gravel. Exploration borings near the tunnel reaches found the tunnel zone soil

Figure 2. Left: Jacking shaft at Freeway Drive Crossing. Right: Jacking shaft at Highway 29 Crossing

to be predominantly clay with potential sandy materials in some areas and shallow groundwater. Therefore, a slurry-based watertight microtunneling system that would provide hydrostatic and earth pressure balancing with a closed face was recommended for construction.

The potential risks considered during the design of the microtunnel boring machine (MTBM) centered on the highly cohesive clay: (1) balling or clogging of the cutterhead, (2) slurry thickening and soil separation difficulties, and (3) swelling and squeezing of clay around the MTBM and casing when overburden pressures are removed and exposed to free water, resulting in an increase in the jacking loads required to advance the casing. In addition to the risks due to clayey soil, the MTBM would also need to be configured to account for the possible mixed-face conditions and high groundwater levels.

High groundwater levels are also a concern in the design and construction of tunneling shafts because of the long duration of time they must remain accessible. Therefore, an external dewatering system, such as gravity dewatering wells and/or a watertight shoring system with portal stabilization, was specified for the shafts.

CONSTRUCTION

Vadnais Trenchless Services Inc. (VTS) was JMB Construction's trenchless subcontractor. Initially, both trenchless crossings were to be installed using microtunneling. However, the MTBM for the Freeway Drive crossing was damaged on a preceding project, and repairing the machine could take up to 8 months. Therefore, to avoid a delay in the project schedule, VTS proposed pilot-tube guided auger boring (PTGAB) for this crossing instead of the specified microtunneling method. According to the geotechnical conditions encountered in exploration borings near the crossing, utilizing PTGAB was acceptable. However, there were inherent risks that the contractor was required to account for—specifically, the high groundwater level, and the noncohesive granular native and potential backfill soil types encountered in exploration borings at the crossing.

Shafts

Jacking shafts for both crossings were 15 feet wide and 30 feet long with an excavated depth of up to 21 feet. They were constructed using continuously interlocked and braced 40-foot-long sheet piles (Figure 2) with a minimum toe embedment depth up to 8 feet below the excavation bottom. The piles were predrilled to a depth of 20 feet below ground surface to reduce pile-driving vibrations. Four external dewatering wells were installed around the jacking shafts: one outside each corner of the shafts to 25 feet below ground surface. Up to two interior sump pumps were also installed in the jacking shafts. In the jacking shaft for the Highway 29 crossing, an entrance ring with a rubber seal was fitted inside the shaft wall around the tunnel portal to

Figure 2. Left: Jacking shaft at Highway 29 Crossing Right: Jacking shaft at Freeway Drive Crossing

form a seal against both groundwater and slurry ingress into the shaft.

The receiving shafts, shored using a slide-rail system (Figure 3), were 12 feet wide, 16 feet long, and up to 22 feet deep. Because the as-built receiving shaft located at the Freeway Drive Crossing was the planned location, the receiving portal was constructed off-center in the shaft. The receiving shaft at the Highway 29 crossing was constructed about a week before the MTBM reached it. The shaft has sheet piling along the face of the exit wall (Figure 3, right), and the portal was torch-cut through the sheet piling of the receiving shaft wall after the MTBM made contact with it. Both receiving shafts had one interior sump pump to provide a reasonably dry bottom of excavation.

Pilot-Tube Guided Auger Boring

An Akkerman GBM 240A was used for the pilot tube and an American Augers ABM 48/54-900 machine was used for casing during the installation. The 4-inch-diameter, 3.3-foot-long pilot tubes were advanced into the ground behind a 45-degree slanted steering head. Line and grade were continuously verified using a theodolite and camera/LED target system. The pilot tube installation was completed in a day. The push pressure during the pilot tube installation varied from 300 pounds per square inch (psi) to 500 psi at the beginning to 2,000 psi by the end.

A reaming head/casing adapter (Figure 4) with a 1.5-inch overcut was used for the casing installation; 20-foot-long casings were welded at each joint. Soil removal was monitored to evaluate soil displacement relative to casing advance rate to check against inadvertent overmining. Lubrication was applied outside the casing to maintain the overcut and reduce the skin friction, and inside the casing to facilitate cuttings removal. It took eight days to complete casing installation, including a two-day weekend shutdown period and a day delay because of poor air quality from wildfires in the area. Recorded jacking pressure during casing installation varied between 1,300 psi and 1,400 psi. The soil conditions were predominantly clay throughout the installation, as predicted, and no significant ground loss and groundwater inflow through the portals occurred.

Grout ports were installed every 10 feet along the casing crown for contact grouting. Approximately 66 cubic feet of contact grout was used. This volume is significantly less than the theoretical volume of 129 cubic feet required to fill a space created by 1.5-inch overcut. The difference in volume was most likely due to the lubricant used during the casing installation filling a portion of the overcut space, and swelling and expanding of the clayey tunnel-zone soil between the time of tunnel completion and the contact grouting. After contact grouting was complete, the 15-inch-diameter PVC

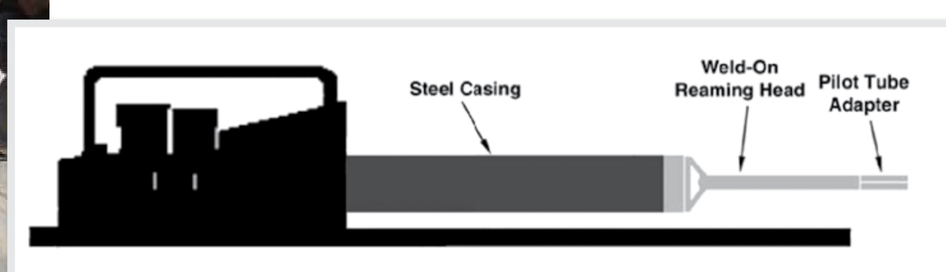


Figure 4. PTGAB reaming head/casing adapter (left) and setup (right)

Figure 5. Camera, slurry pipe, water pipe, and target visible in MTBM rear

sanitary sewer pipe, attached with casing centralizers, was placed on stainless steel skids and set inside the completed casing. The PVC pipes were connected using spigot and bell joints with additional bell restraints to ensure the pipe did not become overinserted.

Microtunneling

A slurry separation plant used during microtunneling installation consisted of shaking screens, hydrocyclones, and centrifuge to remove both coarse and fine particles from the slurry. Following particle separation, the water was recycled to the MTBM in a closed-loop slurry circuit. The MTBM used for this crossing was an Iseki TCC1000 (Figure 5). During the installation, bentonite lubricant was continuously pumped to the periphery of the steel casing through the tail of the MTBM to reduce the jacking friction. Lubrication and contact grout ports were also installed every 10 feet along the top of the casing, to allow for injection of additional lubrication from inside the tunnel, if necessary. The lubrication ports had a one-way check valve installed to prevent the flow of bentonite or groundwater back into the casing. These check valves remained in place for the duration of the installation, and each port was sealed with a screw-type plug only after contact grouting. The first 10-foot-long casing connected to an adapter ring and the remaining 20-foot-long casings were welded at each joint. Soil conditions encountered during the installation were predominantly clayey, which was softer in the beginning and stiffer toward the end of the crossing.

When the MTBM had reached approximately 56 feet in from the jacking portal, a gap developed between the MTBM and the first casing, with a maximum gap width of 1.5 inches (Figure 6). The alignment at that moment was off by 3.2 inches left of the target center. To close the gap, VTS field-fabricated and welded gusset plates to the adapter ring at the same location as the connection locations around the end of the MTBM. Simultaneously, VTS also welded a 4-inch by 4-inch kicker bar. This connected the shoring and the casing at the jacking pit entrance to prevent the casing that was in the jacking pit from shifting horizontally as the MTBM made horizontal steering corrections. Then, the first casing was reconnected to the MTBM using four 1.25-inch all-threaded bolts at the connection locations. The bolts on the right side were tightly tightened while the bolts on the left side were left loose to create an angle towards the right and allow for more aggressive steering. Afterwards, the operator steered the MTBM to the right to correct the left offset in horizontal alignment.

The MTBM was still moving left after these modifications were completed, and the alignment was off by 6 inches to the left at 76 feet in from the jacking shaft wall. It only started showing signs of movement to the right after reaching approximately 90 feet in from the jacking portal. When the MTBM was at about 100 feet from the jacking portal, the gap between the MTBM and the first casing decreased from 1.5 inches to 0.6 inch. The offset in the alignment gradually reduced as the MTBM advanced.

In addition to the gap between the machine and the first casing, there were three additional weld ruptures between casings (Figure 7). Gaps with a maximum width of 2.5 inches were observed initially, and the number of gaps increased as the MTBM approached the jacking portal. Gaps with a maximum width of 0.7 inch were observed between the casings. VTS field-fabricated and welded brackets between those casings to repair the gaps.

Figure 6. Gusset plates welded to the adapter ring (left); and 1.5-inch gap between the MTBM and the first casing (right)

When the MTBM reached approximately 200 feet from the portal, the gaps between casings had reduced and the pipe joint was closer to flush. Thereafter, the construction was shut down for four days at Christmas, and work resumed without incident on December 28 with the MTBM daylighting into the receiving shaft on December 30.

When the MTBM reached the receiving shaft, the machine was approximately 0.6 inch left of the designed target center. Jacking loads started at 20 tons, then gradually increased as the installation advanced. Significant increases in jacking load were observed regularly at the beginning of each shift and after delays due to ruptured casing joint repair. The average jacking load throughout the installation was approximately 80 tons, with a maximum of 163 tons. It took a total of 21 days to complete the microtunneling casing installation. This includes the delay due to reconnecting the MTBM to the first casing, repairing ruptured joints, and weekends and holiday shutdown.

By the completion of casing installation and MTBM removal, the largest remaining gap between casing segments was 0.7 inch. The casing gaps were temporarily plugged with burlap prior during contact grouting. A total of 132 cubic feet of cement grout was used to complete the contact grouting, which is greater than the theoretical overcut volume of about 104 cubic feet. This difference in volume was most likely due to an increase in overcut volume from casing steering corrections. After grouting was completed, the burlap was removed, and the gaps were closed with a combination of small filler bar and fillet welds. Afterwards, the 30-inch-diameter PVC sanitary sewer pipe with casing centralizers was placed on stainless steel skids and set inside the 48-inch casing. The PVC pipes were connected using spigot and bell joints with additional bell restraints to make sure the pipe did not become over-inserted.

Figure 7. Gaps between casings 5 and 6 (left) and brackets welded between casings 7 and 8 (right)

CONCLUSIONS

The trenchless crossing of Freeway Drive by PTGAB, as a contractor-proposed alternative to designed microtunneling, was completed without complications. It took a total of 14 days, not including weekend shutdowns, to complete the crossing, including mobilization and demobilization, and contact grouting after the casing had been installed.

The trenchless crossing of Highway 29 by microtunneling was completed successfully, but there were some complications. The contractor had suggested that the MTBM became off line from the target as a result of the soft soils that were shown to exist near the jacking shaft. The soft soils not only affected the target line of the MTBM, but they also affected the target grade. The MTBM was about half an inch above the target grade when the installation began. It started moving downward during the first 40 feet of the installation to approximately 2.4 inches below the target grade, even with the machine being steered upward. Then, the machine moved upward gradually and ended at 0.9 inch below the target grade when it reached the receiving shaft. A significant deflection occurred between 56 and 80 feet from the jacking portal, and the laser had to be readjusted to compensate for the left offset. This deflection was likely a contributing factor to the ruptured welds between the casings. Another possible contributing factor was weld strength. The weld between the casings was initially designed for the jacking load alone during the installation. When the deflection occurred, additional load was added onto the joints from this deflection, causing the joint weld to rupture. Consequently, VTS revised the weld design to strengthen the weld and prevent more joint failure.

It took a total of 26 days, not including the weekend and holiday shutdowns, to complete the microtunneling installation of Highway 29. The average advance rate was about 20 feet per day without any joint weld repairs, and the time it took to weld casing joints was much greater than the time it took for actual casing installation.

ACKNOWLEDGMENTS

We are grateful to many colleagues at McMillen Jacobs Associates, Napa Sanitation District, and GHD for their contributions to the project success and this paper. We also acknowledge contributions from the prime contractor (JMB) and their trenchless subcontractor (Vadnais). We thank Heather Marsh for her review comments on an earlier draft of this paper.

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Su Soe, P.E. *is a Project Engineer from McMillen Jacobs Associates (MJA). She graduated with a master's degree in Geotechnical Engineering and her career started in 2017 as a geotechnical engineer working mostly on building structures. She joined MJA in 2019 and is currently working on various pipeline and trenchless installation projects.*

Major 72-inch Sewer Interceptor in Desperate Need of Rehabilitation

Big Challenge Overcome in Albuquerque, NM

By: Michael Rocco, AUI Inc.

Hobas Pipe on site

The Albuquerque Bernalillo County Water Utility Authority (Authority) has several major interceptor lines that have reached their life span. The Authority had videoed an existing 72- inch RCP sewer line in 2019, located in the South Valley neighborhood of Albuquerque and is located about a mile from the Authority's sewer plant. It didn't take long for the Authority to realize that the RCP had lost all or most of its structural integrity. Holes in the pipe, hanging rebar and exposed aggregate were some of the major defects. In February of 2020 the Authority put out a bid to rehabilitate this sewer line installed in 1960, which was approximately one mile long. The Authority considered several trenchless methods, however, due to the structural integrity, the Authority wanted a new fully structural pipeline. The Authority accepted Slip-Lining of the sewer with a centrifugally cast reinforced polymer mortar pipe, otherwise known as fiberglass pipe.

The Authority opened bids and AUI Inc., was awarded the project to rehabilitate over 7,000 LF of the 72-inch RCP sewer

Hobas Slip-line Pipe 72-Inch

One of the biggest saving to an owner who utilizes the Slip-Line process is the elimination of by-pass pumping

line with new 66-inch inside diameter pipe as well as over 19 rehabilitations of existing manhole/ vault structures. The first major construction activity on this project was cleaning the existing 72-inch RCP which was which was about half full of debris. AUI along with its subcontractor Southwest Sewer utilized their major interceptor pipeline cleaning method. AUI strategically located insertion pits/ cleaning pits and excavated to the spring line of the interceptor sewer. The existing RCP was saw-cut, and the top half was removed. This gave access to the live sewer line and a location to remove the debris. Southwest Sewer's specialized cleaning nozzles pulled the debris from inside the sewer line into the insertion/cleaning pit. Once the debris was inside the pit AUI used a backhoe to remove the debris and place

The Authority wanted a new fully structural pipeline

Six-foot Armorock manhole

in into low profile containers. Once the containers were filled with debris they were hauled off and disposed at the city of Albuquerque's Soil Amendment Facilities. The total amount of debris that was removed from the 7,000 LF of pipe was 1,202 tons! This was a significant amount of debris that had rocks, silt and other weird stuff inside the pipeline.

Once the sewer line was cleaned the next major construction sequence was installing the new fiberglass pipe inside the old sewer line. AUI Inc., installed HOBAS pipe inside the existing RCP. HOBAS pipe is a corrosion resistant fiberglass composite and provides a long maintenance free 100-year design life. Hobas has been manufacturing fiberglass pipe at its Houston, TX facility since 1987. AUI Inc., used the push method to install the Hobas pipe inside the old pipe. The push method involves using a push plate inside the bell of the

Debris cleaned from sewer. 1202 tons of material was removed!

Hobas pipe and using a 125,000 pound excavator to push the pipe inside the old pipe. The hydraulics of the excavator had enough power to stab the Hobas joints and to continue pushing the Hobas pipe. The new Hobas pipe was 66-inch inside diameter and 69.1 inches outside diameter and weighed 478 pounds per foot of pipe.

The flow of an existing sewer line is never interrupted during the Slip-Line process, and live flow can continue to operate, thus no by-pass pumping of sewer is ever required. One of the biggest saving to an owner who utilizes the Slip-Line process is the elimination of by-pass pumping and pump watch. The risk associated with by-pass is eliminated as the Hobas pipe is installed in live flow conditions and the sewer water even acts as a lubricant and helps float the pipe for easier installation.

Another major construction activity was rehabilitating the existing vault structures. Each of the existing vaults were 12 feet wide and 8 feet long with a 12-inch thick flat top and stacked on top of the flat tops were 4-inch diameter cone sections. The project called out

for removal of the two 4-inch diameter cone sections on top of the flat top. The existing two 4-inch diameter cone sections (per vault) were installed for access to the vault so one could be used to clean and one for observation. Once the old cone sections were removed the old flat top was saw cut, removed and disposed. After the saw cut, AUI,Inc., installed a new flat top with one 6-foot diameter opening in the center of the flat top. The Authority approved two types of manhole material for the 6-foot diameter barrel sections on top of the concrete flat top. The two manufacturers that the authority approved were Armorock and LFM manholes. Both materials were used on the rehabilitation and new installation of 4-, 6- and 8-foot diameter manholes.

The project started in March 2020 and Phase I of the project which was over 7,000 LF of Slip-Line and 19 EA rehabbed manholes was completed in November of 2020. The Authority was so impressed of the operation and no disruption to the traveling public that they extended the project, Phase II, for another 2,000 LF of 72-inch sewer rehabilitation and 4 EA manholes/vaults. The entire project Phase I & Phase II was completed in June of 2021.

Overall, the project was a great success for the Owner, engineer and contractor. The project was completed on time, under budget and minimal inconvenience to the driving public. The Authority has used the Slip-Line method in years past and will continue to use in the future.

Cleaning of 72-Inch Sewer

PROJECT SUMMARY:

Phase I & II

- 9,872 LF of 72" RCP Slip-line with 66" Hobas Pipe.
- 1,718 Tons of Debris removed from sewerline.
- 22 Vaults Rehabbed with new Armorock or LFM Fiberglass MH's.

SPECIAL THANKS TO THE FOLLOWING FOR MAKING THE JOB A HUGE SUCCESS!

AUI Employees
Corey Bond – Project Manger
Archie Lucero Sr. – Project Superintendent
Archie Lucero III – Project Superintendent
Chris Benavidez – Project Foreman
Miguel Acosta – Project Foreman

Subcontractors
Southwest Sewer – Pipe Cleaning & CCTV
Condeck Corp – Annular Grout
Bogan Bros – Zebron Coating

ABOUT THE AUTHOR:

***Mike Rocco** has been employed with AUI, Inc., for over 30 years and works in the estimating, project management and marketing departments. His experience includes rehabilitation of water, storm sewer and sanitary sewer pipelines by Slip-lining, Pipe Bursting and Spiral Pipe Rehabilitation trenchless methods. Mike has well over 30 years' experience with various trenchless applications, and is a long-serving Director on the WESTT Chapter Board.*

CALTRANS Emergency Reline and Repair: San Diego

By: Gaelyn Cunningham, Contech Engineered Solutions

Technical Detail:

- Product: DuroMaxx® SPRE Liner Pipe
- Diameter: 120-inch
- Length: 330 LF (20-ft lengths)

"The material and installation cost-savings were also quite substantial when compared to other alternatives"

In the summer of 1985, development was underway for the construction of an intersection at I-15 and Clairemont Mesa Boulevard located in San Diego, California. As part of the construction, a new MULTI-PLATE® structural plate culvert was installed. The 326-foot-long, 132-inch diameter pipe was designed with variable gages (steel thicknesses) such that the inlet and outlet ends of the structure were a lighter gage than the pipe which was under more significant fill heights. The ground sloped at a 1.5:1 ratio all the way up to the roadway elevation, which was 70 feet above the crown of the pipe at the centerline. It is common to vary the gage on structural plate pipes throughout a culvert system where fill height changes significantly (e.g. heavier gages in the center of the culvert where the fill is greater).

The MULTI-PLATE culvert performed well for several decades. However, over time, scour became noticeable at the inlet end. The pipe was built on a 2.8 percent slope, and it operated at an abrasion level 3 or 4 per FHWA's classification system. The scour and higher abrasion levels caused pitting and slight perforations to form at the invert as well. The increased abrasion to the invert of the inlet end came under scrutiny in 2017 and was scheduled

The entire length of the 326 LF culvert was lined with DuroMaxx SRPE liner pipe, providing a long-lasting structural solution

Guide rails ensured proper liner pipe alignment and elevation while decreasing friction during installation

20-foot sections with pre-installed grout ports were shipped from the Ogden UT factory

for maintenance. Unfortunately, a huge storm event came through the area causing a critical failure to the first 40-foot section at the inlet due, in large part, to the lighter thickness of this section coupled with the highly abrasive bed loading. The California Department of Transportation (Caltrans) District 11 had to react quickly and decisively. The field investigation confirmed that only the 40-foot portion of the 132-inch diameter storm drain located within the city right-of-way had collapsed. The collapse caused an area of slope to fail that supported the northern side of the Clairemont Mesa Boulevard. Not only would that section need replacement, but they also needed to limit the amount of impact to the remaining portion of the roadway directly above the culvert. Caltrans immediately began working on a solution to design and construct the necessary repairs.

Their initial assessment was positive. Outside of the first 40 feet, the remaining section of the culvert was still in good condition. Rather than go through a costly excavation and replacement of the entire culvert, they determined that they could tear out the front section of the inlet, replace with a concrete pipe section, and then reline the entire culvert for a complete repair to the entire storm drain. They determined the soil arching effect common to MULTI-PLATE pipe under this much fill was still performing as designed. Still, they wanted a fully structural solution with a reline pipe that could carry the intended loads and not crack if movement occurred or change properties over time. Caltrans opened the project up to bid to determine the best product solution to repair the entire length of the culvert.

After bids were received and evaluated, a contract for the work was awarded to a local contractor, S&B Engineering, Inc. based in San Diego, California. Upon receiving the award, the contractor investigated pipe material options and determined that a steel reinforced polyethylene pipe (SRPE) product manufactured by Contech Engineered Solutions would be the best and most viable approach. The DuroMaxx® SRPE liner pipe was ideal for this solution as it adhered to both AASHTO MP 20 and ASTM F2562 material specifications and featured proven joints that would keep the grout from leaking into the pipe during the grouting stages. Not only was the lead time a critical factor in the decision-making process, but the material and installation cost-savings were also quite substantial when compared to other alternatives. The smooth interior of the liner pipe provided a pipe that was hydraulically efficient, capable of Manning's "n" value of 0.012. The hydraulic requirements of the project allowed the use of a slightly smaller new pipe diameter of 120-inches. This diameter made the sliplining process even easier.

The steel reinforced polyethylene (SRPE) liner pipe was manufactured with eighty (80) ksi tensile strength steel reinforcing ribs which provided the inherent strength, while the pressure rated polyethylene (PE) resin provided the durability.

They were able to reline the entire length of the 326 LF culvert with DuroMaxx SRPE liner pipe. The pipe was manufactured in 20-foot sections at the Contech manufacturing facility located in Ogden, Utah and delivered to the site within the desired three-week turnaround time. Longer lengths are typically used but the 20-foot lengths allowed for efficient shipping. To aid in the grouting and bracing process, 2-inch diameter grout ports per piece of pipe were installed at the Ogden plant. Grout ports were placed in predetermined locations of each piece of pipe. The purpose of the grout ports was to allow the contractor to monitor the grout level during grout installation, pump grout through any of them, and to enable screw jacks to hold the liner pipe in place during grout installation using a floor beam and screw jack method that is common with segmental sliplining. Skid rails were also installed on each piece of pipe to aid in joint alignment and minimize sliplining friction.

Once submittal documents and shop drawings were approved, S&B began the installation process. They cleaned, dewatered and inspected the existing host pipe and prepared for the liner pipe to be sliplined directly into the entire length of the 326 LF culvert. An important part of the preparation work included laying two continuous and parallel plastic pipe runners along the invert of the host pipe. These runners would act as rails, which the liner pipe rested on during the pushing process. The rails insured proper liner pipe alignment and elevation while decreasing the friction between the host pipe and the new pipe. Pipe lubricant was brushed on the runners ahead of the sliplining process.

The liner pipe was pushed through the new inlet pipe and through the remaining pipe. The grout used was a standard sand-cement-water grout that had a plasticizer admixture and had a fluid unit weight of about 115 pcf. The grout unit weight produced buoyant forces applied to the liner pipe during the grouting process that had to be managed. The beams and screwjacks, along with another buoyant force countermeasure strategy, which involved grout placement in four separate lifts, were used. Staging the lifts allowed enough time for the grout to achieve initial set. The first grout lift was only 8 inches deep. After the grout was 8 inches deep at the highest end of the pipe, the contractor filled the remaining void in 3 additional lifts.

The project went much better than expected and was completed under budget. The new culvert will easily provide in excess of 100 years of maintenance free service.

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Trenchless Installation as the Economical Choice: Mission Bay & Pacific Beach CA

By: Jeff Boschert P.E., National Clay Pipe Institute

The communities of Mission Bay and Pacific Beach, in San Diego, CA (the City) are much like many other oceanfront areas with high tourism, and high-water tables; they have an expectation of, and a need for, uninterrupted services.

The Sewer Group 786 project in this area of San Diego included replacing, rehabilitating, or realigning approximately 15,145 linear feet (LF) of sewer mains in areas adjacent to Sea World and other tourist traffic. The project was planned for depths ranging from 4 – 21 feet with ground water present at 8 – 14 feet. As an added challenge, many of the slopes on this gravity flow sewer project were very flat, ranging from 0.25 – 0.75 percent.

The original plan for the Sewer Group 786 project included the replacement of existing 8- and 12-inch sewer mains via the following construction methods:

- **replace-in-place** approximately 7,973 linear feet (LF) within existing trench alignments via open trenching (4-21 feet deep)
- **realign** approximately 3,672 LF of sewer main within new trenches via open trenching (11-21 feet deep)
- **construct** approximately 3,500 LF using trenchless technology (4-21 feet deep)

The project footprint was located entirely within the public right of way (including alleys), easements on private property and streets within the communities of Pacific Beach and Mission Bay with an average surface elevation of just 14 feet above sea level and unstable soils. This area has a great deal of tourist traffic. Any lane closures would cause backups in all directions on major arterial roadways and the unstable soils would necessitate closure of multiple lanes of traffic on those roads in the case of open trench installations.

The bid documents specified the installation of new pipe via the use of Horizontal Directional Drilling (HDD) as the trenchless method for approximately 3,500 linear feet (30 percent of the entire project scope). The design slopes for these 8 and 12-inch gravity flow sewer pipelines ranged from 0.25 – 0.75 percent. To maintain these exacting slopes in unstable soils with concerns about contaminants and maintaining traffic flows, Ortiz based their bid on a plan to use the Pilot Tube Method of Guided Boring (PTM) with Vitrified Clay Jacking Pipe (VCP-J) and the Akkerman Guided Boring Machine (GBM) 240A system in lieu of the specified HDD method. PTM is applicable for gravity flow installations and includes a theodolite guidance system, pilot tubes, jacking frame, power pack, and lubrication pump.

As a knowledgeable general contractor with extensive experience in the area, Ortiz Corporation (Ortiz) worked with the city's plan calling for a blend of open trench installation and

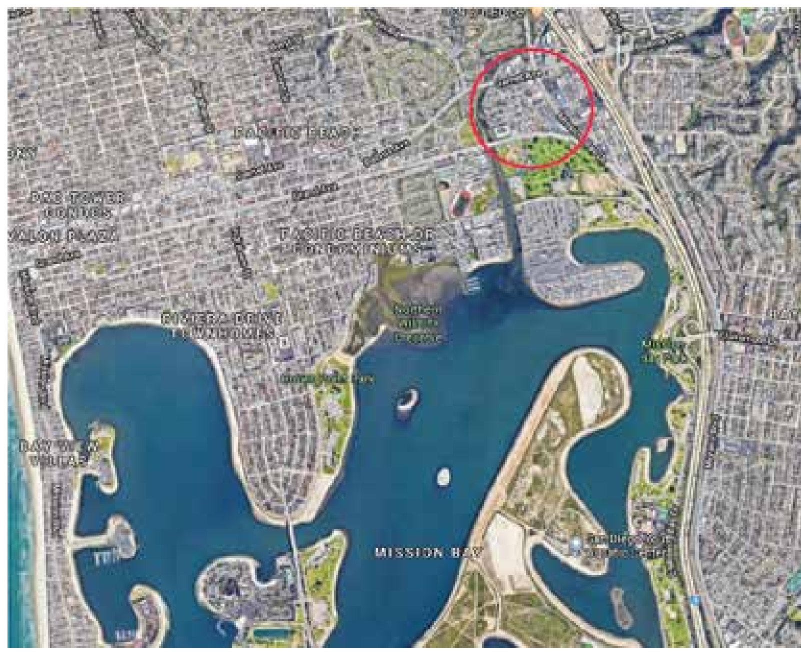

Figure 1. The project (located in the red circle above) was affected by tidal influence and needed to be managed entirely within the public right of way

trenchless technology to upgrade a portion of the collection system in the Mission Bay area. They also recommended consideration of planning the full project as a PTM project.

Prior to starting the project, Ortiz conducted research to identify any environmental concerns in the area. GeoTracker is the California Water Board's data management system for sites that impact, or have the potential to impact, water quality in the state. The emphasis of the system is on groundwater. One of the benefits of the program is a user-friendly map very similar to Google Maps. Many of the closed cases on GeoTracker revealed that significant tidal influence may have pushed the plumes around. There was a concern the dewatering system would pull any latent contaminants into the work zone.

The City also hired Allied Geotechnical (Allied) to perform an additional geotechnical exploration. The scope of Allied's investigation did not include a Phase I Environmental Site Assessment to evaluate the possible presence of soil and/or groundwater contamination beneath the project alignment. During the subsurface investigation, soil samples were field screened for the presence of volatile organics using a RAE Systems Mini-RAE

PTM can be significantly more cost effective than open trench installation, especially where unstable soils create concerns

Figure 2. Onsite GAC treatment plant

3000 organic vapor meter (OVM). The field screening did not reveal elevated levels of volatile organic compounds.

There were several considerations that led to the selection of PTM as the installation method of choice, but the primary motivators were the extreme precision required by the flat slopes, the desire to maintain traffic flows in a tourist area, and the probable spread of contamination plumes based on the state's GeoTracker program.

The contractor still had concerns due to the proximity of other known contaminants and the tidal influence. Soon after dewatering began, the contractor's fears were realized. Once the contaminant was identified, granulated, activated carbon (GAC) system vessels were put in place to pull the hydrocarbons out of the groundwater prior to disposal.

The first five PTM trenchless drives progressed as planned, with all drives being "on-target" and within the constraints of the exacting design slopes.

The first open cut section began after the fifth trenchless drive and involved the following:

- 395 feet of open trench with cuts up to 15 feet deep
- 2,204 square feet of pavement replacement with widths in excess of the trench width
- 1,484 tons of contaminated soils
- 1,636 tons of imported backfill materials to replace contaminated and unsuitable soils.

Figure 3. Pilot tube theodolite with integrated camera and visible LED illuminated target

The installed cost per linear foot of pipe in this open-cut section of the project was $1,267. The installed cost per linear foot of VCP-J installed using PTM was approximately $570.

After experiencing the PTM trenchless method and facing the challenges (and cost) of the first 395-feet of open trench installation, the owner opted to convert the remainder of the project to PTM. With people, equipment, and experience all in place, the City also opted to add five PTM drives which were not included in the original contract.

The rich clays on the project created obstacles for the dewatering filtration and treatment system. The primary issue was clogging of the GAC system. Bag filters were installed to prolong the life of each carbon filter, and bags were replaced one to three times per week with a single change of the GAC filters costing more than $12,000.

Figure 4. Over 250 wells were drilled at depths ranging from 35 to 40 feet

Figure 5. Installing 12-inch VCP-J in the 3rd step of the Pilot Tube Method using a powered reaming head (PRH)

> *"The owner opted to convert the remainder of the project to PTM"*

With the exacting specification for slope, the PTM guidance system was critical to the success of the project. The "real-time" view of the location and steering head orientation of the pilot tubes, together with the ability to make adjustments quickly during the entire installation, resulted in pinpoint accuracies.

Because the average compressive strength of VCP-J is 18,000 psi, the pipe itself can resist the high jacking forces generated as the pipe is pushed through the ground during PTM installation. This eliminated the need for an external casing pipe. The high compressive strength, low-profile, zero-leakage joints of VCP-J make it the cost-effective choice for PTM installations.

VCP-J has the same material benefits as all VCP. The proven lifecycle and greater range of options for long term operations and maintenance are prime considerations for more municipalities as they evaluate the material choices.

Plans were adjusted as the project progressed to limit the impact of contaminants and to minimize disruption to traffic flows. Actual conditions were not consistent with conditions indicated on the plans. Modifications and new alignments were necessary to maintain gravity flow. In the adjusted project map, new alignments caused deletions of planned drives. Those deletions were replaced by rerouted drives. In most cases, grade differentials were non-existent, requiring the team to find new routes for the pipeline while maintaining proper slopes.

PTM can be significantly more cost effective than open trench installation, especially where unstable soils create concerns. The owners are now asking contractors to consider doing more trenchless installations, when feasible. This is becoming a win-win for the community in reducing both the total cost of the installation and the disruption (to both traffic and area businesses) this kind of project can create.

To see the paper presented at NO-DIG 2021 about this project, visit **ncpi.org/education-center/papers-tech-notes/**.

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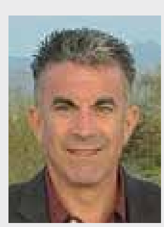

__Jeff Boschert, P.E.__ is the President of the National Clay Pipe Institute (NCPI) and represents the industry on multiple ASCE and ASTM committees. Jeff was one of the principal authors of the ASCE/UESI Manual of Practice (MOP No. 133) on Pilot Tube and Other Guided Boring Methods and is serving as Vice Chairman on the ASCE/UESI Pipelines Division Executive Committee (ExCom). He holds a BSCE from Missouri University of Science and Technology.

Mission Critical Corrugated Metal Pipe (CMP) Repair

By: Craig Camp, GHD

ABSTRACT

The potential cause of the sinkhole was failure of the CMP storm drain. The CMP experienced flattening of the profile, corrosion of the invert, and open joints. The potential causes of the CMP failure were the naturally corrosive nature of the soils, age of the culvert, poor workmanship in installing the culvert, and poor design. This project encountered numerous complicating factors including:

1. The roadway is sole access to critical base assets. The roadway remained open to restricted weight loads, less than normal requirements.
2. Access and work area required the base and contractor to expedite clearing affected areas for permitting including biology, archeology, Native American, surveyor, etc.
3. The existing CMP culvert was comprised of several section of CMP with various shapes and sizes. The largest of these was approximately 7-feet in diameter.
4. There were three grade breaks within the CMP alignment. The breaks allowed the storm water to fall approximately 2 feet over a run of 2 feet.
5. The existing alignment for repair was approximately 270 feet in length with a left horizontal curve with a radius of approximately 1500 feet and approximately 120 degrees.
6. The CMP was galvanized steel with a bitumen lining.
7. The culvert invert was cast concrete.
8. The proposed tunnel construction replacement method had to negotiate the curved alignment, consume the CMP, and then allow for abandonment or removal of the proposed construction equipment while still supporting the failed ground above the tunnel termination. The tunnel replacement ended at the concrete tunnel, start of the railroad easement.
9. The work area and access were tightly controlled to avoid protected habitat and sensitive cultural resources while maintain a safe grade.
10. The work area required a method to divert storm water in the event of rain. The channel is subject to flash flooding.
11. Short design and construction schedule.

INTRODUCTION

VAFB is part of the U.S. Strategic Command providing facilities for the Joint Space Operations Center, 614th Air Operations Center. Their defined mission, as provided in the bases fact sheet dated April 2018, is "Execute operational command and control of space forces to achieve theater and global objectives." Additionally the base operates 24 hours every day of the year. This culvert repair project was required for VAFB to maintain operational capabilities.

The culvert repair project is described in the following sections:

- Project description
- Issue resolution during design
- Construction
- Project Conclusion/Lessons Learned

PROJECT DESCRIPTION

Vandenberg Air Force Base (VAFB) is located along the California central coast between the cities of Santa Barbara to the south and Santa Marie to the north within the County of Santa Barbara, California as shown in Figure 1. VAFB is an environmentally sensitive landscape with unique requirements based upon its mission. The elements surrounding the Repair of Coast Road Sinkhole and Culvert project affected VAFB's ability to carry out those missions, thereby becoming a mission critical project. The project required the replacement of a failed corrugated metal pipe (CMP) storm culvert and restoration of the roadway to the pre-existing condition.

The project timeline commenced with the discovery of the first sinkhole within Coast Road during the winter 2017. A second sinkhole was found upon further investigation. The base issued an RFP with proposals due in August 2017. The repair design commenced immediately upon award. Construction commenced in April 2018 with completion in November 2018, before the 2018-19 winter storms.

Coast Road is a critical asset because it provides access to portions of the base required for the base to fulfill its mission. The

Figure 1. Santa Barbara County, California (Google Maps)

Figure 2. Looking south over sink hole in north bound lane

Figure 3. Second sink hole near power pole

roadway could not be shut down or have risk of shut down for any time period which drove the expedited design and construction timeline.

The larger sinkhole occupied the entire northbound traffic lane and shoulder of a two-lane roadway as shown in Figure 2. The smaller sinkhole was located on the east roadway embankment below the roadway and near a power pole as shown in Figure 3.

Potentially additional sinkholes could develop along the CMP culvert. Immediate remedial actions included constructing a temporary bypass road along Coast Road. The realigned roadway used the southbound lane for northbound traffic and moved the southbound traffic onto the temporary bypass road. This remedial action allowed access to this portion of the base while prohibiting heavy loads. Additionally, a contractor stabilized the ground

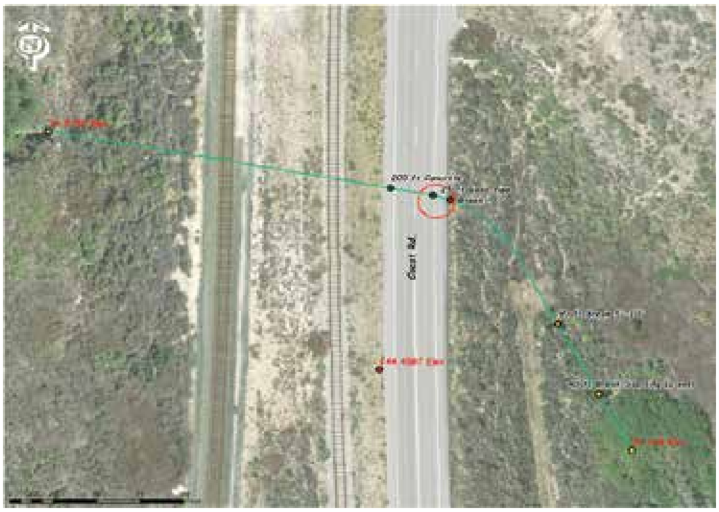

Figure 4. Aerial view of the culvert alignment including sink hole locations. (Google Earth)

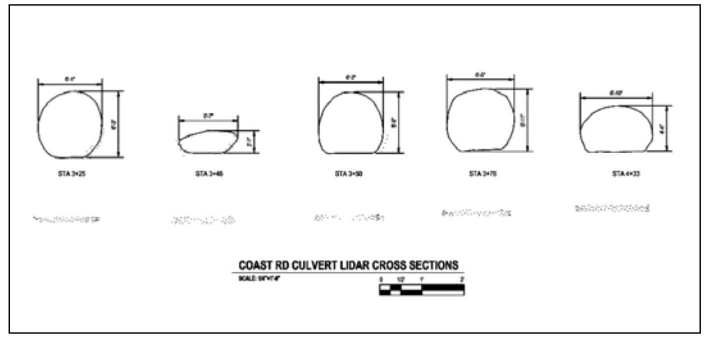

Figure 5. CMP LIDAR demonstrating various sizes and shapes

surface to prevent further sinkhole development and stabilized the CMP by casting a concrete invert to prevent further erosion of the floor of the culvert. Two HDPE conduits were also added by the base to contain low storm water flows.

The approximately 270 linear feet of seven-foot inside diameter CMP conveys storm water from the upstream end from a point south and east of the roadway undercrossing before turning west and perpendicular to the roadway. The CMP then crosses under the roadway and intersects a concrete horseshoe shaped tunnel that continues an additional 200 feet west, for a total length of 470 feet, until it intersects the surface as shown in Figure 4. The concrete tunnel lies approximately 50 feet below the surface under two existing sets of parallel railroad tracks. The entire 470-foot long alignment of the drainage pipe, CMP and concrete horseshoe tunnel, appears to be in locally derived fill that grades as silty sand. The repair could not affect the railroad tracks in any way. Railroad approval is required to pass under their right-of-way and acquiring a permit within the required construction schedule was extremely unlikely.

The project included repairing the Coast Road roadway damaged by the sinkhole and re-grading the sloped embankment. The work included site visits, geotechnical investigation, design, and additional fieldwork to provide a conceptual design. The conceptual design, 35 percent design submittal included design analysis, interviews, list of specification section titles and numbers, cost estimate, recycled materials list, reports, and drawings. The culvert repair design was drastically compressed by very close government and engineer cooperation to allow for expedited start of construction.

ISSUE RESOLUTION DURING DESIGN

Each of these issues required resolution or mitigation in design to avoid issues during construction.

1. The roadway is sole access to critical base assets. The proposed construction method was required to complete the tunnel while allowing the road to remain open and in limited service. The existing CMP had approximately 50 feet of cover at the roadway. Tunneling was seen as viable to allow the road to remain open.

Figure 6. Existing CMP material showing bitumen, zinc, and rivets

Figure 7. Failed CMP invert before being cast with concrete

2. Access and work area required clearing for biology, archeology, Native American, etc. The base provides protected habitat for several protected species and protected plants. The base also has sites that have Native American artifacts. The previously disturbed surface, areas of previous construction, was of minimal concern and required clearing and in some locations widening to accommodate the roadway construction and tunnel construction. The existing access road from the south generated the least amount of disturbance. Unfortunately the south access required transporting the construction equipment over the road with the sink hole. The topography and cleared land allowed for a road to be built north of the sink hole to the upstream end of the existing CMP. The grade was acceptable for the construction equipment requirements and narrowly avoided protected habitat.
3. The existing CMP culvert included various shapes and sizes, see Figure 5 below for profiles of the existing CMP. Tunneling is a viable method to consume the existing CMP. The tunneling machine was sized to consume the known profile and allow for some unforeseen variations. The contract documents included a 12 foot tunneling machine to navigate the entire existing configuration. The tunneling machine was to have an open face to allow the CMP to enter the shield for demolition. The contractor was allowed to select the mucking system to remove the spoils, excavated material, and debris.
4. There were three grade breaks of approximately 2 feet fall over a run of 2 feet. The design grade was designed at a constant slope over the entire tunnel length and the tunneling machine was required to have steering capability to maintain the design slope. The new tunnel design was more constructible than the existing configuration.
5. The existing alignment was approximately 270 feet in length with a 120 degree left curve with a radius of approximately 1,500 feet. The tunneling machine was required to have steering capability to negotiate the curve including additional capability if the curve had to be tighter due to unforeseen conditions. The contractor was allowed to use steel rib and wood lagging for the initial ground support as the method can be adapted to accommodate the curve by cutting the lagging lengthwise on site.
6. The CMP was galvanized steel with a bitumen lining as shown in Figure 6 below. The CMP cannot be cut with a torch because zinc fumes are hazardous, cause death, and bitumen is flammable. The CMP had to be cut with shears or the rivets removed to reduce the CMP to a size conducive for removal. The tunneling machine protected the workers while during CMP demolition.
7. The culvert invert was cast concrete with two temporary HDPE conduits. The CMP culvert invert failed as shown in Figure 7 below. The invert was cast in concrete as a temporary repair to prevent further erosion during the ongoing wet season. Proposed tunneling method was sized to excavate beyond the concrete cast invert.

Figure 8. New RCP pipe, headwall, and trash grate before restoration

8. The tunnel replacement ended at the concrete tunnel, start of the railroad easement. A retrieval shaft could not be constructed without closing Coast Road. The contract requirements required the contractor to cannibalize the tunneling machine and leave the steel shell buried at the concrete horse shoe tunnel.
9. The work area and access were tightly controlled to avoid protected habitat and sensitive Native American cultural resources. The allowable work areas were clearly delineated and protected.
10. Contractor was required to divert storm water in the event of rain. The two HDPE pipes within the CMP could be used to remove storm water. The contractor elected to remove the HDPE pipe. The contract requirements included a temporary catch basin to protect the workers. The contractor elected to use pumps with temporary HDPE pipe to transfer storm water from this drainage to the next drainage to the north.
11. Short design and construction schedule. The design included a steel reinforced final liner with the invert using cast in-place concrete and a shotcrete crown. Other final liners were considered and not included due to the time constraint. The contractor proposed using reinforced concrete pipe (RCP) with cellular grout backfill as the initial liner. This change was foreseen as contractors tend to receive better delivery schedules than non-purchasing inquiries. The project was awarded in April 2018 with project completion in November 2018. The contractor completed the required tunnel within the allocated time.

CONSTRUCTION

The design as-bid did not require any special materials or equipment for tunneling. The general contractor moved on site and immediately began developing the access from Coast Road to the tunnel work area. Once the access was completed, the tunnel contractor mobilized two crews to the launch area and immediately prepared the launch site. The tunnel construction commenced with two crews working two shifts tunneling every day to complete the tunneling as quickly as possible. The only change requested was the use of 84-inch RCP with cellular concrete backfill to replace the cast-in-place concrete invert and shotcrete crown. This was a no-cost no-schedule change. As previously stated this was anticipated but could not be bid based upon the best delivery date provided by RCP manufacturers before the bid.

Once the tunneling machine was against the existing concrete horseshoe tunnel, the sinkhole repair commenced. The tunnel contractor placed the new reinforced concrete drainage pipe within the tunnel and grouted the remaining opening between the new pipe and the initial tunnel support system. The upstream headwall was reconfigured to improve the hydraulic flow into the tunnel and a trash grate added to minimize flow material damaging the tunnel as shown in Figure 8 below. The new north access road provides access for future maintenance.

The project value was $4 million as determined by the successful low bid.

PROJECT CONCLUSION/LESSONS LEARNED

The contract documents conveyed the project requirements and provided direction to allow the contractor to deliver the Repair of Coast Road Sinkhole and Culvert project. The owner was receptive to the contractor requested changes and the changes were actually discussed in the design process. The lack of change orders and requests for information (RFIs) indicates the project was well understood and delivered as expected.

This project was successfully constructed due to the efforts of the command of VAFB, the prime contractor Potter Enterprises, and the two tunneling subcontractors Golden State Boring and Mine Development.

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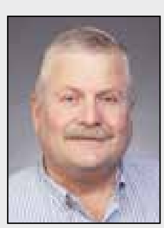
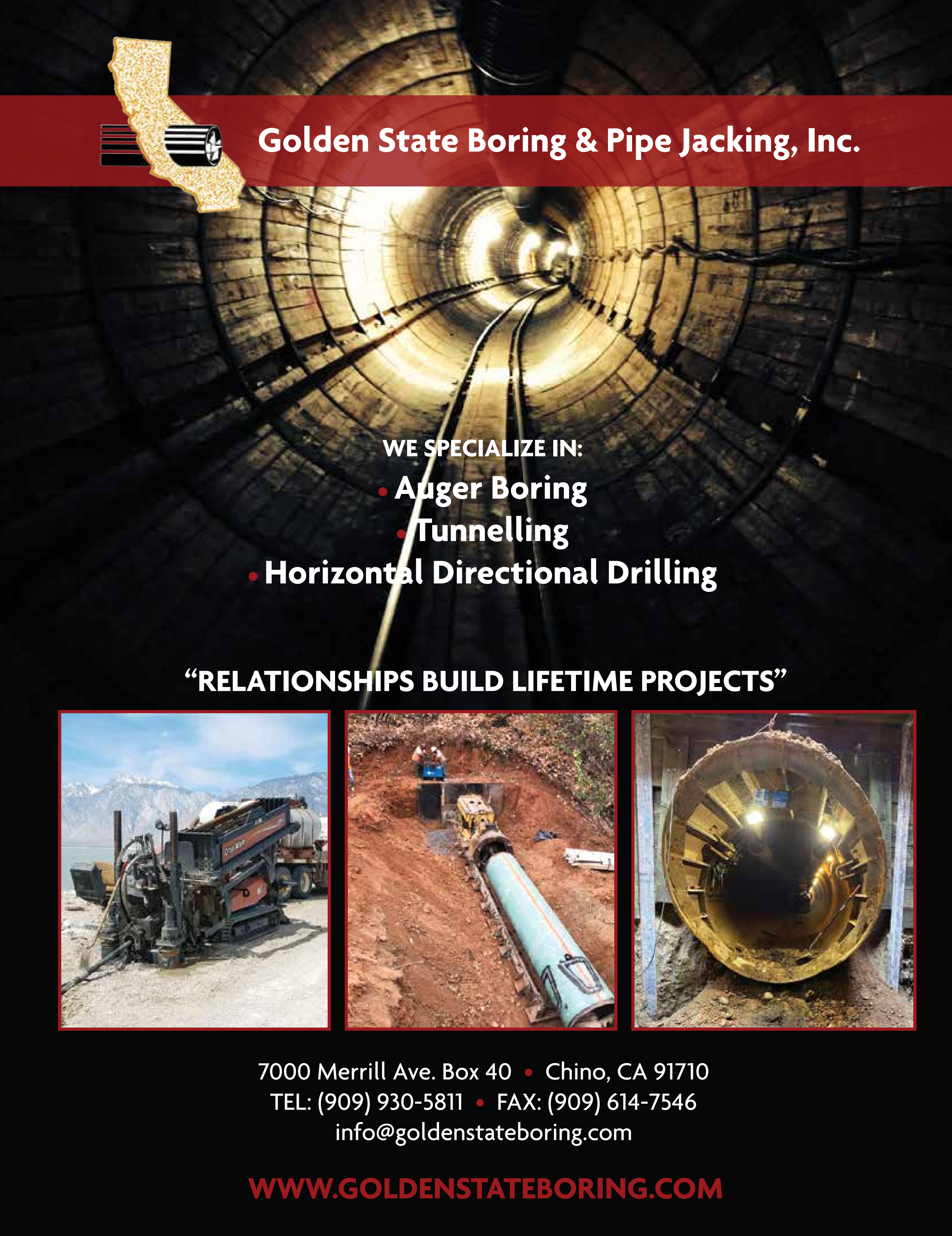
Google Earth Pro, modified with kmz file

Google Maps, https://www.google.com/maps

ABOUT THE AUTHOR:



Craig Camp *has over 40 years of experience in underground construction. His expertise encompasses all phases of microtunneling and other trenchless construction methods including conceptual design reviews, preliminary design reports based on anticipated ground conditions, production estimates, specification reviews, drawing reviews, geotechnical baseline reports (GBR) reviews, project cost estimating, and resolution of project issues. He has been involved in over 200 trenchless design and construction projects installing over 300,000 feet of pipelines throughout North America.*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Spiral Wound Pipeline Rehabilitation: Albuquerque NM

By: Jacquie Jaques, Sekisui SPR Americas

PROJECT SCOPE

AUI, Inc, an installer of Spiral Wound lining technology located in New Mexico, recently completed a pipeline rehabilitation project for Albuquerque Bernalillo County Water Utilities Authority (ABCWUA). The project description included the rehabilitation of approximately 304 linear feet of interceptor sewer ranging in diameter from 20-inch to 24-inch including all connecting manholes.

The interceptor sewer consisted of approximately 265 feet of 20-inch CI and 39 feet of 24-inch CP located under I-40 between manholes H17861 and H17874. I-40 is one of the two major interstates in Albuquerque consisting of five lanes of traffic East and West bound. This interceptor section included two manholes that required rehabilitation and MH H17871 would be abandoned. Due to the sensitive location of the work, the Contractor had to make all efforts to control odor release as outlined in project supplemental technical specifications.

CHOOSING A TRENCHLESS LINING METHOD

For this project, ABCWUA specified Sliplining, CIPP, Fold and Formed and SPR™EX Spiral Wound liners. The contractor needed to select the rehabilitation lining system that would best meet the project design and constructability requirements. As part of their selection criteria the contractors needed to address the following questions:

1) Does the rehabilitation method selected require annular space grouting?
2) Does the method selected require access pits or site modification?
3) Does the lining method require pre lining point repairs or obstruction removal?
4) Does the rehabilitation method require de-watering or bypassing either for the cleaning, CCTV and/or installation process?

Due to the location of pipe segments located along the I-40 interstate, it was determined that SEKISUI's SPR™EX PVC Spiral Wound liners were the best structural repair solution for this project. SPR™EX is a tight-fitting lining solution that does not require annular space grouting. The SPR™EX installation equipment fits through existing manholes without any access pits or alteration of the current structures. As it is a mechanical installation process, SPR™EX does not produce any chemicals or odors that would be in non-compliance with the project supplemental technical specifications citing odor control.

Additionally, the contractor would not have to perform pre-lining point repairs or remove obstructions to install SPR™EX. More importantly, since setting up a bypass pumping system on the freeway proved to be impossible, SPR™EX addressed this concern with the ability to be installed in live flow. The Contractor determined that SPR™EX was the most cost-effective solution for this project.

INSTALLATION & INCORRECT AS-BUILTS

Southwest Sewer Service Inc., AUI's subcontractor, spent weeks cleaning these pipelines to remove years of debris and grease build up. The lines were in such a condition that mechanical cleaning equipment was used to clean the sewer line. This was achieved with a series of chain cutters to break up the tuberculation inside the pipeline and then the lines were jetted just prior to the SPR™EX liner being installed.

Figure 1. Due to location on freeway, bypass pumping was impossible

However, once the lining had begun, it was determined that the as-builts provided had incorrectly identified the diameters of the host pipes. Instead of having 21-inch and 24-inch pipelines, the sewers were actually 18 inches and 21 inches respectively. With any rehabilitation method, this would have meant a costly change order with new pipe liners having to be ordered.

Figure 2. Heavy tuberculation was removed with chain cutters

Figure 3. Installation equipment fits through existing manholes

> *SPR™EX addressed this concern with the ability to be installed in live flow.*

Figure 4. Over 300 linear feet were lines using SPR™EX

However, with SPR™EX, AUI, Inc. was able to make on site corrections by downsizing the winding cage within the SPR™EX winding machinery. This would allow AUI to construct a smaller diameter liner to fit the needs of these pipe segments. This adjustment proved successful, and the 18 and 21-inch pipes were properly lined using SPR™EX, a total of just over 300 linear feet. Despite the changed conditions, the result was a structural liner that met the agency's hydraulic capacity requirements on time and on budget.

ABOUT THE AUTHOR:

SEKISUI SPR
Leading Edge Trenchless Solutions

***SEKISUI SPR Americas, LLC** provides Spiral Wound liners for trenchless pipeline rehabilitation. Spiral wound involves constructing PVC liners inside existing pipelines utilizing machinery. SEKISUI SPR is based out of Atlanta, GA with representatives on the East and West Coast U.S.*

Yelomine® PVC Pipe Is the Answer for Above-Ground Temporary Water Pipeline Challenge in California

Municipal Case Study

By: Rowena Patenaude, NAPCO Pipe & Fittings

PROJECT TYPE: Municipal	**OWNER:** San Juan Water District	**CONTRACTOR:** San Juan Water District
APPLICATION: Temporary bypass	**PRODUCT USED:** 12" D2241/RJ Certa-Lok® Yelomine® SDR 26 PVC pipe with NBR gaskets	**ENGINEER:** San Juan Water District

The San Juan Water District in Granite Bay, California, needed an above-ground water delivery solution to support two large temporary drinking water storage tanks. The product selection was crucial for success as the pipe had to withstand environmental exposure and a wide range of temperatures while maintaining the required performance for 2 years.

CHALLENGE

A major improvement project underway by the San Juan Water District included the rehabilitation of the Hinkle Reservoir. The reservoir has a surface area of 12.5 acres and provides quality drinking water to more than 265,000 people annually in the Sacramento region. The project required that the 62 million- gallon water reservoir would be out of service for approximately 2 years while they replaced the liner and cover – the liner and reservoir were originally constructed in 1980. To assist with operational control during the project, two large temporary tanks were planned for installation on the District's property just beyond the main entrance gate. The bolted steel tanks would support water delivery to residents while the reservoir was being serviced. The only suitable location for the large tanks was also over an existing buried 18-inch C905 PVC pipeline, with a depth of cover approximately 5-7 feet.

The existing buried pipeline supplies water for drinking and fire service to the City of Folsom, an adjacent residential and commercial area with a population of over 86,000. There was concern that the load of the tanks on top of the existing buried pipeline could damage the pipeline causing a major outage. With the line turned-off and out of service for 2 years, a temporary watermain was needed to ensure a water supply to the residents and businesses while the tanks were in-service.

APPLICATION

When it became evident that temporary water tanks were needed to offset storage lost by taking the Hinkle Reservoir out of service for repairs and to alleviate the concerns of a potential outage in case the existing buried pipeline was damaged, the district considered a temporary above-ground bypass pipeline. The new bypass pipe had to meet requirements of the current operating

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>
> Mark Hargrove, Senior Engineer, San Juan Water District

pressure, 50 -70 psi, and accommodate an anticipated delivery of water at 3000 gallons per minute from the new tanks. The San Juan Water District chose 400 feet of 12-inch D2241/Restrained Joint Certa-Lok® Yelomine® SDR 26 PVC pipe for the above-ground temporary water pipeline.

SOLUTION

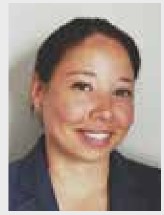
A four-person crew installed the temporary bypass line a few feet away from the new water tanks. To support the pipe, the district considered multiple options including bare earth, wood blocking and adjustable steel supports on concrete footings, but ultimately chose sandbags placed 6 inches above ground level to keep the pipe in place. The pipe was raised 6 inches to provide a gap between the ground and the bottom of the pipeline allowing for drainage which was directed into a nearby drainage channel. Key criteria for determining support types included cost, stability, and schedule. Since stability had not been an issue, sandbags worked well from a cost and schedule viewpoint. The sandbags are double bagged and UV rated to provide strength and enough durability to last the project duration.

Certa-Lok Yelomine PVC pipe from NAPCO Pipe & Fittings was chosen for the project because the pipe is made up of a specially formulated PVC compound that contains impact modifiers and UV inhibitors. These modifiers and inhibitors provide higher impact strength over an extended period of time and the pipe can be used in above-ground, exposed applications. The pipe was installed in 20-foot lengths and the Certa-Lok Yelomine restraint can be assembled in less than one minute per joint providing for a quick and efficient installation. The Yelomine pipe was installed cartridge style with no extra equipment required.

"This line went together in less than a day," said Mark Hargrove, senior engineer San Juan Water District. "It was very easy to put together."

The 12-inch Yelomine bypass pipeline was then connected to an existing 18-inch pipeline. The water line passed the pressure test for a successful installation.

ABOUT THE AUTHOR:

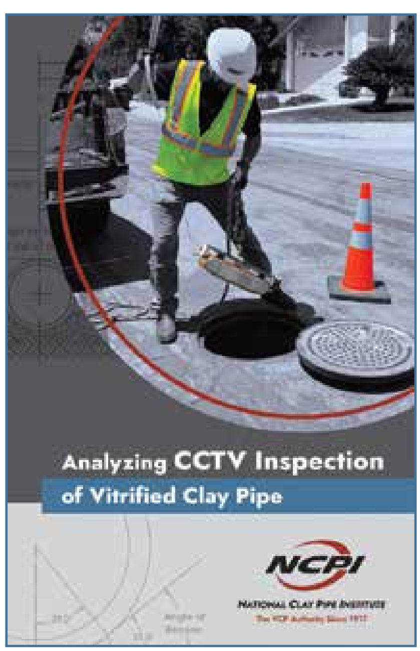


Rowena Patenaude *is a Regional Specification Sales Engineer with ten years of experience working for NAPCO Pipe & Fittings. She is committed to promoting the proper use of PVC products in municipal infrastructure and has contributed to the publishing of industry standards.*

INDEX TO ADVERTISERS

NCPI RELEASES NEW CCTV INSPECTION HANDBOOK

The National Clay Pipe Institute (NCPI) announced the publication of a new Handbook titled Analyzing CCTV Inspection of Vitrified Clay Pipe.



“As valuable as a CCTV inspection can be, human and software errors can and have resulted in expensive and unnecessary ‘repair’ projects that are difficult to justify,” according to Jeff Boschert, President of NCPI. “This new handbook is designed as a tool for the reviewer or operator inspecting VCP to minimize the risk of misinterpretation.”

The new revision features 4K high-definition CCTV images in eight conditions, with two images at different defect tolerance levels for side-by-side comparisons.

The new handbook also includes cross-sectional joint images, details on various cosmetic imperfections, and angular joint deflection analysis.
“The intent for all the additions to the updated handbook is to better educate and ‘hopefully’ reduce the number of incorrect observations made by the reviewer or accepting agency.”

It is currently available on the NCPI website at ncpi.org, on the publications page.

VCP jacking pipe joint.