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Western Society for Trenchless Technology - Trenchless Review

FALL 2013

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Pearl City
After a series of breaks, a section of a large-diameter dual wastewater force main system needed immediate repair

Rehabilitation
Approximately 1,000 feet of reinforced polymer mortar pipe was installed daily in a Los Angeles sewer project

Installation
A corroded culvert was repaired with a product that can be manufactured to virtually any size and shape

Also...

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Western Society for Trenchless Technology - Trenchless Review - 2013
Chairman’s Message

After the Gold Rush
Craig Camp - WESTT Chairman

Welcome to this year’s Western Regional Trenchless Review, and what promises to be a great Western Regional No-Dig Conference in the Aloha State.

The past 12 months have been an interesting and exciting time for WESTT, the Western Chapter of NASTT. Members came out of the 2012 regional conference, held last October 29-30 at the Ayres Hotel & Suites in Ontario, California, brimming with information and (one hopes) renewed enthusiasm in the field of trenchless technology. A few months later, a WESTT city, Sacramento, hosted NASTT’s 2013 No-Dig Show at its Convention Center. Dubbed “The Great Trenchless Gold Rush,” the March 3-7 conference and exhibition was a huge success – from Kickoff Breakfast, to presentation of 150 excellent peer-reviewed papers, to Educational Auction and Reception, to Gala Awards Dinner, to closing luncheon. Immediately following the auction, WESTT also hosted our first ever WESTT member reception, and for that I extend a BIG THANK YOU to WESTT members in attendance and two special board member volunteers that made it happen, Cory and Matt.

Though the economy has been sluggish and governments continue to tighten their belts, trenchless technology keeps on growing in acceptance and opportunities – in no small part because it offers cost-effective ways of building and rehabilitat-ing underground infrastructure. This year’s Review includes outstanding examples of the innovative, cost-effective alternatives we bring to municipalities and utilities in our states. Besides saving owners money, we also make projects “greener.” In one of this publication’s articles, Keith Hanks and co-authors examine how Los Angeles reduces its carbon footprint via trenchless methods in sewer rehabilitation.

WESTT is fortunate to have developed a strong and productive relationship with the Northern California Pipe Users Group (PUG) which has included PUG offering its members NASTT training courses. As detailed in an article by PUG’s Vice-Chairman, the group has continued building its members’ knowledge of trenchless technology with on-site demonstrations of local construction projects using the latest pipeline installation practices. We thank them for their help in spreading the word on trenchless construction.

WESTT’s ninth annual Western Regional Do-Dig Conference, Exhibition & Course is being held October 28-29 at the Ala Moana Hotel, 410 Atkinson Drive, Honolulu, Hawaii. This is our first return to Hawaii since September 2009 when we held the fifth annual Western Regional No-Dig Conference, Exhibition & Course there. It’s always great to spend a little time in Hawaii; I’m sure this time is no exception.

As mentioned earlier, last year’s WESTT conference was held in California. In the interests of ensuring that the annual event is accessible for members throughout our region, we head east to New Mexico for the 2014 edition, which will take place in Albuquerque.

Albuquerque was the host city for NASTT’s 1998 No-Dig Show. This will be WESTT’s first regional conference in New Mexico.

The mission of WESTT and its parent organization is to advance trenchless technology and promote its benefits for the public and the natural environment by increasing awareness and knowledge through technical information dissemination, research and development, education and training. In service to that mission, it helps that we’ve been blessed with a dedicated group of volunteers on WESTT’s Board of Directors. We continue to see great enthusiasm and great work from our board. Many thanks to Vice-Chairman Cindy Preuss and everyone else on the board for the great work they’ve done over the past 12 months. I am indeed fortunate to work with such a bright and dedicated group of volunteers.

As part of our ongoing efforts to provide value to WESTT members, we have sent NASTT’s Horizontal Directional Drilling Good Practices Guidelines to all our members. Special thanks to Noel and Sam for making that happen.

If you wish to join this group of volunteers, please contact anyone on the board as many dedicated hands make the load easier on all and make a better organization for all.

Lastly, thanks to NASTT Chairman Derek Potvin, NASTT Executive Director Mike Willmets, and the hard-working staff at NASTT for all their efforts. They’ve made our work a lot easier.

Regards,

Craig Camp
Chairman, WESTT
Our Regional Chapters are vital to the success of the society and the industry. The WESTT chapter is home to many of our important volunteers who make us what we are, and I appreciate you giving me this opportunity to recognize and thank some of these dedicated industry leaders.

NASTT members have been hard at work this summer planning for the future of the society. Recently we launched a membership-wide survey in order to gather your feedback on the current state of NASTT and how we can enhance our service to the trenchless industry. We hope you were able to participate in this online survey and give us your feedback on our efforts and initiatives.

Once the surveys are completed and the data is gathered, a committee of your peer members will meet to discuss the findings and outline a Strategic Plan for our future. Your fellow WESTT chapter member, Frank Firsching, is a valuable member of this volunteer committee. Thank you for helping us with this important endeavor, Frank!

NASTT is all about education, and it is our fine volunteer instructors that help make this happen. Last summer we kicked off our first-ever trenchless webinar with great response. We’ve continued the successful webinar series this year, with our first webinar of 2013 held in July. Presenters for the HDD, CIPP and Pipe Bursting webinar for the gas industry included WESTT instructors Collins Orton and Dr. Dave Bennett. This webinar was attended by over 450 people!

NASTT’s 2013 No-Dig Show pre and post courses, held right in the WESTT chapter’s backyard in Sacramento in March, featured some WESTT chapter industry experts. Presenters included Dr. Dave Bennett, Dr. Sam Ariaratnam, Collins Orton, Jennifer Glynn and Matt Wallin. We appreciate these members coming in early or staying after the conference to make these special educational seminars available to the trenchless industry.

NASTT has successfully partnered with other organizations including Underground Construction Technology (UCT), the American Gas Association (AGA) and Benjamin Media to bring our Best Practices courses around the country. NASTT’s Pipe Bursting course was offered at UCT’s annual conference in Houston this past January. The course was presented by WESTT instructors Dr. Sam Ariaratnam and Collins Orton. In May, NASTT’s HDD, CIPP and Pipe Bursting course for the gas industry was offered at the AGA annual conference in Orlando, Florida, with WESTT instructor Collins Orton included as a presenter.

Coming in November, NASTT will partner with Benjamin Media for their Trenchless Technology Road Show in Boston and offer the New Installation Methods course. WESTT instructor Glenn Boyce is included in that training lineup.

Several of the NASTT Regional Chapters have their annual conferences coming up this fall, and many WESTT instructors will be making appearances. Coming up in October, your very own WESTT annual conference in Honolulu will offer NASTT’s New Installation Methods course presented by Craig Camp and Glenn Boyce. In November, the Rocky Mountain chapter will host their annual conference in Denver and WESTT members Dr. Dave Bennett and Collins Orton will present NASTT’s Pipe Bursting course. Also in November, Dr. Sam Ariaratnam will head up north to Calgary, Canada, to help present NASTT’s HDD course for the Northwest chapter’s annual conference.

The WESTT chapter will also be represented at NASTT’s biggest fundraising social event of the year, the 13th Annual Educational Fund Auction and Reception. Brian Avon and Cindy Preuss are serving as Chair and Vice Chair, respectively, of the Educational Fund Auction Committee. Since its inception, the auction has raised over $600,000 for NASTT’s educational initiatives. The 2014 auction is expected to be another huge success.

Thank you so much to all the WESTT chapter volunteers. We appreciate your dedication to NASTT and to the growth of the trenchless industry.
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2012 - 2013

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Western Regional No-Dig Conference, Exhibition & Course
October 28-29, 2013
Ala Moana Hotel, Honolulu, HI
Contact Info:
Craig Camp
craig.camp@hatchmott.com
www.WESTT.org

NASTT’s New Installation Methods Good Practices Course
Tuesday, October 29, 2013
Ala Moana Hotel, Honolulu, HI
Contact Info:
Craig Camp
craig.camp@hatchmott.com

Rocky Mountain Regional No-Dig Conference & Exhibition
Wednesday, November 6, 2013
DoubleTree Hotel, Westminster, CO
Contact Info:
Bo Botteicher
bbotteicher@undergroundsolutions.com

NASTT’s Pipe Bursting Good Practices Course
Thursday, November 7, 2013
DoubleTree Hotel, Westminster, CO
Contact Info:
Bo Botteicher
bbotteicher@undergroundsolutions.com

NASTT’s HDD Good Practices Course
Wednesday, November 13, 2013
Coast Plaza Hotel, Calgary, AB, Canada
Contact Info:
www.nastt-nw.com

Northwest Trenchless Conference
Thursday, November 14, 2013
Coast Plaza Hotel, Calgary, AB, Canada
Contact Info:
www.nastt-nw.com

NASTT’s New Installation Methods Good Practices Course
Thursday, November 14, 2013
Holiday Inn Boxborough, Boxborough, MA
Contact Info:
info@benjaminmedia.com, www.nastt.org

NASTT’s Sewer Laterals Good Practices Course
Wednesday, January 29, 2014
George R. Brown Convention Center, Houston, TX
Contact Info:
info@benjaminmedia.com, www.nastt.org

NASTT’s HDD Good Practices Course
Wednesday, February 12, 2014
PSE&G Edison Training & Development Center, Edison, NJ
Contact Info:
george.ragula@pseg.com

NASTT’s 2014 No-Dig Show
April 13-17, 2014
Gaylord Palms Hotel & Convention Center, Orlando, FL
Contact Info:
info@benjaminmedia.com, www.nodigshow.com
‘Spreading the Word’
Chair Says Chapters Are Heart of NASTT

PTR Communications

If you’ve been to the NASTT No-Dig Shows in the last 15 years, you’ve probably met Derek Potvin. NASTT’s new Chair has been a regular at No-Digs, including the 2013 edition in Sacramento, California.

Potvin, previously Vice-Chair of NASTT, has been an active member for more than 15 years. He’s President of Ottawa-based Robinson Consultants Inc. and also Treasurer of NASTT’s Great Lakes, St. Lawrence and Atlantic (GLSLA) Chapter. No-Dig Show veterans may recall one or more of the many papers he has authored for the annual event, including one that won an award for Outstanding Paper.

He has seen trenchless technology progress considerably since attending his first No-Dig Show in 1995. “Initially, trenchless was seen as revolutionary and unique,” he recently told Trenchless International magazine. “However, it is now viewed as a responsible and progressive approach to infrastructure construction and renewal. In my area, almost all clients are now using trenchless technology in their everyday work programs.”

We spoke with him briefly in Sacramento and later exchanged emails to get the new Chair’s views on NASTT, its Chapters and the future of trenchless.

First up: What motivates Derek Potvin to stay active within the NASTT organization and the GLSLA Chapter? The first source of motivation he mentioned is “the belief that trenchless technologies benefit society by minimizing disruption to residents and businesses, limiting impact to the natural environment, offering potential cost savings and reducing greenhouse gas emissions.” He also mentioned the “overall dedication and volunteer spirit of the organization,” and said it is “exciting to be part of an organization that is supporting something we are truly passionate about. The spirit of the organization makes it easy to volunteer time.”

“We are pushing forward in educating people about trenchless technology,” he added. “Seeing the success and advances over the years is very rewarding and motivating. Now that I am Chair, I am privileged to have the chance to guide something I have been a part of for so long. This too, is very rewarding.”

Asked about his objectives as NASTT Chair, he pointed out that assistance from Regional Chapters is vitally important. Among his key objectives is advancement of NASTT’s “exceptional educational line-up,” including the Webinar series, Good Practices seminars and Trenchless Technology Short Courses. He wants to see NASTT expand the Trenchless Bookstore and pledges NASTT’s support of Chapters by offering local training.

Potvin wants to see awareness of trenchless technology increased by developing relationships with other industries. “We are already committed to providing training to the American Public Works Association, the American Gas Association, the Alberta Water and Wastewater Operators Association, the Atlantic Canada Water and Wastewater Association and the Association of Equipment Manufacturers, and we are currently discussing training opportunities with other associations,” he noted.

He also mentioned a desire to further
the success of the Municipal and Utility Scholarships and said NASTT encourages its members in Regional Chapters to talk to non-member colleagues about the benefits of joining. Having more members will improve NASTT’s ability “to reach out to even more municipal and utility owners and an even broader audience,” he said.

“NASTT’s Carbon Calculator is nearing completion of Phase II, which will offer a web-based user-friendly version of the software,” he remarked. “This is a stand-alone NASTT initiative, and a Phase III training module is being contemplated.”

Asked to describe the relationship between NASTT and its Chapters, he emphasized that “Chapters are the driving vehicles of NASTT’s mission to provide trenchless technology education and training.” The Chapters and NASTT – the organization as a whole – must work together for the key objective of increasing awareness of trenchless technology. Potvin said the Chapters have shown dedication to that objective with their successful work in education and training.

“Chapters’ assistance at the grassroots level is vitally important, and it is their enthusiasm and dedication which really makes NASTT a successful organization,” Potvin declared. “Chapters encourage peers, colleagues, members and non-members to participate in NASTT, whether it is at Regional Chapter events, with the student chapters, or via a subcommittee.”

The Chapters’ work is mainly about “spreading the word,” he said, and they’re already doing a tremendous job promoting trenchless technology. Many Chapters have a great lineup of seminars and workshops available. Our Chapter functions reach out at the grassroots level to our members and potential members. The future of our industry involves each of us doing our part in educating people about the benefits and capabilities of trenchless technology.

It’s important that trenchless technology education and training be accessible, and Chapters help with accessibility by holding local and regional events that people can get to. In a similar vein, Potvin said “NASTT has found that our complimentary webinars are a great success because the participants have no travelling cost. It allows more members and prospective members to participate in our education initiatives.”

NASTT and its chapters are in a partnership to advance understanding and awareness of trenchless technology. NASTT is always looking to grow the benefits of membership, which in turn enhances benefits for all members.

“NASTT is continually updating and improving existing courses, developing new courses, preparing new publications and offering courses in new formats such as webinars,” Potvin said. “These education initiatives greatly benefit the joint NASTT and Regional Chapter mission to educate and promote the benefits of trenchless technologies. New initiatives such as the Municipal and Public Utility Scholarship program will allow more Chapter members to attend the annual NASTT No-Dig Show.”

NASTT Executive Director Mike Willmets, Communications and Training Manager Michelle Hill and Board members will attend Chapter functions and events to support education initiatives or to discuss what NASTT has to offer its membership, he said.

Potvin said Regional Chapter magazines such as this one are “a place to show new technology and share the successes of trenchless technology. They also promote local and national education seminars, webinars, conferences, etc. They are a great outlet of education and information for the trenchless community and even those interested in learning about trenchless technology. They also allow for the showcasing of regional trenchless projects and local industry champions.”

The Chapters those magazines serve are hubs where people “share ideas, network with colleagues and find solutions to trenchless questions,” he said. “The great thing about the Chapters is that everyone is so passionate about trenchless technology and is very willing to share their knowledge and inform others about the benefits of the technologies. NASTT really profits from all of the Chapters’ contributions.”

He underscored the importance of Regional Chapters when he was asked for concluding thoughts in our conversation: “We must thank our Chapters as NASTT’s strength evolves from a Chapter-based level, and it is that volunteer spirit that really makes it a successful organization.”
# Conference Registration

**REGISTER NOW**

The Western Chapter of NASTT is hosting the Ninth Annual Western Regional No-Dig Conference, Exhibition, and Course: Honolulu, Hawaii • October 28-29

## Conference Registration Fees:

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<thead>
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<th>Category</th>
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<td>-$50</td>
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<td>NASTT Member Discount</td>
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**NASTT Good Practices Course—Oct 29 (New Installations)**

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<td><strong>Government Employee Rate‡</strong></td>
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† Both discounts may be used, if applicable
‡ Cannot be combined with any other discounts

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<tr>
<td><strong>Platinum</strong></td>
<td>Includes table top display with up to 4 representatives, full-page ad in conference program, and break/meal sponsorship</td>
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<td><strong>Gold</strong></td>
<td>Includes table top display with up to 2 representatives, and half-page ad in the conference program.</td>
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<td><strong>Silver</strong></td>
<td>Includes table top display with up to 2 representatives.</td>
<td>$750</td>
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## Registration and more information at:

[www.WESTT.org](http://www.WESTT.org)

For questions about the conference, contact:
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The conference is useful to public officials, engineers, utility company personnel, designers, and contractors alike who are involved with designing underground infrastructure.

## Ala Moana Hotel

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Western Society for Trenchless Technology - Trenchless Review - 2013
A Pipeline of Trenchless Resources

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Train
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- Pipe Bursting
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- Horizontal Directional Drilling (HDD)
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www.nastt.org
North American Society for Trenchless Technology
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Phone: 315-409-7552
The City and County of Honolulu (CCH) faced a serious public health and environmental problem with one of its large-diameter dual wastewater force main systems after experiencing four breaks between April 2006 and July 2010.
All four breaks occurred within a 250-linear-foot section of the force main system. The failure locations were discovered to be near a fuel pipeline corridor with an aggressive cathodic protection system, in corrosive soils, and in tidally influenced groundwater levels.

The Limtiaco Consulting Group (TLCG) was contracted by CCH to design an immediate repair solution for a 1,200-plus-LF section of the dual force main in spite of the challenging and physically restraining site conditions.

Constructed in the late 1970s as part of a large-diameter dual wastewater force main system (comprised of ductile iron pipe of 30-inch, 36-inch and 42-inch diameters), the Pearl City Force Main (PCFM) serves an urban region of the CCH with daily maximum dry weather flow of approximately 27 million gallons per day (MGD) from the Pearl City Pump Station (PS) to a junction box located at the Waipahu PS where flow from the Waipahu SPS combines with the PCFM system.

While only one force main is needed during normal dry weather conditions, both force mains are utilized during wet weather conditions to accommodate peak flows as high as 47 MGD. The complexity of the system layout, including the addition of flows from the Waipahu PS, creates operational challenges. Pump throttling and valve adjustments require advance planning as flow from one PS directly affects the hydraulics of the other; essentially two pump stations are connected by one force main.

**DESIGN**

This project faced a number of design challenges from the very beginning. The force main system was constructed with unconventional bends (reportedly 74 degrees and 60 degrees) and very close together, near existing structures. The force mains were constructed in unstable and corrosive soil conditions. Due to the recent history of pipeline failures, the project had an accelerated schedule.

Construction materials were subject to long lead times (typically six to eight weeks) because of Hawaii’s remote location. Supporting a densely populated urban region of Honolulu, the force main system needed to remain operational during construction.

Several construction alternatives were evaluated during design: slippining, CIPP (steam, water, and ultraviolet curing methods), HDD, tight-fit liners, and shallow-bury open-cut pipe replacement. The slippining method using fusible PVC pipe was selected to meet the challenging site conditions and aggressive schedule.

The recommendation proposed to line the 30-inch host pipe with 24-inch fusible PVC pipe, while the 42-inch host pipe would be lined with a 36-inch fusible PVC pipe. Hydraulic analysis confirmed the reduction of inside diameter would have negligible effect, which met CCH criteria. To keep the aggressive schedule, a
construction contract was awarded with pre-final design drawings with the understanding that engineering adjustments would be made as site assumptions and conditions changed during construction.

CONSTRUCTION

After the sewer bypass system was constructed, repair of the force main system proceeded from the upstream end. The contractor exposed the unconventional bends to confirm the angles and determine their condition. Fortunately, the bends appeared to be in good condition and a collaborative decision was made to retain them in place and restore the cathodic protection system. The design was modified with additional pipe fittings to accommodate the bends.

The contractor was required to clean and inspect the host pipe prior to sliplining. Initial investigations did not reveal any problems; however, a series of force main deflections were discovered during excavation of the entry pit. The deflections

Pulling Fusible C905 over the adjacent drainage channel and into the 30-inch force main
were severe enough to threaten the sliplining recommendation. TCLG suggested testing the pipe deflections by pulling a sacrificial 20-foot pipe section through the host pipe. The test confirmed the host pipe deflections were not severe enough to prohibit sliplining and provided the contractor an opportunity to perform a practice run.

Site constraints had a big impact on this project. Proximity to the pump station and force main system alignment made it difficult for the contractor to make a direct insertion. Furthermore, during excavation of the entry pit the contractor uncovered a concrete electrical duct bank (not shown in location on as-builts). The duct bank turned out to be the main electrical feed for the pump station backup power. Interruption of the electrical feed or moving the pump station were not feasible options, so the contractor decided to bend the fusible PVC pipe around the pump station building and electrical duct bank, into the host pipe. To minimize the pipe deflection and assist with the sliplining process, the contractor extended the entry pit and used a pulling head on the fusible PVC pipe.

LESSONS LEARNED
Sliplining with fusible PVC was successful in repairing the dual force main section and restoring its service life. Post-construction review with CCH wastewater operators confirm the new fusible PVC pipes are performing well. The sliplined pipes have had negligible impacts to the system’s hydraulic performance despite the inside-diameter reduction of the host pipes.

Awarding the project at pre-final design allowed for valuable contractor feedback when developing the final construction documents. The approach created an effective and efficient transition from design to construction. The process allowed the contractor to inventory materials and plan for long-lead items. TCLG emphasized a collaborative approach to foster productive relationships between the designer, contractor, and owner. This, in turn, opened communication lanes and expedited solutions when construction issues emerged. Technology innovation, design creativity and designer-contractor-owner teamwork were the pillars for this successful project.
The 4th Avenue–Slauson Sewer Rehabilitation Project achieved a daily installation rate of 1,000 feet of 66-inch liner pipe into the existing 75-inch South Branch of the North Outfall Sewer (NOS) with the existing sewer in service.
This project was to rehabilitate the deteriorated 75-inch clay-tiled concrete sewer pipe from the NOS Junction Structure at Slauson Avenue and Van Ness Avenue, west on Slauson to 4th Avenue, then north on 4th to Vernon Avenue – a total distance of approximately 6,300 linear feet. The sewer was built in 1924 of six-inch-thick reinforced concrete pipe with a one-inch-thick vitrified clay tile lining. Challenges to project construction included odor control, traffic control, community impacts, the original pipe liner having been discontinued by the manufacturer, and grouting of annular space.

Community Impacts

Prolonged exposure to high levels of hydrogen sulfide (H2S) gases had structurally compromised the 90-year-old clay-tiled concrete sewer. Odor-control measures consisting of hydrogen peroxide injection and two carbon scrubbers addressed the sewer gases and odors, with some exceptions during the hot summer and fall seasons. The project specifications had reflected H2S levels in the sewer of approximately 25 parts per million (ppm), while the actual levels averaged between 250 ppm up and 450 ppm. These increased levels resulted in increased usage of the hydrogen peroxide injection to lower the H2S levels as a pre-treatment to the carbon scrubbers.

To more effectively and efficiently control the usage of hydrogen peroxide, the Construction Manager decided to relocate the hydrogen peroxide injection point further upstream to allow for an increased reaction time with the chemical and the dissolved sulfide, resulting in more efficient H2S removal and more effective odor control. Odor control was a significant community concern and required constant oversight to comply with legal requirements and minimize community impacts.

The construction of this project required extensive traffic control and lane

Existing 25-feet-deep 75-inch sewer exposed

Assembly of carbon scrubber with manifold, exhaust fan and carbon cylinders
Top of the existing 75-inch sewer pipe removed

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Metal mandrel being pulled through the existing 75-inch sewer

closures on major streets, impacting local and through traffic and this impacting community.

Cleaning Operation

During construction the NOS was carrying flows of upwards of 44 cfs from various sewers connected to the NOS, resulting in a pre-cleaning flow depth of approximately one foot above spring-line, posing a tremendous challenge of thoroughly cleaning the existing NOS. Maintenance-hole structures and sewer-access pits were constructed at a closer spacing during the construction to facilitate cleaning and work access; existing structures were spaced between 1,000 and 5,000 feet apart. Contractor was able to clean 1,000 feet of the sewer every two weeks using a cleaning mandrel and man entry. Debris cleaned from the sewer consisted of 18-inches of fallen clay tiles, brick from the upstream sewers, grit, and sand.

Subsequent to the award of the project, the bid pipe manufacturer, Ameron, stopped making the pipe that was to be used for this project. As permitted by the contract documents, Contractor submitted Flowtite pipe as a substitute product. However, Flowtite was not a City of Los Angeles-approved product. After a very expeditious and thorough investigation (which included Short Term Tests) of Flowtite, the City’s Engineer of Design gave a one-time approval, pending further testing and approvals as required by the City for it to be placed on the City’s “Approved Product List” for future use.

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Lining, Grouting

After all of these challenges, the lining operation was very efficient and approximately 1,000 feet of 20-foot reinforced polymer mortar pipe (RPMP) sections was installed daily. Even with the added buoyant value of having flow in the sewers, the maximum push achieved was 2,000 feet without crushing the pipe or damaging the jacks. The 90-degree bend section posed another challenge which was overcome by using short RPMP liner pieces, custom beveled and placed manually.

The liner pipe was grouted in approximately 600-foot-long reaches in conformance with project requirements. As part of installing the liner pipe, bulkheads were installed in the annular space to create the necessary reaches. Grout tubes were installed adjacent to both the maintenance hole structures and sewer access shafts.

Grouting of the lined sewer was a major challenge. The initial grout submission was for a cement grout; Contractor chose to use a 17.5 sack cement content per cubic yard grout, but it was so hot that it was setting in the pump.

The secondary grout submission was for cellular grout with a foaming agent. This grout was able to flow in reaches of up to 500 feet. In reaches of more than 600 feet, the grouting time exceeded the manufacturer’s recommended times and the grout broke down and density increased, resulting in higher grout takes per reach. During the grouting operation, there were challenges such as leaking bulkheads and pipe joints, which were addressed.

Conclusion

Although community complaints were received for the duration of the work, the traffic and odor issues/complaints would have been far greater if the project had been constructed using traditional open-cut methods, rather than by a trenchless method such as slippining.
Repair of Culverts with StifPipe™

Mo Ehsani, PhD, PE, SE
President, PipeMedic, LLC

Corrugated metal pipe (CMP) culverts have been used for decades in highway construction. Many of these structures have deteriorated over the years and are in need of repair. In most cases, the culverts support traffic loads, so any repair or replacement must restore the structural integrity of the original culvert.

The newly developed StifPipe™ takes advantage of developments in the aerospace field to build a lightweight but very strong pipe. Unlike conventional pipes, the wall of this pipe is not solid. It consists of a lightweight honeycomb that is covered with glass or carbon fiber reinforced polymer (FRP) as skin reinforcement. Similar to an I-beam, the honeycomb acts as the web portion, while the strong FRP layers represent the flanges in an I-beam.

The construction of the pipe begins by building a mandrel of the desired size and shape. The mandrel is covered with a non-bonding release material. Depending on the design requirements for internal pressure rating of the pipe, one or more layers of carbon fabric saturated with resin is wrapped around the mandrel. These fabrics typically have a thickness of less than 0.05 inches per layer. For gravity-flow pipes, lower-cost glass fabrics can be used in lieu of carbon.

Next, a honeycomb sheet is coated with epoxy and wrapped around the carbon fabric; the thickness of the honeycomb typically varies between a half-inch and 1 1/2 inches, and is determined based on the overall stiffness and strength requirements for the pipe.

Additional layers of carbon or glass fabric saturated with epoxy are wrapped on the outside of the honeycomb. The pipe section is cured in ambient condition before it is removed from the mandrel. If necessary, the curing process can be accelerated by heating the assembly to a moderate temperature (e.g., 180 degrees Fahrenheit).

The relatively simple construction technique allows pipes to be made to virtually any size or shape (Fig. 1); this is particularly helpful for repair of non-circular culverts or sewer pipes. The pipe weighs only 10-15 percent of what conventional pipes weigh, which lowers transportation and installation costs. The non-metallic pipe does not corrode.

FIELD INSTALLATION

The first installation of StifPipe was recently completed at the Arc Terminal in Mobile, Alabama, to repair a 60-foot-long 24-inch CMP that was corroded. Due to access limitation, the client required pipe
sections that were only eight feet long. The construction of the pipe consisted of two layers of glass fabric on each face of a half-inch-thick honeycomb. This resulted in a nominal wall thickness of 0.7 inches. In order to maximize the flow through the pipe, the internal diameter of the pipe was selected as 20 inches. Figure 2(a) shows the manufacturing of the pipe.

To connect the pipe segments, a slightly larger-diameter StifPipe of the same construction was built. As shown in Fig. 2(b), the pipe segments can be connected using the sleeves. The completed eight-foot-long pieces of the pipe weighing about 50 pounds each can also be seen in the photo. The pipe segments were shipped to the job site.

The corroded culvert is shown in Fig. 3. The lightweight StifPipe segments were easily lifted by hand and assembled together. The finished segments were manually pushed into the pipe. The annular space around the liner was filled with grout, and the completed installation is shown in Fig. 4.
ADVANTAGES

The main advantage of the new StifPipe for gravity-flow applications is the fact that the pipe can be manufactured to virtually any size and shape. This will minimize flow loss and grouting requirements during installation. Depending on the size of the project, a temporary manufacturing facility can be set up at or close to the job site. The constituent materials are shipped in a compact container that will reduce transportation charges compared to shipping completed pipe sections. The lightweight pipe reduces labor costs and minimizes the need for heavy equipment during installation. A mobile manufacturing unit is currently being designed that will further facilitate on-site construction of the pipe.

The method of manufacturing StifPipe and repair of pipes described above are subject to pending U.S. and international patents by the author.

Professor Mo Ehsani is a pioneer in the development of applications of FRP technology and is internationally recognized as an expert on this subject. A few of his innovations are listed below:

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West Valley Sanitation District provides wastewater collection and disposal services for the cities of Campbell, Monte Sereno, Los Gatos and Saratoga, and unincorporated areas of Santa Clara County in Northern California. As of 2012, the District’s collection system consists of approximately 413 miles of main and trunk sewer and 209 miles of sewer laterals for a total of 622 miles of sewer lines. The District has 44,400 connections and serves a total population of approximately 106,000 people.

The Project involves replacing approximately 1,600 linear feet of eight-inch-diameter high-density polyethylene (HDPE) sewer line in Saratoga, California. The line was constructed in 1981 and crosses a known active landslide area along State Route 9. During installation of the original pipeline, HDPE pipe was selected for its flexible physical properties so as to endure land shifting caused by the active landslide. The sewer line was inspected via CCTV in 2008, and the results showed the HDPE was severely deformed and required replacement.
GEOTECHNICAL INVESTIGATION/MONITORING

The 1,600-foot-long section of sanitary sewer pipeline is located along the bottom of a valley formed and incised by Saratoga Creek. The pipeline generally parallels Congress Springs Road (State Route 9) and crosses Saratoga Creek at two locations. The subject section of Congress Springs Road where the existing sewer is located is approximately 2.5 miles north-east of the San Andreas Fault, which forms a fault boundary between the Pacific and North American tectonic plates.

The subject area is underlain by a large, active landslide locally known as the Congress Springs Landslide. The landslide is roughly 2,900 feet long and 2,000 feet wide and its toe day-lights on the south-facing slope, just beyond the northern bank of Saratoga Creek. The landslide thickness at the toe is estimated to be up to 135 feet deep in the vicinity of the pipeline. The area also contains the potentially active Berrocal fault crossing the sewer pipeline alignment just (approximately 250 feet) west of the subject section of pipeline.

In recent years, shallow slides/failures have been observed on the northern bank of a section of Saratoga Creek extending into the creek channel during periods of prolonged and/or intense rainfall. Because the sanitary sewer pipeline crosses through the toe of the landslide, it is likely that the pipeline is experiencing distress associated with vertical as well as lateral earth movement.

To provide the geotechnical investigation team with a better understanding of the landslide’s potential to distress the existing and future sanitary sewer pipelines, the subsurface conditions along the subject section of sanitary sewer pipeline were explored by means of four 150- to 160-feet-deep, small-diameter borings. Each boring was equipped with a slope inclinometer casing with the intent that monitoring of the casing with a slope inclinometer instrument should assist in defining the depth and rate of landslide movement. Eight survey monuments were installed along the approximate pipeline alignment, and the tops of the slope inclinometers were surveyed. This information was used as a benchmark for further geotechnical monitoring of the landslide area.

Since completion of the 2009 investigation, the District has performed yearly monitoring of the slope inclinometers and survey monuments to better characterize the landslide and understand rates and depths of land movement. Based on the District’s experience with large landslides combined with the recent investigation, it was concluded that the landslide will likely continue to move and distress the sanitary sewer pipeline. Renewed movement could occur several weeks or months after the end of the winter rains.

INITIAL DESIGN CONSIDERATIONS

Due to the size and depth of the Congress Springs Landslide, repair/stabilization of the landslide would require the cooperation of multiple property owners and agencies and would likely be prohibitively expensive. As such, the next step was to look for potential solutions that specifically addressed repair and continued operation of the existing sewer. Possible options that were considered to mitigate the potential for landslide-related distress included:

- rerouting the existing sewer;
- placing the sanitary sewer pipeline above-ground in a flexible pipe;
- placing the sewer underground in a vault with sufficient room to deflect;
- replacing the existing sewer in its existing alignment using trenchless technology with a plan to repeatedly and cost-effectively replace the existing pipe to provide adequate levels of service for a

The sewer line is located in a narrow and winding canyon corridor within Caltrans jurisdiction
shorter-than-typical life-cycle. The existing sewer is located within a narrow canyon with steep embankments on either side. Because of the existing topography, rerouting the existing sewer would be impossible without the construction of an expensive lift station. The pipeline is also located along the heavily traveled State Route 9, the main source of ingress and egress for local residents. Because the sewer is located within a State Highway, all construction along this corridor is subject to review and approval by Caltrans. Caltrans would not permit the installation of an above-ground pipeline for fear it would cause a hazard to local motorists who travel along this narrow and winding roadway. The placement of large underground vaults, which would allow for movement of the sewer during landslide earth movement, proved to be difficult to construct in such a narrow corridor with steep embankments without shutting the road down entirely. Shutting the road down entirely for construction was out of the question as it was the only means of ingress and egress for local residents. Therefore, the District decided to move forward with the only feasible solution remaining: rehabilitate the existing sewer in-place via pipe bursting with a plan for routine repair or replacement as needed.

**DESIGN AND CONSTRUCTION**

After careful analysis of all options, the District decided upon the use of pipe bursting to replace the existing pipe. During the preliminary analysis, it was determined that pipe bursting was the only viable solution that would be acceptable to Caltrans and would have the least impact on local residents.

Pipe bursting also proved to be a relatively quick and non-disruptive solution to the District’s problem when compared to the open-cut alternatives. Because there were no lateral connections on the existing sewer along this segment of the alignment, the contractor was able to set up his access and reception pits and burst and replace the pipeline relatively quickly and with minimal disruption to local traffic.

The sewer was replaced with the use of static pipe-splitting technology. When replacing pipes with the static splitting technique, a bursting rod is pushed from a launch pit through the old pipe into a reception pit. On arrival in the reception pit, the burst-
ing blade with the new pipe connected is attached to the rod string. When pulling back the rod string, the old pipe is destroyed by the blade, the pipe fragments are displaced into the surrounding soil, and the new pipe is pulled in simultaneously. When a static bursting system like this is used in conjunction with the cutter head, the technology is referred to as pipe splitting. For this project, the existing HDPE pipe was replaced with the HDPE pipe of the same size and DR.

Because State Route 9 is so important to local residents, staging areas and access pits for construction were located as far off the roadway as possible. In addition, the Contractor was not allowed to have access pits open on both sides of the roadway at one time. The Contractor was also not allowed to have more than four access pits open at one time, and he was subject to Caltrans-regulation day and time restrictions so as not to impede commute traffic. Additionally, the Contractor was required to enclose all pits with k-rail, crash barriers, warning signs and significant traffic controls.

Because State Route 9 is the only corridor through steep canyon terrain, it contained many other utilities that needed to be protected in place during construction. In addition to the sewer line, the narrow roadway contained a 16-inch water transmission main, a telephone conduit, and large storm drain pipes and box culverts. Electrical lines were also present on overhead wires. The existing 16-inch water main meandered back and forth across the street and crossed the sewer eight times in close proximity within the 1,600-foot alignment. So as not to damage the existing water main, the contractor was required to pothole at each of the eight water main crossings and remove the soil between the sewer and water line. This was also done for any other utilities within five feet of the existing sewer (either vertically or horizontally).

**CONCLUSION**

The District was faced with a sewer located within a steep and narrow canyon subject to ongoing and cyclical land movement associated with an existing large-scale landslide in the area. Recent survey monitoring indicated that the landslide toe had experienced cumulative horizontal movement of about two to four inches towards the north and vertical movement of between 1.5 and four inches up.

The District considered rehabilitation efforts directed at preventing future deflection damage, but such projects were deemed costly and still included the risk of future landslide activity. In lieu of attempting to stabilize the landslide, the District’s approach is to repeatedly and cost-effectively replace the existing pipe using trenchless technology to provide adequate levels of service for a shorter-than-typical life-cycle.

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Hawaii’s geologic history and resulting subsurface conditions present unique and challenging conditions for microtunneling. On the island of Oahu, coral reef growth as the island subsides resulted in back-reef sedimentary environments that trap lagoonal silts, and waves and marine life work calcareous sands and gravels. The open framework of gravel-sized to occasionally cobble- and boulder-sized coralline fragments provide a meta-stable skeletal framework for very loose to very soft sands and silts to deposits in the interstitial voids. As a result, many relatively low-lying areas in the urban core and suburban towns on Oahu are underlain by saturated

Figure 1. USGS Pacific Sea Floor Map (Torresan and Gardner, 2000) with approximate vicinity of known probable buried submerged canyons or channels shown plotted in green dashed lines.
complex and highly variable ground conditions, with the subsurface geotechnics typically ranging from hard to friable to probably reworked loessic in nature.

Also, at least two submerged buried-deep canyons exist in low-lying areas and to thousands of feet beyond the current shoreline (Figure 1). The silty sediments in the buried canyons can contain up to 60 percent fine sands. The occurrence of very soft or loose soils (SPT N=4 or less) at depths five feet to 150-plus feet below sea level appears to contradict soil mechanics theory that overburden pressure should consolidate the underlying soils with depth.

Mixed ground conditions consisting of flowing silts and sands, variously cemented friable soils to strongly cemented soil/rock, all present within microtunneling and shaft construction zones, are very difficult to explore properly and characterize for bidding purposes. The inherent difficulties lie in the susceptibility of the variously cemented ground to sampling disturbances, in the worst-case situation leading to over-simplification of the ground conditions by inadequately trained and inexperienced personnel, and inadequate consideration of the anticipated construction difficulties during design and preparation of construction contract documents (Kwong et al., 2006).

Selected examples of ground-condition-related challenges in past microtunneling include:

A. Cementation of calcareous soils due to increased temperature and pressure during construction. Calcareous minerals can dissolve and/or precipitate under conditions of minor temperature and pressure changes. In one project involving a 12-inch-diameter mini-microtunnel system, excessive spinning of the reaming augers in calcareous sands resulted in temperature and pressure increases that caused cementation of the soil near the system's intake, thus creating an obstruction for spoil removal.

B. Effects of mixed ground conditions on jet grouting. Weakly cemented soils or friable weak rock can render jet grouting inconsistent to ineffective, or obstruct soil-mixing mechanical augers. Mixed with flowable sands, such construction inadequacies have caused flowing ground into shafts, excessive water flows into shafts, bottom boiling in shafts, and related sink-hole formation outside the shaft and ground subsidence.

C. Non-steerable soils. Over 10 years ago, a microtunnel boring machine (MTBM) had to be rescued via an emergency shaft in Waikiki after it drifted 16 feet off-line during tunneling through very soft lagoonal deposit. Since then, three

Figure 2. Cemented sand found inside mini-microtunnel ramming head
different contractors have successfully microtunneled to within the specified line and grade tolerances through equally soft lagoonal and estuarine deposits that were improved by jet grouting. However, for smaller-diameter MTBMs (<36 inches O.D.) and pilot-tube microtunnel equipment, jet grouting of very loose sand and gravel can result in soilcrete that approaches the strength of concrete and may be an obstruction to microtunneling.

Where microtunneling was planned to mine through deep (>150 feet below MSL) buried channels filled with N=0 sands and silts, an initial approach was to avoid the highly challenging microtunneling ground conditions (Kwong and Kalani, 2004). However, avoidance of deep buried channel deposits is not possible in some areas of the urban core and where deep pipelines need to cross parts of the Honolulu Harbor, and in locations where deep ground improvements are not practical over water. Two such crossings at about 100 feet below mean sea level are planned to commence before the spring of 2014 for an ongoing project. The precautionary measures for these crossings, each of which approach 1,600 feet in length, include use of steel casing, automatic guidance systems capable of supporting long and curved microtunneling, as well as detailed evaluation of buoyancy situations and stresses on the steel casings and joints during and after installation.

D. Natural (not man-made) obstructions. Unanticipated cemented zones and rock ledges acted as obstructions to shaft construction. In problematic cases, these obstructions led to tilted caissons, deflections of sheet piles, excessive vibration and liquefaction/densification of the ground and excessive inflows into shafts. Other related situations included claims of uncontrollable steering of the MTBM, and obstruction to pilot-tube microtunneling hole enlargement.

E. Buried aeolian dust. Parrotfish feed on the reef and excrete very fine coral dust, among other things. Aeolian dunes, including submerged ones containing rock flour or dust-like calcareous very fine sand to primary mineral silt or locally called “blown sand,” exist in and near some low-lying coastal areas, particularly where the paleo-geography favored accumulation of such aeolian dust. Very fine sands and primary mineral silt consisting of primary minerals are highly susceptible to form-filling ground conditions, particularly in situations with significant hydraulic gradient. Existing subterranean erosion “pipes” networks were observed in an exposed sinkhole under a roadway and utility corridor, confirming very fine sands and primary mineral silt are prone to in-situ erosion by flowing groundwater. Forensic studies also found very fine sands and “rock flour” are highly susceptible to ground loss due to dewatering pulling of non-cohesive fines; ground subsidence of 12 to 16 inches was measured.

When properly identified and characterized and considered in the bid documents, the ground conditions discussed above can be addressed by experienced, qualified and suitably equipped contractors. Table 1 lists some recent microtunneling drives that were successfully completed despite challenging ground conditions.
<table>
<thead>
<tr>
<th>Jacking Pipe I.D.</th>
<th>Approx. Drive Length</th>
<th>Pipe Type</th>
<th>Year</th>
<th>Primary Geologic Deposits</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 inches</td>
<td>791 feet</td>
<td>Polymer Concrete</td>
<td>2003</td>
<td>Jet-grouted calcareous fine sands and rock dust/silts, 20 feet below sea level</td>
</tr>
<tr>
<td>36 inches</td>
<td>1,178 feet</td>
<td>Reinforced Concrete with PVC liner</td>
<td>2005</td>
<td>Mixed limestone and coralline deposits, 25 feet below sea level</td>
</tr>
<tr>
<td>48 inches</td>
<td>1,312 feet</td>
<td>Reinforced Concrete</td>
<td>2002</td>
<td>Mixed lagoonal deposits, limestone masses and coralline deposits under ocean and 40 feet below sea level</td>
</tr>
<tr>
<td>47 inches</td>
<td>709 feet</td>
<td>Polymer Concrete</td>
<td>2006</td>
<td>Mixed dune sands and coralline deposits, 20 feet below sea level</td>
</tr>
<tr>
<td>46 inches</td>
<td>1,180 feet</td>
<td>Steel Casing</td>
<td>2007</td>
<td>Twin emergency drives through mixed lagoonal, estuarine, and coralline deposits, 20 to 45 feet below sea level</td>
</tr>
<tr>
<td>71 inches</td>
<td>1,250 feet</td>
<td>Polymer Concrete</td>
<td>2012</td>
<td>Double-curve drive through mixed coralline deposits and limestone, 45 feet below sea level</td>
</tr>
<tr>
<td>81 inches</td>
<td>1,188 feet</td>
<td>Steel Casing</td>
<td>2013</td>
<td>Twin drives through lagoonal soils with jet grout support, 35 feet below sea level</td>
</tr>
<tr>
<td>81 inches</td>
<td>1,775 feet</td>
<td>Steel Casing</td>
<td>In progress</td>
<td>Lagoonal soils with jet grout support, 35 feet below sea level</td>
</tr>
</tbody>
</table>

REFERENCES


The City of Los Angeles recently completed one million feet of sewer that has been constructed or rehabilitated using trenchless technologies. The City has an aggressive sewer rehabilitation program to manage and renew its 6,700-mile wastewater sewer system. The information gathered during this construction work is being used to develop a comparison of the carbon footprints of open-cut and trenchless methods.

In Los Angeles, organized municipal sewerage construction began in 1873. Sewer construction kept pace with population growth. The City’s secondary sewer system includes all municipal sewers up to 16 inches in diameter. The primary sewer system includes all sewers greater than 16 inches in diameter. Approximately 90 percent of City sewer pipes are eight-inch diameter.

Until 1919 the secondary system used vitrified clay pipe (VCP). During the 1920s and the 1930s both VCP and unprotected Portland cement were used. Since 1940 vitrified clay has once again become the primary material for the smaller sewers.

Major replacement and rehabilitation programs have been carried out to rehabilitate or replace deteriorated secondary sewers.

The current program, the Secondary Sewer Renewal Program (SSRP), is the result of a settlement agreement. SSRP is required to replace or renew an average of 60 miles of sewer per year. Construction began in 2008 and will be completed in 2014. Work has included open-cut and trenchless rehabilitation.

As of March 2013, the City’s GIS database showed 1,072,174 feet of primary and secondary sewers having been installed or rehabilitated by trenchless methods. Of these, 903,956 feet were the smaller secondary sewers and approximately 75 percent of those sewers are eight-inch mainline sewers.

For work involving the secondary sewers: 68 percent of trenchless work has been carried out in local and collector streets, 19 percent in highways, and just over 10 percent in easements, out of the public right-of-way.

The amount of work in easement sewers is likely to increase in the future as program emphasis shifts to include them.

### Energy Budget

A comprehensive carbon calculator is not yet available to determine the amount of greenhouse gas production avoided by using trenchless methods in Los Angeles. In anticipation of making a more rigorous carbon footprint analysis, some of the needed information is being compiled. For the secondary system, a typical open-trench replacement would look like the project shown in Figure 6.

Using this as the basis for comparison, we can define the open-trench equivalent to the actual trenchless rehabilitation as follows.

The approximate length of rehabilitated sewer is 904,000 feet.

- Average sewer reach = 264 feet.
- Average depth = 10 feet.
- Estimated average trench width = 2.5 feet.
• Estimated pavement thickness in Local Street = 6 inches; in Other Streets = 8 inches.

• The amount of excavated soil that has not been handled is approximately 837,000 cubic yards.

Daily inspection logs have been reviewed for 20 SSRP projects completed between 2007 and 2010 to develop a detailed picture of the equipment actually used in secondary sewer construction and rehabilitation.

In these projects, 123,305 linear feet of sewer have been removed and replaced by open-cut methods and 155,564 linear feet have been rehabilitated using trenchless methods.

Typical SSRP projects include bid items for the following:

• For Remove and Replace – Sewer Pipes (Concrete and VCP); Pipe Diameters (6-inch, 8-inch, 10-inch, 12-inch, 15-inch); with Bedding Cases (1 and 5)

• Rehabilitate by Lining – Sewer Pipes (VCP); Pipe Diameters (6-inch, 8-inch, 10-inch, 12-inch, 15-inch); Wall Thickness (Structural, Non-Structural)

Approximately 48 separate types of equipment have been identified as being used on Los Angeles projects. To simplify this review, equipment of similar types and sizes have been consolidated. Load Factor, the percent of time that the equipment on site was operated, was estimated by knowledgeable staff and the use of Air Quality standard programs.

Simplifying assumptions were made as
follows:
1. Typical equipment was assumed for similar types of equipment.
2. Similar equipment is assumed to have similar horsepower rating.
3. Similarity is assumed between contractors.

Based on the research into actual construction projects and the foregoing assumptions and estimates, an energy budget for City of Los Angeles Secondary Sewer construction and rehabilitation is estimated to be 21 hp days per foot installed via open-trench, and 6 hp days/foot installed in CIPP lining. Two-thirds of the energy required for lining is estimated to be used to fire propane-powered boilers.

Looking Beyond
California is estimated to have 100,000 miles of sewer. Replacing sewer at the rate of a 100-year life would require replacement or rehabilitation of approximately 1,000 miles per year, or roughly three times the current rate.

The choice to use trenchless methods at this rate of production and at the difference in energy budget suggested in this report would pre-
dict potential energy savings in excess of 80,000,000 hp days per year. A more realistic lower-bound estimate, if trenchless methods were simply done at the percentage of the work done by the City of Los Angeles in the projects reviewed in this study, would be in excess of 45,000,000 hp days per year.

It is hoped that legislators and regulators will recognize the benefits of the choice to use trenchless methods and reward cities by crediting them with carbon and greenhouse gas reductions resulting from intelligent engineering decisions in sewer rehabilitation and construction.

Figure 5. Average Depth with Street Type

Figure 6. Typical Open Trench SSRP Project
NASTT’s 2014 No-Dig Show Municipal & Public Utility Scholarship Program

Apply today for complimentary registration and hotel accommodations!

NASTT’s 2014 No-Dig Show Municipal & Public Utility Scholarship Program has been established to provide education and training for North American municipalities, government agencies and utility owners who have limited or no travel funds due to economic challenges. Selected applicants will be awarded full conference registration to NASTT’s 2014 No-Dig Show in Orlando, Florida from April 14-16. One day conference registrations will also be available. Registration will include full access to all exhibits and technical paper sessions. Selected applicants will also be eligible to receive overnight accommodations. Selection will be based on responses to the application as well as need.

To apply, visit www.nastt.org/municipalscholarship
In 2013 the City of Tempe, Arizona, took bids on one of its first pipe-bursting projects. The scope of work included construction of new sewer line by the pipe-bursting method. The old sewer line was an existing 12-inch vitrified clay pipe (VCP) line. The City wanted a new 18-inch-outside-diameter sewer with the inside diameter measured at 15.75 inches.

The City used the standard design-bid-build procurement method. AUI Inc. of Albuquerque, New Mexico, was the successful low bidder on this project, and broke ground at the end of May 2013.

AUI has been a pipe-bursting contractor since 1991; that’s over 22 years of experience in pipe bursting. In 1998, AUI completed a pipe-bursting pilot project for the City of Phoenix. This pilot project included replacement of 521 linear feet of failing sanitary sewer line with new 24-inch VCP using pipe bursting.

The City of Phoenix was interested in the advantages of trenchless pipe replacement to reduce replacement duration, minimize the duration of bypass pumping, minimize or eliminate roadway closures and traffic control issues, minimize the potential for damage to existing utilities through excavation, and reduce the costs associated with surface restoration.

Through this pilot project in Phoenix, AUI effectively demonstrated that pipe bursting offered a solution to the problem of replacing underground utility lines in highly developed urban settings with minimal inconvenience to inhabitants and without increasing construction costs.

Since that pilot project, the AUI pipe-bursting team has completed to date over 205,000 feet of pipe bursting over 92 separate projects.

The 1,508 LF of pipe bursting included in the Tempe project was divided into two segments along Scottsdale Road and Gilbert Street. The AUI pipe-bursting team, including Project Manager Gary Holland and Project Superintendent Archie Lucero Sr., mobilized to Phoenix to begin the first segment on Scottsdale Road (a busy arterial road with businesses on both sides). This segment would require four separate pulls to complete the burst, given the substantial increase in pipe size. The bursting head’s outside diameter was 22 inches.

The pipe-bursting team completed all four pulls and completely replaced this segment of the sewer main in the hot Tempe weather. These segments included burst days when the average temperature was easily over 105 degrees. Because of the extreme daily temperatures, most of the work was done early in the morning when the weather wasn’t quite so hot.

The second pipe-bursting segment of this project ran along Gilbert Road for approximately 295 feet. The work on Gilbert Road also included a new five-foot-diameter manhole (coated with Neopoxy) and 45 LF of open-cut 18-inch HDPE sewer.

**PROJECT DETAILS**

**Project Name:** Gravity Sewer Replacement & Upsize

**Description:** Pipe Bursting 12" Clay to 18" HDPE

**Location:** Tempe, Arizona

**Relative Quantities:** 1,508 LF of Pipe Bursting, 7 EA new Manholes w/Neopoxy Liner, 8 EA Sewer Service Reconnections

**Owner:** City of Tempe

**Engineer:** Project Engineering Consultants (PEC)

**Contractor:** AUI Inc. (Mike Rocco, rocco@auiinc.net)
Michael Rocco, AUI’s Trenchless Technology Division Manager and member of the International Pipe Bursting Association (IPBA) and NASTT, counts this project among the successes of the division and as a victory for pipe-bursting technology in general.

“Not only did we get to prove the pipe-bursting process is a solution to some of the common issues that cities have with the open-cut-and-replace method,” Rocco says, “but we also made inroads for alternative pipe materials in what has historically been considered a clay pipe market.”
The Northern California Pipe Users Group (PUG) is a non-profit organization comprising local governmental agencies, municipalities, consultants, engineers, product suppliers, trade-related professionals and retirees interested in the water, wastewater, or storm water pipeline industry.

PUG’s Board of Directors strives to provide its members with current technical information, training courses and construction demonstrations to stay on the pulse of industry news and technology. Over the years, PUG has coordinated construction demonstration opportunities with vendor contractors to present local construction projects using the latest pipeline installation practices. Here are just a few illustrations of PUG’s recent construction demonstration opportunities.

LMK Technologies
LMK Technologies, a sanitary sewer trenchless pipe renewal company offering trenchless solutions since 1993, conducted an on-site cured-in-place lateral lining demonstration for a West County Wastewater District project in Richmond.

LMK provided PUG members with an informational presentation using photos, videos, and computer animations to portray the evolution of cured-in-place lateral lining as an effective rehabilitation method on sanitary sewers and to educate the audience regarding the technical features for ASTM F2561-11, which is the Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner.

Immediately following the presentation, LMK guided a “live” demonstration of cured-in-place liner installation for over 20 PUG members to observe, and fielded questions from the audience throughout the duration of the show.

rePipe California
A trenchless pipeline solutions company delivering sewer rehabilitation in the western United States, rePipe California hosted an on-site visit for over 20 PUG members in the West Valley Sanitation District located in Campbell.

The project demonstration included the rehabilitation of 18-inch and 21-inch asbestos-cement (AC) pipelines using SPREX spiral-wound liners. SPREX is a PVC profile wall liner pipe for the structural repair of gravity pipelines from six-inch up to 30-inch diameters.

The spiral-wound liners were mechanically installed via existing manholes or access chambers for completely trenchless installation. RePipe monitored the installation process via CCTV to guarantee real-time installation verification meeting the manufacturer’s requirements.

Northern California PUG members attend a session conducted by LMK Technologies in Richmond, California

Three Companies
PUG hosted a hands-on demonstration on valves, fittings, and connections conducted by EBAA Iron, Romac Industries and Mueller Company at the Central Contra Costa Sanitary District Headquarters Office Building in Martinez, California.

EBAA Iron showcased the megalug pipe joint restraints, which included ductile iron and PVC restraints, flange adapters, couplings and flexible/expansion joints. PUG members had the opportunity to handle the multiple megalug joint restraints exhibited.

Romac Industries presented six separate pipe couplings for dismantling, expansion, rotation, bending, settlement and extended joint connection.

Mueller Company discussed two types of gate valves meeting AWWA C509 Resilient Wedge Gate Valve (cast and ductile iron) and AWWA C515 Reduced Wall Resilient Wedge Gate Valve (ductile iron) standards. Both varieties of valves were on display for PUG members to operate.
EcoCast Technology

EcoCast is an advanced geopolymer technology for structural repair of pipelines including sanitary sewers, storm drains, culverts, manholes and other water structures such as wet wells and headwalls. EcoCast directed a manhole rehabilitation demonstration on-site for a West Valley Sanitation District sanitary sewer project.

EcoCast is a centrifugally cast, precision controlled spray application process that allows the geopolymer to be consistently applied to a pre-set coating thickness with every pass. EcoCast can be used to restore circular and non-circular pipes showing out of roundness, rehabilitate pipes that have been separated, and is cost-effective for short-run segments.

PUG members had the opportunity to see first-hand how this trenchless technology can be used for manhole rehabilitation.

For the past 20 years, PUG has embraced the slogan “Sharing Technologies Together.” It has been the mission of the PUG Board of Directors to provide this concept to its ever-growing membership and the pipeline industry. Come join us for a monthly meeting at the office of Brown and Caldwell in Walnut Creek every third Tuesday of the month from 11 A.M. to 1 P.M. For more information, contact Roberts McMullin at rmcmulli@ebmud.com or visit the PUG website at www.norcalpug.com.
Foothill Municipal Water District Assesses Mortar-Lined Steel Pipes with Advanced Non-Destructive Technology

Water and wastewater utilities across the United States face a major funding gap related to buried pipeline infrastructure. The U.S. Environmental Protection Agency estimates the difference between what is needed for infrastructure renewal, the majority of which is associated with buried pipe, and what utilities can afford to spend is between $200 billion and $1 trillion over the next 25 years.

This new reality has forced utilities to squeeze more remaining life out of existing assets, creating more demand for condition assessment programs and proactive management of pipelines. This approach has been adopted by many utilities that have successfully managed risk, rehabilitated isolated distressed pipes and extended the life of their assets for a fraction of the cost of a replacement program.

According to a study by Pure Technologies, large-diameter pressure pipe can be inspected, repaired and managed for roughly five to 15 percent of the capital replacement cost. Pure has found that pipeline distress is typically not systematic across the entire pipeline system, but is usually related to localized problems due to design, manufacturing, installation, environmental, operational or maintenance factors. Proactively locating and repairing individual pipe sections with distress is proving to be a cost-effective method of addressing the infrastructure gap associated with buried pipelines.

There are several different pipe designs that make up pipeline networks across the United States. Each has a specific expected life and different operational requirements. While some materials have well-developed and effective inspection technologies, assessing metallic water and wastewater pipelines with mortar lining has posed a challenge.

Historically, metallic systems have been assessed through test locations along the length of a pipeline. However, data shows that pipe distress is localized, meaning that an area of distress identified using historical methods may inaccurately identify an entire pipeline as distressed, or conversely inaccurately identify the same length of pipeline as in good condition. With tight capital budgets, accurate information that provides a utility operator with certainty is essential for making rehabilitation plans or decisions about a more detailed inspection.

For utilities such as Foothill Municipal Water District (FMWD), which has no redundancy in its system, finding a reliable inspection method that provides condition data for the entire length of a steel pipeline is an important aspect of its condition assessment program.

FMWD covers about 22 square miles in the foothills of the San Gabriel Mountains, between the City of Pasadena on the east and the City of Glendale on the south and west. The District serves approximately 86,000 people through its own member agencies.

In March 2013, FMWD successfully completed a 2.2-mile internal inspection and condition assessment of a 24-inch mortar-lined steel force main to identify broad areas of wall loss. As part of the condition assessment, a structural evaluation was performed to determine whether the force main design satisfies AWWA M11 “Steel Pipe – A Guide for Design and Installation” (fourth edition) standards. The results of this evaluation will help FMWD determine where to focus more detailed inspections in order to make detailed rehabilitation decisions for this force main.
To complete the inspection, FMWD used PureRobotics® electromagnetic condition assessment equipped with PureEM™ technology and high-definition closed circuit television (HD-CCTV). The platform is a non-destructive inline assessment tool that provides screening level wall thickness data in the circumferential and axial directions of metallic pipelines.

The goal of an EM scan on metallic pipe is to identify areas of electromagnetic signal loss that may be representative of metallic wall loss associated with internal or external corrosion which can be identified for more detailed evaluation.

The robotics tool used was assembled inside the pipeline and controlled remotely by operators on ground level. This allowed FMWD to maximize the HD-CCTV function as internal features could be closely inspected with the camera.

By opting for an inline assessment in favor of traditional metallic inspection methods, FMWD has a baseline condition of the entire 2.2-mile force main. After reviewing the EM data, FMWD was able to identify 17 EM anomalies that warrant additional investigation. The top 10 anomalies have been ranked based on the strength, area and repeatability of signal loss and visually using HD-CCTV.

FMWD can now select the most appropriate locations to perform test pitting to obtain higher-resolution data needed to evaluate rehabilitation or repair needs and determine the remaining useful life of the force main.

Ranking the anomalies based on size allows the prioritization of further inspection based on sound and defensible engineering judgment. Risk prioritization is an important facet of any condition assessment program because it allows the most urgent needs to be addressed first.

By proactively managing its pipeline assets, FMWD is continuing to reliably deliver quality water to its member agencies in a cost-efficient manner to meet their projected demands.

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Tuesday, June 25  
HDD, Pipe Bursting and CIPP  
for the Gas Industry

Wednesday, September 25  
Sliplining

Thursday, November 7  
Sewer Laterals

View our archives at: www.nastt.org/webinars

www.nastt.org  
North American Society for Trenchless Technology  
7445 Morgan Rd., Liverpool, NY 13080  
Phone: 315-409-7552
Dear Trenchless Colleagues:

We officially invite you to join us at NASTT’s 23rd annual No-Dig Show, April 13-17 at the spectacular Gaylord Palms Resort and Convention Center.

In 2014 we are bringing “The Magic of Trenchless” to Orlando, Florida. The NASTT No-Dig Show will return to Orlando for the third time, and to the Gaylord Palms for a second time – which is a testament to the state of Florida’s support of the trenchless industry. The No-Dig Show is the only conference in North America that focuses solely on trenchless technology, providing a single event where attendees, sponsors, students and exhibitors can gather to promote and learn about all things trenchless.

The 2014 No-Dig Show Program Committee has put together an industry-leading program. The cornerstone of the NASTT No-Dig Show is the caliber of its educational program. Our technical program begins on Monday featuring 160 high-quality non-commercial papers in a six-track schedule. In addition, our pre- and post-conference courses present a wide array of trenchless applications in detail, including CIPP, HDD, laterals and more.

A successful conference incorporates opportunities for quality educational classroom learning and hands-on exhibit-floor product knowledge with just enough of a relaxing social networking nightlife. At the No-Dig Show, leaders of the industry provide this combination with the opportunity to exchange the ideas that move our industry forward.

Monday is a day that bookends with two terrific networking events. The day gets under way with our “Kickoff Breakfast” and finishes with NASTT’s Annual Educational Auction and Reception. Since 2002, NASTT has raised more than $600,000 for the Educational Fund which supports NASTT educational initiatives. Make sure you pack your pirate gear, as this year features a wild costume contest allowing you to exhibit your inner swashbuckler!

Tuesday evening’s event is the annual Gala Dinner, which brings everyone together for a night of great food, live entertainment and recognition for our industry’s best and brightest. During this evening, NASTT formally presents the Chair’s Award for Outstanding Lifetime Service, the Trent Ralston Award for Young Trenchless Achievement, and the winners of the Joseph L. Abbott Jr. Innovative Product Awards. The highlight of the evening will be the induction of the third class to NASTT’s Hall of Fame; stay tuned for more details on this event.

NASTT’s 2014 No-Dig Show comes to an end on Wednesday with our annual Closing Luncheon — where we will draw the winning ticket for our third annual vacation raffle! We hope you purchase your tickets for a chance to win a trip to the Caribbean! All proceeds benefit NASTT’s Educational Fund. This popular raffle is made possible through a generous $5,000 donation from Vermeer Corp.

Ask any child and they will tell you that Orlando can be a very “magical” place. Come share in the excitement as North America’s premier trenchless event brings the “Magic of Trenchless” to Florida. The Gaylord Palms Resort and Convention Center is located just minutes from the main gates of EPCOT, MGM and Disney World. This is the perfect Spring Break location for you and your family, so make sure you come early and stay late to enjoy all that Orlando has to offer.

We’ll see you in Orlando!

Kevin Nagle  
No-Dig Show Program Chair  
Richard (Bo) Botteicher  
No-Dig Show Program Vice Chair
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- Horizontal Directional Drilling (HDD)
- Laterals
- New Installation Methods
- Pipe Bursting

Upcoming High-Value TRAINING EVENTS FOR 2013

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For More Information and the Latest Course List Visit www.nastt.org/calendar
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