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FALL 2010

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Welcome back to our fourth edition of the Western Regional Trenchless Review! As our regional chapter continues to become established in the industry, we are excited to produce and distribute valuable information and ideas centered around a region of the country that continues to grow and thrive despite the difficult economy. Thank you to all the advertisers and article contributors for helping to make this year’s magazine a success.

As my second year as Chairman of WESTT draws to a close, I am proud to say that our regional chapter continues its work toward the advancement of the science and practice of Trenchless Technology for public benefit through promoting and conducting education and training. We had great success (and a whole lot of fun) with last year’s Annual Western Regional Mini No-Dig Conference and Exhibition in beautiful Honolulu, Hawaii.

This year, the Sixth Annual Conference will be held in Phoenix, Arizona at the Sheraton Phoenix Airport Hotel on October 25-26th, 2010. The Chapter’s first ever conference was held in Phoenix, and we are excited to return to the same venue in the same region 5 years later. Much has changed in our industry over the past 5 years and we are excited to bring the latest innovations and trends in the trenchless industry to members of the engineering community in the greater Phoenix area who might not otherwise have had an opportunity to attend the annual National No-Dig Conference. This year’s focus continues to be about our goal to become a “local” source for connecting individuals interested in learning about various trenchless technologies as a viable solution to their infrastructure needs.

I look forward to another excellent year for trenchless activities in the Western region and welcome new members to join the Western Chapter. Please feel free to contact me at jglynn@rmcwater.com or (925) 627-4151 or check out our website at www.westt.org if you require any information on WESTT or trenchless in general.

Warmest regards,

Jennifer A. Glynn, P.E.
Chairman, WESTT
I am well into the final stretch of my tenure as Chairman of the NASTT, and it has been a great honor to serve this association. It has also been invigorating to see the dedication of all NASTT members and regional chapters.

The WESTT has been a model of success that all regional NASTT chapters can learn from. There is a tremendous amount of passion, commitment and knowledge in the WESTT chapter that has been responsible for the exceptional growth of the trenchless market in that region. As NASTT chair, I’ve had the opportunity to see first hand the great work being done by the members of the WESTT chapter.

I also want to take a minute to promote WESTT’s upcoming conference in Phoenix, October 25-26. It is a well-organized, quality conference that consists of many valuable programs for those old and new to the trenchless industry. It is a must attend event.

Terrific job everyone!

Chris Brahler
Chairman, NASTT
TT Technologies, Inc.
In so many ways, 2010 has been an exceptional year for NASTT, and I spent much of my time thanking our predecessors for building solid foundations which allow our Society to flourish. The trenchless community was on the road again, this time to NASTT’s No-Dig 2010 in Chicago (Schaumburg), Illinois. Here at our nineteenth No-Dig Show, we celebrated two decades of NASTT by reflecting on past accomplishments, praising current achievements, and looking ahead to a promising future.

The strength of our No-Dig Show is not only the abundance of exhibitors, but also our unrivalled technical program. As always, the efforts of our Program Committee were well focused on our mandate to educate. In tune with the anniversary theme, Special Committees encouraged us all to remember our history and the trenchless pioneers of the early days.

NASTT was proud to announce two new initiatives for 2010. The Michael E. Argent Memorial Scholarships were presented for the first time to five worthy university students, all of whom have the potential to become our trenchless champions of the future. Meeting and speaking with these five exceptional young people only reaffirms our commitment to education and to the next generation of trenchless professionals.

Also for the first time, the Trent Ralston Young Trenchless Achievement Award was presented by the NASTT Chairman, Chris Brahler. This memorial award was created to recognize a young individual who has demonstrated excellence in the early stages of their career and who has made a valuable contribution to trenchless technology. Dr. Jason Lueke fit that profile and we are all proud of his accomplishments and his passion for our industry.

The 2010 Chairman’s Award for service to NASTT and to trenchless technology was fittingly presented to former Chairman Marlin Gonzales. Truly making a difference on our Society’s timeline, Marlin played an instrumental role in saving NASTT from imminent bankruptcy in 1998. How can we ever thank Marlin enough!

Undoubtedly, 2010 is a milestone for NASTT; a year to discover, to learn, and to celebrate. We continue to have enviable attendance and sponsorship at our No-Dig Show. Our membership roles are strong and the ranks of our volunteer Committees never seem to diminish. Thank you all for your generosity and your enthusiastic support.

As for the future, the 20th NASTT No-Dig Show will be held in Washington, D.C. on March 27 to 31, 2011. Planning is well underway through the leadership of the 2011 Program Chair, Jack Burnam II, who will most likely arrive by Harley Davidson. Don’t miss it.

Best Regards.

Mike Willmets
Executive Director, NASTT
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BACKGROUND
PG&E’s gas pipeline 137B serves the cities of Arcata and McKinleyville in Northern California. The 8-inch coated steel pipeline was constructed in the late 1950’s, and was installed beneath Freshwater Slough in Eureka, CA using open-cut methods. By 1998, the banks of the tidally influenced channel had eroded significantly, exposing the gas pipeline, and required replacement. Horizontal directional drilling (HDD) was selected as the best option for replacing the pipeline to minimize the environmental impacts to the sensitive habitat. The regulatory agencies with jurisdiction included the California Department of Fish and Game (CDFG), the California Coastal Commission, the US Army Corps of Engineers, and the National Oceanic Atmospheric Administration (NOAA).

In August 2005, HDD construction of the 1,000 foot crossing began, but quickly encountered difficulties. Approximately halfway through the pilot bore, a hydrofracture occurred in the slough. Drilling stopped immediately and the drilling fluid was contained and removed. However, because of the permit restrictions, the contractor was directed to abandon the bore and demobilize.

In 2006, PG&E re-evaluated the options for replacing the pipeline, including open-cut, an Ercon mat system, a pipe suspension bridge, and HDD. PG&E again concluded that HDD would result in the least amount of disruption to the protected species in Freshwater Slough, and would provide a secure, long-term solution. However, the crossing would need to be re-designed to minimize the risk of hydrofracture, and new permits with the regulatory agencies were required.

GEOTECHNICAL CONDITIONS
The geotechnical conditions presented some difficulties for HDD construction. The soil in the upper 50 feet was relatively weak clay, silt, and poorly graded sand, and was very susceptible to hydrofracture. The soils deeper than 50 feet improved and were predominantly stiff to very stiff silt and medium dense to dense silty sand. Wood was encountered at approximately 80 feet below the ground surface. Evidently, Freshwater Slough had been used as a logging channel and logs had sunk very deeply into the soft soils beneath the slough. To avoid the buried logs and weak soils as much as possible, the re-designed crossing would have to be very deep.

BORE DESIGN
The alignment for the replacement section of pipeline was constrained on either end by the tie-in locations to the existing pipeline. The entry pit was sited in approximately the same location as the previous HDD attempt, but was located as far from the slough as possible to allow the bore to reach maximum depth before passing beneath the slough. Hydrofracture risks are typically lower closer to the entry point, since drilling fluid pressures, and therefore hydrofracture risk, increases as the bore increases in length. Keeping the drilling fluid pressures low near the location of the 2005 hydrofracture would
reduce the chance of hydrofracture in the same weak soils. Hydrofracture risk was further mitigated by locating much of the bore in the deeper, more favorable soils, increasing the depth of cover beneath the slough, and selecting a steep entry angle to achieve maximum depth before crossing beneath the slough. The final recommended bore geometry had entry and exit angles of 16° and a total horizontal length of 1,008 feet.

**HYDROFRAC TURE ANALYSIS**

A detailed hydrofracture evaluation was conducted for the entire bore to evaluate the risk of hydrofracture. The analysis compared the maximum pressure the soil can withstand before hydrofracturing to the anticipated required pressure to return the drilling fluid to the entry pit. When the drilling fluid pressure exceeds the maximum allowable pressure, there is an elevated risk of hydrofracture.

The output when using this method for analyzing hydrofracture risk is dependent on the assumed geotechnical conditions, bore geometry, and drilling fluid properties. Unfortunately, soils are never truly homogeneous and drilling fluid properties always fluctuate throughout the installation process. However, the parameter values used were carefully selected from the borings to represent a conservative estimate of the soil conditions and drilling fluid properties.

The estimated hydrofracture risk was highest near the exit point, as expected. However, the regulatory agencies were primarily concerned with the environmental impact of a hydrofracture within the slough channel; a hydrofracture in the field north of the slough did not represent a significant concern because it was outside the protected species’ habitat.

In addition to deepening the bore approximately 30 feet below the initial HDD attempt, downhole pressure monitoring was specified to help mitigate hydrofracture risk.
During the pilot bore, drilling fluid pressures were measured at the drill bit. If pressures started climbing toward the maximum allowable limit, the contractor could slow the drilling rate, adjust the drilling fluid properties, or trip out to alleviate the pressure.

During the permit application process, the regulatory agencies agreed that coastal resources would be best protected by not requiring a work stoppage if a hydrofracture occurred. If a hydrofracture occurred, the agencies were prepared to assess the environmental impact and immediately grant approval to continue work if they felt the impact was minimal and proper contingency measures were implemented. By coordinating with the permitting agencies before construction, the resolution process became streamlined, and was an essential component to the success of the project.

**CONSTRUCTION**

The HDD contractor, ARB Inc., used a Vermeer 100-120 drill rig. The guidance and downhole pressure monitoring system was an InRock Paratrack system. Hay wattles and sand bags were placed around the entry pit, drill rig, and separation plant to protect against accidental surface spills and water runoff. A row boat stocked with hydrofracture containment equipment (barrel, shovels, sandbags, and silt curtain) was placed in the slough, ready to be deployed if necessary.

During the pilot bore, the contractor found wood in the drilling fluid returns, approximately 70 feet beneath the slough, very close to the location of the 2005 hydrofracture incident. When the bore encountered the wood, there was a spike in the drilling fluid pressure and the contractor tripped out to circulate their drilling fluid and reduce pressures. The following morning, as the tide dropped, a small surface spill was discovered in the marsh near the slough in the approximate location where the pressures had spiked. The contractor removed approximately 25 – 50 gallons of drilling fluid and secured the area. The biological monitor notified the appropriate regulatory agencies, which then sent representatives out to the site. Because of the arrangements made during the permit acquisitions, the regulatory agencies were able to respond quickly, assess the situation, and approve the resumption of drilling that day.
Three more small hydrofractures occurred near the exit point, as anticipated. Because these last three hydrofractures occurred outside the protected species' habitat, the biological monitor allowed the contractor to resume drilling once the hydrofractures were cleaned up. The contractor completed the pilot bore in 6 days, including down-time for hydrofracture containment and clean-up.

The bore was push-reamed to a diameter of 12 inches over four days. Wood was found during reaming operations in the returns at the same locations where wood was encountered on the pilot bore, however, no further hydrofractures occurred. After swabbing the bore, the pipe was successfully pulled into the bore in just under 6 hours. The open-cut connections were then completed by PG&E and the pipeline is currently in service.

**COMPARISON OF THEORETICAL VS. ACTUAL DRILLING FLUID PressURES**

By comparing the estimated maximum allowable pressures, the estimated minimum required drilling fluid pressures, and the actual pressures during the pilot bore, we can assess the appropriateness of the hydrofracture model currently in use.

In general, the model accurately predicted the maximum allowable pressure the soil can withstand before fracturing. With few exceptions, hydrofractures occurred where the spikes in actual drilling fluid pressure exceeded the predicted maximum allowable pressure. Specifically, this is seen in the last 260 feet of the bore, where the model predicted the highest risk of hydrofracture and three hydrofractures occurred.

Although the contractor continually monitored the downhole pressure and carefully managed the drilling fluid properties, pressure spikes occurred. Unfortunately, the largest spikes occurred with no advance warning. Because of the nature of underground construction, even the most conscientious contractor can have an inadvertent fluid return incident.

**SUMMARY AND CONCLUSIONS**

Estimating hydrofracture risk is an important aspect of design when dealing with crossings of sensitive environments. By using accurate geotechnical information it is possible to accurately model the hydrofracture risk for a crossing. The primary benefit of a hydrofracture evaluation is identification of high risk segments of a bore, rather than to pin-point exact hydrofracture locations.

It cannot be understated that a contingency plan for quick containment and clean-up of hydrofractures drastically reduces environmental impacts. By identifying hydrofracture risks during design the contractor was able to plan a response accordingly. Because of the contingency measures that were available on-site for a quick response, the contractor was able to minimize the impact of the hydrofracture to the sensitive habitat and allowed the regulatory agencies to quickly approve resumption of the work.

Kate Wallin is an Engineering Assistant at Bennett Trenchless Engineers in Folsom, CA.
INTRODUCTION
The use of condition assessment techniques is rapidly gaining popularity in the realm of infrastructure management as pipeline owners look to stretch their budgets in difficult times. There are many techniques available to help owners develop a proactive pipe replacement program, and one such technology is PICA’s patented use of Remote Field Eddy Current to inspect the existing condition of the pipe wall. PICA and the City of Calgary recently completed year two of a multi-year project helping the City assess its current infrastructure. PICA’s inline inspection tools are developed by Edmonton-based Russell NDE Systems and by using a modified fire-hydrant adapter, PICA can gain trenchless access to the water line. Russell NDE is a leader in Eddy Field Technology for pipe inspection, developing tools for over 35 years.

TECHNOLOGICAL OVERVIEW – PICA AND RFT
With a variety of in-line inspection tools, PICA is capable of inspecting pipes ranging from 4” to 78”. After consulting with the City of Calgary, they opted for a winched application of the 6” HydraSnake tool instead of its ‘free-swimming’ counterpart, the See Snake. Both tools use Remote Field Testing (RFT). RFT involves a dual-module set-up of an exciter component that emits an electromagnetic current and a detector component that measures this current after it has passed through the pipe wall twice. By observing changes in the magnitude of the current and changes in the time of travel, the tool calculates the overall thickness of the pipe.

Because the tool is able to record both internal and external wall loss, a comprehensive picture of the pipe’s condition can be obtained. A major advantage of RFT is that scale build-up does not affect the quality of the data. Also, because the City wanted to inspect lines that contained up to 90° bends and intersected other larger diameter pipe, HydraSnake’s flexible nature allowed Calgary to reach its target inspection distance.

INFRASTRUCTURE MANAGEMENT – STRIKING A BALANCE
The cost of waiting too long to replace a main is catastrophic. Burst pipes inflict economic difficulties as owners and operators struggle to accurately allocate a budget for emergency pipe failures. In addition to the economic consequences, the social costs can be even higher. On the other hand, replacing a pipeline too early is also quite costly. Just because a pipe is 100 years old does not necessarily mean it is in worse condition than a pipe 60 years younger. A replacement plan based heavily on
suspicion of mature pipeline failures can lead to suboptimal outcomes. The balance lies somewhere in the middle: catching susceptible water lines after they have exhausted their minimum level of serviceability but before their hazardous failure.

In conjunction with a condition assessment program, the City of Calgary has conducted soil samples, recorded break histories, and monitored the overall age of their pipelines. Moving forward, the City is better able to decide whether to take no action, rehabilitate the pipe, replace the pipe, or some combination within.

**TRENCHLESS APPLICATION – INSPECTING THE CITY’S WATER LINES**

The City of Calgary owns and operates close to 4,700km (2,500 miles) of water pipeline and replaces an average of 1-1.5% of these mains every year. Deciding which mains to replace is a complicated problem. According to the City of Calgary’s Charles Pullan (P.Eng), “The data obtained from these inspections are instrumental for determining the actual condition of the pipes inspected, rather than estimated condition based on breaks, age, and soil conditions.” Instead of waiting for their infrastructure to fail and then react accordingly, the City of Calgary has decided to confront aging infrastructure head-on. Their goal is to develop a comprehensive map of the water system and make budgetary decisions based on concrete information rather than anecdotal break history.

Before PICA arrived on site each day, the City of Calgary would notify residents that water would be temporarily out of service, isolate the inspection line and set up temporary supply hoses from an adjacent hydrant outside the shutdown area. PICA gains access to the water line via street hydrants which allows the inspection to take place without a costly excavation. A hydrant adaptor, equipped with an odometer and water pressure from an adjacent water line, pushes the HydraSnake tool to the far end of the inspection area. Upon reaching its destination, the tool is winched back through the line to its original launch location. During the winching process, the tool stores condition assessment data on-board, the analysis of which will give the client a visual representation of the corrosion present in the pipe.

After conducting short distance runs in the summer of 2009 (average...
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length: 200 m), the City of Calgary and PICA aimed to optimize the inspection process and determine what is the maximum inspection distance that can be accomplished in one day's work. The main constraints on this length include the winch's limitations and the City's desire to minimize resident's discomfort (turning water off after breakfast and having it back on before dinner).

This year, inspection runs were longer and involved more complicated aspects (multiple bends, 12” crossings, significant changes in slope, TEES, etc.). The 2010 inspection average was 400m (the longest inspection distance being 835m). With the City’s workers now familiar with the inspection process, both parties are confident that 800 meter inspections can be accomplished daily.

PICA is currently in the process of analyzing over 4km of data and preparing a report for the City of Calgary that will be used to help make water line maintenance budgeting decisions.

CONCLUSION

After two years of successful assessments, the City of Calgary and PICA have inspected over 5,000m of water pipeline. Calgary’s proactive approach to asset management has led to its use of RFT as a means to save their residents money and headaches. The result is a pipeline infrastructure for the 21st century.

Preparing the tool for data download post-inspection
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Education & Training
NASTT provides top-notch, quality education and training programs for trenchless professionals. Currently, NASTT offers six training courses covering Cured-in-Place-Pipe (CIPP), Horizontal Directional Drilling (HDD), pipe bursting, sewer lateral rehabilitation, an overview of trenchless technologies, and new installation methods such as auger boring, pipe jacking, pipe ramming, and the pilot tube method. Earn Continuing Education Units (CEUs) for your participation.

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- And much more! Our members often join for one reason, only to discover the value of many others.

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The Show!
The annual No-Dig Show is the largest trenchless technology event in North America, offering an impressive collection of quality papers, an exhibition hall with more than 125 trenchless companies displaying their products and services, a series of specialized training courses, and many entertaining networking events and special awards. Mark your calendars for NASTT’s No-Dig Show, March 27-31, 2011 in Washington, D.C.!
The City of Riverside, California’s wastewater collection system comprises 870 miles of pipelines and serves a population of 300,000, transporting approximately 31 million gallons daily. The Downtown Sewer Main Replacement was a small part of the Riverside Renaissance, a $1.57 billion investment in the community and the most ambitious program in Riverside’s history. The project specified pipe bursting to replace a 6” sewer line, originally installed in the 1930s, with a new 8” line. This was needed to meet the needs of the current residents of the area.

The line to be replaced is located in a densely populated area of the central city that only allowed a very small project footprint. The small work area available caused a number of challenges for the installation. The alignment of the sewer to be replaced ran through narrow alleyways between residential buildings. A traditional open-cut installation would have blocked traffic access for residents and impacted adjacent streets, causing an unacceptable level of disruption to the community. The easements were very narrow and the available working space prohibited open excavation. Many of the buildings were multi-unit residences and disruption to their wastewater services had to be kept to a minimum. Rerouting the line during work was impractical, so it was critical that the line be returned to full service at the end of each day.

A trenchless installation minimized both the disruption to the community and the amount of space needed to manage the project. Pipe bursting was selected as the desired method due to the speed of installation, competitive cost in comparison to other available trenchless methods and the ability to upsize the pipe all while maintaining a very small construction footprint. The city chose to replace the existing 80-year old vitrified clay pipe (VCP) with new VCP with a projected service life of at least 200 years.
“Many engineers still labor under the false impression that they must use a specific kind of pipe if they want to use this method,” said Collins Orton of TT Technologies. “The truth is there are many options.”

Bryan Vansell of Mission Clay Products agreed. “The best option is VCP. A jurisdiction’s most valuable asset is normally their infrastructure. Maximizing that asset is only good business. No other pipe material delivers the proven performance and long life cycle of clay, and the ability to now use it for pipe bursting gives engineers and city managers some powerful options.”

Strong collaboration is an essential starting point for any pipe bursting project. Pipe size and strength issues dictate changes in how the equipment is used and how the project is designed. The pipe bursting expander ring is designed to accommodate the exact outer diameter of the new pipe and minimize the amount of friction during the pull. On the Riverside project, a strong team effort resulted in two innovative approaches to address the multiple challenges encountered. The first innovation was a new design for a static pull pipe bursting machine. Machine manufacturer TT Technologies, Inc., working with the VCP manufacturer Mission Clay Products LLC, designed a new static...
pull pipe bursting machine capable of installing segmented clay pipe. TT Technologies and the National Clay Pipe Institute worked closely with the City of Riverside’s engineering division in the design phase of the project, offering advice and technical expertise on both method and material.

The hydraulically operated machine pushes interlocking steel “Quicklock” rods through the existing pipe, from the receiving pit to the launching pit. In the launching pit, the bursting head and expander are attached to the Quicklock bursting rods. The rods are fitted through each new NO-DIG® clay pipe segment, and then the assembled segments of pipe are held in compression behind the expander by a hydraulic-powered Squeezer device, an end place that fits behind the last piece of the pipe train. The Squeezer is pinned to the rods extended through the assembled sections of pipe, and actuated to push the joint “home”. Hydraulic pressure is kept on the “Squeezer” and maintained throughout the pull. This ensures all of the new pipe joints are kept in compression (the joints stay together) thus maintaining joint integrity throughout the process. After each section of pipe is launched, additional sections of new pipe and rod are added and the process continues until the complete length of the pipe bursting run is achieved.

Efficiencies were realized by loading two 5’ segments of pipe at a time. The expander and new pipe are pulled back toward the receiving pit, bursting the old pipe and displacing
the fragments into the surrounding soil. The equipment’s jobsite footprint above ground is minimal, and was further reduced by the use of the stacked segments of clay pipe. This process, known as “Cartridge Loading” is very advantageous in crowded urban streets and alleys where “lay down” area for new pipe is not available. This method eliminated the need for a long laying area as required when using a fused pipe. The soils in this area were expandable and leant themselves very well to pipe bursting. The typical pipe bursting run length for this project was 250 linear feet. Each burst length was accomplished in about 2 hours after the specialty pipe bursting equipment and pipe was setup.

The second challenge was the number of sewer laterals. The multi-unit residences lining the alleyways meant a high concentration of laterals. In order to keep laterals in service for residents for the duration of the project, it was required that the contractor reconnect all laterals for each newly installed section at the end of each business day.

The innovation that addressed this challenge was a new tapping saddle developed by Mission Clay. Once a hole is cored in the mainline pipe, the EPDM
rubber saddle and ABS tee are installed by hand in seconds. The TwisTee™ tapping saddle twists into a grooved saddle expanding the saddle and locking it in as it goes. The contractor pre-excavated the lateral connections, completed a pipe bursting process, and then reconnected all laterals to the new mainline in the same day.

The depth of the sewer was minimal overall (generally 8 ft), which allowed the laterals to be excavated easily. As it was, “the number of laterals [80] was a problem. One real positive was that after the contractor’s learning curve with the new method, I would say it was 30% faster, or more, than open trench,” said Lonny Young, Principal Engineer, City of Riverside.

VCP’s long lifespan makes it a preferred material for gravity sewers. Until recently however it was not considered an option for pipe bursting. With the success of the Riverside project, pipe bursting with VCP provides a proven new option for engineers.

“Partnership and communication between the city, equipment manufacturer, material supplier, and contractor is important,” says Vansell. “That was something that was really a positive on this project. We all learned a lot from each other.”

The Downtown Sewer Main Replacement by Pipe Bursting Method project included approximately 2300 lineal feet of sewer, specified VCP, to be installed by static pipe bursting. The Engineer’s estimate was $693,000, and Arizona Pipeline Company of Corona, CA was awarded the contract with a bid of $630,866. Construction began in early 2009. Mission Clay Products supplied NO-DIG VCP jacking pipe in 5’ lengths, with 316 stainless collars and EPDM rubber compression gaskets. Arizona Pipeline used TT Technologies’ Grundoburst 800G static burst machine.

Vansell was “excited by the opportunities presented by both the pipe bursting method and the TwisTee tapping saddle. We expect to see many more applications for both in the future.”

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Difficult Situations Are All in a Day’s Work for Rain for Rent

Known to provide complete solutions that deliver proven results, Rain for Rent sees value in committing resources to specific markets.

It is the only rental company with a dedicated group of project managers, called the Sewer Water A-Team (SWAT), available to specifically handle jobs requiring intricate solutions. SWAT groups work closely with Rain for Rent’s in-house Engineering Department. The services of these groups, including bypass planning and design or detailed drawings and equipment overlays for complex project locations are available for Rain for Rent’s customers. They will also attend governing agency meetings with customers to assist with presentations to ensure proper project planning and operation.

An example of Rain for Rent’s complete solutions is a recent bypass for a city in northern California. In the

Anna Porter

Installation of 1 MGD system of (1) DV-150i SA primary and (1) DV-150i SA Backup for pumping
early winter of 2009, the City scheduled a sewer rehabilitation project for two 48-in. diameter aging pipeline infrastructure connected to its Wastewater Treatment Plant (WWTP). The project design required multiple temporary bypass pumping and piping systems for a cured-in-place-pipelining (CIPP) and manhole rehabilitation project.

Rain for Rent sales representative Zach Smith headed up the team that pulled resources from its Woodland, Calif. branch, SWAT and engineering department. The team was onsite for the duration of the project and ensured that all aspects of the project were engineered, installed and operated in a safe and effective manner.

According to Smith, “The infrastructure was in urgent need of repair.” The two lines feeding into the WWTP’s primary treatment building, along with the vault and manhole, needed to be rehabilitated utilizing CIPP and epoxy lining, respectively. Before any repair work could be started, the infrastructure required cleaning and video inspection. Seven pumping stations would be required to bypass the flow to allow access to the lines.

Smith met with the City to discuss its pipeline rehabilitation needs, which included design, cleaning, inspection, high flow bypass pumping and cured-in-place pipe (CIPP). Rain for Rent designed and installed the seven bypass pumping stations with total pumping capabilities ranging from 47 mgd to a maximum of 56 mgd to combat wet weather flows. Six of the pump stations bypassed influent to the 3 million-gal Emergency Holding Basin (EHB) located inside the WWTP, while the seventh transferred influent from the EHB to the final discharge point. The CIPP portion of the project was subcontracted to a CIPP company.

The largest pumping station bypassing flows to the EHB was on the “A” Interceptor, a 66-in. reinforced concrete pipeline. After excavation by subcontractor FedCo Construction, the manhole cone and barrel section were removed and six 8-in. DV-200c Power Prime pumps were lowered to the proper suction elevation to meet the 20 MGD pumping requirement. The influent sewer was bypassed from the “A” line, through dual 18-in. HDPE pipelines into the EHB.

The next largest pump station was responsible for bypassing a total 13 MGD from the R.P. Vault (RPV) to the EHB. The RPV received flows from the North via the City’s “B” Interceptor, as well as from the South via the R.P. Interceptor. Four 90-hp
submersible pumps were lowered into the RPV to bypass the “B” and R.P. lines into the EHB through dual 18-in. HDPE pipelines. Heavy duty, galvanized road crossings ensured access in and out of the WWTP during the entire bypass operation. During normal plant operations, the RPV also receives flows from the “C” Interceptor. However, to effectively isolate the pipelines undergoing remediation, the flows from the “C” Interceptor needed to be bypassed directly into the R.P. Interceptor. To achieve this, Rain for Rent assembled a third pumping station located offsite and upstream of the RPV. This station used two 6-in. Sound Attenuated (SA) DV-150i pumps to transfer approximately 1 mgd of influent from the “C” Interceptor directly into the R.P. Interceptor.

At the fourth pumping station, submersible pumps bypassed approximately 75 gpm from the WWTP’s control building to the EHB. A fifth pumping station, operated with primary and back-up 4-in. SA DV-100 pumps, bypassed 400 gpm from the sludge thickener building into the EHB.

The sixth pump station was added due to approaching weather conditions. The Compost Facility (located across the street from the WWTP) has a small storage basin that drains into the “A” interceptor. However, the “A” interceptor had to be plugged to remediate the 48-in. pipelines. The basin could store the Compost Facility’s daily effluent, but during a rain event the basin would overflow and the facility would flood if unable to drain. In response, Rain for Rent installed the sixth pump station, which was located between the Compost Facility and the “A” Interceptor along the basin drain line. This pump station utilized one primary 4-in. SA DV-100, one backup 6-in. SA DV-150i pump and discharged into a nearby grit removal basin. During this project, the City experienced its worst October storm since 1962 – 3 to 5 in. of rain in one day. Rain for Rent’s Compost Facility Pump Station was able to bypass all incoming flows and prevented flooding at the facility.

The flows from the six bypass stations culminated in the EHB, where they were collected by the seventh and final pumping station. This flow was bypassed into the north
end of the primary treatment building via two discharge locations. The primary discharge channel was located 40 ft below the entrance to the building and could not exceed a velocity of 12 ft per second and a flow rate of 35 MGD. A secondary discharge location was located at a nearby influent vault. This discharge location was to be used during wet weather flows and could accept an additional 12 mgd at a maximum 12 ft per second. The team met these specifications with a system of three 16-in. DV-400 and three 8-in. DV-200c Power Prime pumps manifold together with two 24-in. HDPE pipelines and six 12-in. Victaulic aluminum pipelines. The manifold system allowed for pump to discharge to either location for full system flexibility.

The wet weather season governed the City’s 47 mgd target. Thanks to 26 pumps, 4,500 ft of pipe, the right accessories, and the excellent sub-contractors, the project ran for approximately one month and was successfully completed.

With a project like this, the peace of mind brought by a company like Rain for Rent, which was first onsite and last offsite was most appealing to the City. Based on its traditional mission, vision, and values, Rain for Rent was diligent with project management and able to oversee the project from design to completion.
We have concluded our annual conference, and the results are in. I am pleased to report that No-Dig 2010 in Chicago was a resounding success for NASTT and the trenchless industry at-large. We hosted a record number of attendees for a North American No-Dig. We had the largest number of 10x10 booths sold in No-Dig history, and we raised the highest number of sponsorship dollars and support ever.

One of the most exciting things about No-Dig 2010 is that we celebrated the 20th anniversary of our Society and recognized the many influential men and women who have helped build the tidal wave of interest in trenchless means, methods and applications over the past two decades.

We owe so much to these individuals because they had the vision to form an organization that would bring people together from different interest groups by providing a Society designed to support the growth of trenchless construction from engineering, municipal, contractor, vendor and student points of view.

The volunteerism and commitment demonstrated by our founders and early members created what has become the hallmark of our Society. All those who participated in No-Dig stand as a testament to the very fact that what was started 20 years ago has grown into something much larger and gains strength as others join and contribute to the whole.

Many dedicated volunteers have spent hours working behind the scenes to ensure the success of this year’s No-Dig. Without their collective support and commitment to this greater cause, we would not have had such a memorable event.

Thank you to our Program Chair Mark Hallett, for all the dedication and commitment he has demonstrated to us over the past year. Thank you to our Program Committee members, session leaders, presenters and moderators who were supported by NASTT staff, Michael Willmets and Angela Ghosh.

Thanks to the generous support of our loyal sponsors and exhibitors who help make the No-Dig experience affordable and relevant. These are the people that have invested significant amounts of money and energy to address some specific needs within our industry. Thank you again to these fine companies for their participation and commitment to growing the trenchless industry.

And finally, I wish to personally thank all of the attendees who came to Chicago as it is their willingness to share their knowledge that makes any good conference a success.

Please mark your calendars for next year’s No-Dig in Washington, D.C., March 27-31, which is the 20th anniversary of the No-Dig Show. Hope to see you there!

CONFERENCES HIGHLIGHTS
• Record-number of attendees in North American No-Dig history
• 137 exhibiting companies hosted at the Renaissance Schaumburg Hotel & Convention Center
• Largest number of 10x10 booths sold
• Largest amount of sponsorship dollars raised
• $52,000 raised at the Monday evening Educational Fund Auction (last year’s event raised $45,000)
• Comprehensive technical program included 136 paper presentations and 8 pre- and post-conference seminars

Event photos at www.nodigshow.com
2009 NASTT No-Dig Outstanding Paper Award (Rehabilitation)
1-MN-320 Emergency Sliplining Project
- Charles Lewis and Thomas Noerenberg, Brown and Caldwell; E. Scott Dentz, Metropolitan Council Environmental Services; and Fred Chase, Lametti and Sons

2009 NASTT No-Dig Outstanding Paper Award (New Installation)
Comparison of Predicted and Observed HDD Installation Loads for Various Calculation Methods – Glenn Duyvestyn, Hatch Mott MacDonald

2009 NASTT No-Dig Outstanding Board Members
Jack Burnam, CH2M Hill; Keith Hanks, City of Los Angeles; and Mark Knight, University of Waterloo

2010 Trenchless Technology Person of the Year
Keith Hanks, City of Los Angeles

NASTT 20th Anniversary & Michael E. Argent Memorial Scholarships
Brad Carey, Arizona State University; Eleazar Ivan Diaz-Loya, Louisiana Tech University; Karl Elhen, McGill University; Lalit Chilana and Sahar Hasan, University of Texas at Arlington

NASTT Recognition Award
Alan Atalah, Bowling Green State University

NASTT Student Chapters Activities Presentation Competition
1st place – McGill University; 2nd place – Virginia Tech University; and 3rd place – Arizona State University

NASTT Student Research Poster Competition
1st place – Kazi Rahman, Queen’s University and Runner-up – Brad Carey, Arizona State University

John P. Lake Rain for Rent Academic Scholarships
Brad Carey, Arizona State University; Eric Slusser, Louisiana Tech University; Kelly Quintana, University of Texas at Arlington; Bryan Adams, Vanderbilt University; Alison St. Clair, Virginia Tech University; and Patrick Calvelage and Jonathan Bill, Bowling Green State University

TrentRalston Award for Young Trenchless Achievement
Jason Lueke, Arizona State University

NASTT Chairman’s Award for Outstanding Lifetime Service
Marlin Gonzales, Boh Bros. Construction Co.

NASTT Innovative Products Awards
RapidView IBAK – Panaramo Manhole Inspection System and Cosmic Tophat – CS100 Navigator System

2009 Trenchless Technology Project of the Year (Rehabilitation)
Renewing WSSC’s Water Transmission System

2009 Trenchless Technology Project of the Year (New Installation)
7 HDD Crossings Mark Natural Gas Project

NASTT Student CCTV Competition
1st place – Varun Raj Sekar and Leon Gay, Virginia Tech University; 2nd place – Alex Provencher and Karl Elhen, McGill University; and 3rd place – Rodney Harris and Anthony Macaluso, Louisiana Tech University

2010 Outgoing No-Dig Program Chairman Award
Mark Hallett, Saertex multiCom LP

2011 No-Dig Show Call for Abstracts Deadline: July 2, 2010

NASTT is now accepting abstracts for its 2011 No-Dig Show in Washington, D.C. located at the Gaylord National Resort & Convention Center, March 27 - 31. The conference theme is "Trenchless: The Sustainable Solution."

Prospective authors are invited to submit a 300-word abstract outlining the scope of their paper and the principal points of benefit to the trenchless industry. Abstracts may be submitted electronically via www.nodigshow.com by July 2, 2010. The Program Committee will review abstracts in late July, and notify the primary authors of acceptance immediately afterward. To ensure meaningful technical content, all papers and presentations will be peer-reviewed. Final papers will be published in the conference proceedings.

Questions?
Please contact Jack Burnam, 2011 No-Dig Program Chair, e-mail: jburnam@nastt.org, phone: 425-453-5000.
What do you get when you have a mile high city and severely aged Clay Sewer pipes? Mile High Trouble if they are not repaired. AUI Inc. (Albuquerque Underground, Inc.) was invited to bid on a City and County of Denver project under the contract of the Waste Management Division. The project was located in a very heavily populated residential area, and consisted of roughly 2,000’LF of 8” Clay sewerline to be pipe burst and upsized to new 12” HDPE dr 17 pipe and 350’LF of 27” Clay upsized to new 28” HDPE dr 17 Sewer. The project also consisted of new manhole installations, rehabilitation of old brick manholes, conventional trench, backfill, and compaction, and sewer service reconnections. AUI Inc. was the successful low bidder, and was chosen due to our experience and best value bid. AUI upsized the 8” Clay to 12” HDPE dr17 and the 27” Clay to 28” HDPE dr17 utilizing Hammerhead equipment.

Michael J. Rocco
Trenchless Manager
AUI Inc.
The city of Denver is no stranger to trenchless construction, and it is a commonly used practice, but pipe-bursting was somewhat new for the project engineer Wayne Querry. The interceptor pipe ran through several back yards and heavily utilized residential areas with utilities throughout - traditional methods would have been very costly, and had a serious impact to the residents and general public in the area. In this case, the damage was severe enough in some parts, that along with the requirements to keep up with the demands of area growth and increased capacity needs, pipe bursting was the perfect solution. The satisfaction and curiosity of the residents was proof enough of the technologies merits - they were all amazed that so little pavement and earth needed to be disturbed, as well as how little inconvenience there was throughout the project.

Some of the challenges during the project were the sheer size and weight of the 24” Hammerhead bursting tool and the size of the 28” HDPE dr17 pipe. AUI was very limited in where pits could be dug. Specialized shoring and trench equipment had to be brought in and utilized, which in turn required a lot of careful planning by the Project Superintendent Archie Lucero Sr. Since this was AUI’s largest upsize project, Archie wanted to make sure all of the bases were covered. Along the 12” portion it laced in and out of residents yards, and there were many other municipalities that AUI interfaced with to gain the required access. The original plans called for replacing the existing manholes, but due to utility conflicts, as well the fact that most of the manholes were in residential back yards, Guildner Pipeline Maintenance (Commerce City, CO) was there to install their Poly-Triplex 5600 series approved lining for the manhole rehabilitation process. This sped up AUI Inc.’s schedule, prevented additional stress to residents, and saved the City and County of Denver nearly $10,000 in manhole replacement costs.

Pipe bursting in Denver was a huge success for us at AUI. The 28” Pipe Burst was a milestone for us, as it was our largest pneumatic burst to date, surpassing our previous largest burst of 24”. The Existing 350’ of old 27” Clay was burst to new 28” HDPE in 1 hour & 15 minutes! All the praise and credit goes out to our crew, led by our Project Manager Larry Reeves, Superintendent Archie Lucero Sr. and our Foreman Dartanyan Wofford.
Some of the key subcontractors from the mile-high area that need to be recognized are Guildner Pipeline Maintenance (Commerce City, CO), America West Construction (Denver, CO), Chacon Paving (Northglenn, CO) and Traffic Control West (Castle Rock, CO). The City and County of Denver Waste Management Division Field Inspector Mr. Dave Shaw, as well the Project Manager Mr. Chuck Hart, were largely responsible for the smoothness and success of the project and have our thanks.

For more information on this project or any other AUI trenchless projects, please contact AUI Inc.’s Trenchless Manager Michael Rocco at (505) 242-4848 x 3004 or e-mail at rocco@auiinc.net
NASTT is a grassroots organization that has been built upon the efforts and dedication of our local (regional) chapters. The WESTT Chapter of NASTT is a shining example of our organization. The dedication and leadership of your membership in the field of trenchless technology is renowned at the national level. I have had the pleasure of working with many of your members, and am sincerely looking forward to doing so in the future.

In March 2011, Washington, D.C. will host the 20th Annual NASTT No-Dig Show at the Gaylord National Hotel and Conference Center on the historic Potomac River. The last time the No-Dig Show was in Washington, D.C. was in 1992, with our parent organization the International Society for Trenchless Technology. At that time, NASTT was a fledgling organization, with the mission of developing trenchless training applications and educating owners, operators, and designers of the benefits associated with this new construction science. Twenty years have passed, and with the help of our Chapters, we are still growing. Our membership continues to push the envelope on the uses and benefits of a trenchless approach to resolving infrastructure problems in the United States, Canada and Mexico.

The theme for the 2011 conference – Trenchless: The Sustainable Solution emphasizes our point that trenchless technology provides a green and sustainable solution to the deterioration of our aging infrastructure. Trenchless is no longer the “experimental” technology of 20 years ago; it has been proven in our municipalities time and time again. No longer are we the last tool in the toolbox to be considered - many agencies now insist on trenchless over other methods. NASTT will be 21 years old in 2011, and we continue to grow our ability to service our membership and our communities, as well as provide the type of information and forum required to engage the industry.

The technical topics of the 2011 No-Dig Show will cover the complete span of “The Trenchless” effect on the infrastructure industry. Not only are we interested in the latest technological advances, but also how proven technologies have been applied in innovative ways. We are constantly improving; we want to know why project problems occurred, how they were resolved, what lessons were learned and how they can be applied to future projects.

Plan on attending our 20th Annual No-Dig Show in Washington D.C. You will have the opportunity to meet with your peers or to introduce yourself to our industry and the exciting directions that it provides. I can assure you that you will see and hear the current status of our industry and the directions anticipated for future growth.

Jack Burnam, 2011 Program Chair

For more No-Dig 2011 information, visit our web site at www.nodigshow.com.
Aging infrastructure will never go away, and the available funds to repair and rehabilitate our vast system of deteriorated pipelines never seem to be enough. Indeed, in our current economic malaise, utility owners are scrambling to “do more with less” to keep their conveyance and collection systems in good repair. With the ongoing innovations in trenchless technology for pipeline point repairs, owners have a viable technique, with lower costs, to keep their systems humming.

Point repairs are used to address localized structural defects in a pipeline. These can be grouped as stabilization or structural repair systems. Stabilization techniques will address a localized problem, such as infiltration, but should not be relied on to add significant structural integrity to the pipeline. Structural repairs will address most problems and bring the pipe to the full load-bearing capacity of a new pipe. Typically, stabilization techniques include injection grouting and mechanical inserts. On the other hand, structural repair techniques include segmented linings with cured-in-place linings and fiber-reinforced polymer pipe.

This paper will discuss point repairs by;
• Injection grouting
• Mechanical inserts
• Linings

**Injection Grouting**

A common method of sealing leaking joints in gravity pipelines is to use a packer which combines the functions of leak testing and grout injection. A packer with an inflatable bladder is positioned across a pipe joint and pressurized to isolate the joint. Air or water pressure inflates the packer to seal the area around the joint or defect, and the inner area pressure tested. The rate of pressure loss through the joint is then measured. If the loss exceeds a specified limit, a sealing resin compound is injected into the joint through the packer and the joint is re-tested.

The packer design varies, using either a two-part acrylic grout or a water-active polyurethane resin. The grout combines with the ground around the leaking joint to form an impermeable mass, preventing leaks and enhancing structural stability. Avanti International is a well known manufacturer of grout and in addition makes a compound which has dichlobenil for root retardation.

Polyurethane grouts are hydrophobic and react either with ground water in the soil or with a water solution.
injected through the packer at the same time as the grout.

Resin injection grouts, normally using an epoxy resin or mortar, are used to stabilize and re-bond the existing pipe structure in addition to sealing against exfiltration / infil- 
ination. Originally aimed at pipes where damage was not too severe or extensive, this technique has evolved and may be considered for more serious defects, such as holes and circular fractures. The technique is usually considered when infiltration / exfiltration problems have been identified.

An inflatable packer is winched into position so that it is centered on the defect. The isolated defect is repaired by the injection of a rapid-setting epoxy resin into the crack, fracture or hole in the pipe wall. The packer is left in position until the resin has cured and is then deflated and removed. A thin internal collar of resin usually remains after the packer has been withdrawn.

**Mechanical Inserts**

Some of the earliest methods for repairing isolated defects were using mechanical inserts. They can be installed in pipe as small as 6-inch diameter going all the way up to 16-feet in diameter, and typically have an ability to seal around a defect with a rubber or gasket material and be retained in place with stainless steel bands, sleeves or a locking device. These are not normally relied on to add structural strength to the damaged pipe. There are a number of manufacturers, but three sample types are highlighted here; Weko-Seal, by Miller Pipeline, Quick-
lock by Rausch and Link-Pipe.

- **Weko-Seal.** This system specifically addresses leaks in a pipe and is a flexible rubber sleeve held in place with stainless steel retaining bands and resists pressures as high as 300 psi. My understanding of the installation method is that it is to be installed manually, however they manufacture seals down to 16-inch diameter which implies robotic or packer installation is possible. The largest seal is 16-feet diameter.

- **Quick-lock.** This system uses a pneumatic packer to install a stainless steel sleeve with O ring gaskets. The stainless steel sleeve is coiled so that it can be inserted in the pipe. The sleeve has a locking mechanism such that when the packer bladder expands the sleeve tight against the pipe it is locked in position sealing the gasket in place. Sizes range from 6-inch to 24-inch in diameter.

- **Link-Pipe.** This man-entry system uses rigid PVC pipe material which comes in 6 segments. The segments are created by cutting the pipe material longitudinally and allowing the crown and invert segments to be small enough to be inserted into the host pipe. When the seg-
ments are at the defect location jacking devices are placed vertically and horizontally to expand the seg-
ments and recreate a circular pipe inside the damaged pipe. Grout material is then pumped into the annular space between the sleeve and the host pipe to seal and transfer loads to the insert. They also manufacture Grout Sleeve which uses a packer to install 4-inch to 54-inch stainless steel liners with grout pumped in the annular space.

![Installation of mechanical insert Courtesy of Weko-Seal](image1)

![Packer installation of mechanical insert Courtesy of Link Pipe](image2)
Point repairs made using lining material is done by positioning a short sleeve of resin-impregnated material within the host pipe and cured over the area of distress. A fabric material is typically saturated with a suitable resin creating the lining and wound around an inflatable packer. The packer is pressurized with water, steam or air and presses the lining material against the existing sewer wall while the resin cures. Both thermal-cure and ambient-cure systems are available. Resins are usually polyester (ambient temperatures) or epoxy (thermal cure). Patch repairs are short versions of cured-in-place liners, using polyester needle-felt on its own or in combination with glass fiber.

For both systems, it is necessary to limit the rise in temperature of the materials until the patch is inflated within
the pipe and avoid premature cure, which can cause failure.

The curing time depends on the resin formulation, the thickness of the patch, the temperature within the packer (in thermal-cure systems) and the temperature of the existing pipe wall. A high ground-water table will cool the outer surface of the patch and additional curing time should be allowed for hot cured systems. Ambient cured patches may not have sufficient thermo-energy to ensure a full cure. After curing, the packer is deflated and removed. The patch should then be inspected by CCTV.

**Cured-in-Place Lining Case Study**

The City of Bellevue, Washington, was looking for a repair process for a large number of isolated problem pipelines which didn’t need complete rehabilitation of the whole length. In early 2008 the City enlisted the help of Harris & Associates to identify locations that could be candidates for a pilot project to do point repairs. 15 places were chosen on sanitary and storm drain pipelines from 8 to 24-inch diameter. Ambient-cure, CIPP was specified with 4 mm minimum thickness felt. Bids were received from three contractors. The low bidder used the Perma Liner process and finished the work in approximately three weeks. Costs ranged from $3500 for 8-inch to $15,000 for 24-inch at an average cost of $10,000 per repair, including traffic control. The City was very happy with the results and achieved considerable cost savings to their capital projects budget.

**Fiber Reinforced Polymer**

Fiber Reinforced Polymer is a relatively new player in the pipe rehabilitation market. The process can use either Carbon Fiber Reinforced Polymer (CFRP) or Glass Fiber Reinforced Polymer (GFRP) and is manufactured by placing several layers of carbon or glass fabrics together, and applying epoxy resin, heat and pressure to obtain very thin (0.025 inches or 0.7 mm) laminates that can be as wide as 60 inches (1.5 m); they are typically packaged in 300 ft (90 m) rolls. Quake-wrap is a manufacturer of FRP,
and can be installed with a packer on smaller diameters, as well as by hand for pipes large enough for man entry.

About The Author
Vern Phillips, PE is a Senior Vice President at Harris & Associates, a consulting engineering firm in design and construction management. He has over 30 years of professional experience and been involved with trenchless technology since 1990. He has served on the Pipe Users Group board of directors and the APWA Greenbook Committee for Trenchless Technology Specifications.
As many municipalities and water supply companies will attest, cast iron and steel water, sewer, and irrigation mains can become a real nuisance after the mains reach their 50-year age mark. Old, corroded and leaking mains frequently force the debate on which is more cost-effective — to continue repairing main breaks or to replace the main with a corrosion-resistant material. Last year, irrigation water supplier Pineview Water Systems was in this very position with one of their steel secondary water lines in Ogden, Utah, which was 60 years old.

“The steel pipe had degraded over the years and rusted out in some parts,” says Ben Quick, staff engineer for Pineview Water Systems. “It had become a high-maintenance issue, and we were making a lot of repairs to it.”

Pineview Water Systems decided to replace the steel irrigation lines with non-corrosive PVC pipe. Since the irrigation line was installed at a rather shallow depth in a neighborhood of 36 homes and runs under several yards, the company knew replacing the pipe in an open-trench operation would cause considerable disturbance. To mini-
mize disturbance, they hired contractor Utah Pipebursting LLC, of Ogden, to install the new irrigation line via static pipebursting.

A rather new trenchless pipe installation method, static pipebursting is an efficient way to install new water and sewer pipe in congested areas and keep disruption at a minimum. It involves pulling an expander — sometimes preceded by a cutting head — through the existing line with a hydraulically powered bursting unit. As the expander passes through, it splits the hosts pipe, forcing pipe fragments out into the surrounding soil, while simultaneously pulling the new pipe in behind it. Static bursting is compatible with all pipe that can be fused or locked together mechanically, including restrained-joint PVC.

To streamline the installation and take up less space, Utah Pipebursting chose to use Certainteed® Certa-Lok™ Yelomine™ restrained-joint PVC pipe. Certa-Lok Yelomine is assembled in 20-foot lengths with spline-locked couplings as the pullback continues, allowing pipe installation to keep moving at a steady pace.

"In this project, we used the Certa-Lok Yelomine pipe because I didn’t have room to put down 400 to 500 feet of fused pipe without causing a huge traffic problem," says Jay Garrett, owner of Utah Pipebursting. "I only had about 20 to 30 feet to work with, so being able to assemble the pipe during the pull made things more convenient."

Utah Pipebursting began work in December 2009, with a crew that ranged from three to four workers. For the pipebursting, the crew used a Tric Tools® M50 cable system, with 48 tons of pullback. Attached to machinery was a 4-inch Tric Tools bursting head with a HammerHead® ductile iron slitter attached to the end of it to cut through the steel host pipe. Irrigation pipes, charged by reclaimed water, are typically installed at shallower depths than water and sewer mains for easy access, as they are drained and shut down every winter. The maximum depth of Pine View’s irrigation line was 5-1/2 feet, but at one point in its course, it is a scant 18-1/2 inches below ground. This presented the biggest challenge of the project, as the extremely shallow depth offered very little support to the pipebursting equipment.

Pipebursting at this shallow depth caused the steel pipe to rebound and bring the job to halt. "I had about 100,000 pounds of pulling force, so what I ended up with was a 100,000-pound bulldozer," Garrett says. "The pipe was standing still."

Garrett tried a few things to solve the problem. He and the crew added another expander extension behind the bursting head and poured 1-1/4 yards of concrete in the ground 4 feet under the pipe to provide additional support. However, when they made another attempt to burst through, the steel pipe remained reticent, and the machine pushed the concrete 8 inches into the ground. As a last resort, the frustrated crew drove 3/8-inch thick 6-inch x 6-inch steel I-beams 4 feet into the ground along the difficult bursting path. Fortunately, this arrangement provided enough support to allow the bursting to resume. The job moved along more smoothly after this obstacle was overcome.

The crew installed 1,036 feet of 4-inch restrained-joint PVC pipe in three pulls through predominantly clay soil. The static pipebursting installation and Certa-Lok Yelomine pipe lived up to its expectations of keeping dis-
Garrett says. “In an open-cut job, all of that would have had to be moved, which would have been costly.”

The crew finished the job in March and has since received more pipebursting jobs from Pineview Water Systems. The company gave good reviews of the project and is becoming an advocate of pipebursting for irrigation line replacements that are located in residential and other more congested areas.

“Our company is very sympathetic to homeowners, and whenever there’s a way to avoid disturbance to their properties during line maintenance or replacement, that’s exactly what we will do,” Quick says. “With pipebursting, we’re able to leave an area virtually undisturbed, so that’s the route we’re taking in our line replacements these days.”

The above photo shows the expander placed behind the bursting head to make a larger hole for the new restrained-joint PVC pipe.
With the completion of a 600 ft long crossing in December 2009, contractor Gonzales Boring & Tunneling had completed a new distance record. The project marked the longest bore using a Robbins Small Boring Unit (SBU-A), a type of cutterhead mounted with disc cutters for excavating hard rock and mixed ground. “Preparation, a qualified crew, and the right cutting head matched to the right Auger Boring Machine made for a successful crossing,” said Jim Gonzales, President of Gonzales Boring & Tunneling.

The local contractor’s result capped a series of limit-pushing projects across the U.S., including a 544 ft long auger bore using a 36 inch SBU-A in Clermont County, Ohio. A third record-breaking bore in the 54 inch diameter range was accomplished in Louisville, Kentucky, where a contractor excavated a 352 ft long highway crossing.

The crossing in Tigard, Oregon, USA, had all the right variables to achieve record-breaking status. Gonzales Boring & Tunneling needed a solution for three gravity sewer crossings 230 ft, 600 ft, and 320 ft long near an environmentally sensitive area.

Project Background
The Oregon crossings formed part of the Locust Street Sanitary Trunk Upgrade Project, which involved upsizing about 1.1 mi of existing 8-inch diameter sewer lines. The new, larger diameter pipelines, for owner Clean Water Services, were completed to accommodate future needs by the city of Portland.

Much of the gravity sewer line (4,678 ft) was installed
using open trench techniques by general contractor Northwest Earthmovers, Inc. However, a section of the older line ran almost entirely along Ash Creek, a sensitive environmental corridor. To avoid environmental impacts to the stream, Clean Water Services opted to instead build a parallel system some distance away, though this alternative required trenchless construction in a residential area.

Three crossings were needed below properties, between houses, and beneath an active Oregon Military Department facility. The owner deemed open cut an unattractive option because it would impede access and could potentially disrupt daily activities at the military site. “Deep trenching would have been the only option in the area. Geologic conditions at the surface would have required excavation into solid bedrock 30 ft below,” said Tom Lawler, Project Manager for Clean Water Services.

The crossings were initially designed as a pilot tube microtunneling project using vitrified clay pipe. However, meetings between Gonzales, other local contractors, and Clean Water Services resulted in the contract being opened up to other trenchless methods, including hard rock auger boring using a Robbins SBU-A cutterhead. “The owner has saved over one million dollars on the trenchless section alone over their original cost estimates for pilot tube microtunneling. Because the owner listened to the construction community, they saved both time and money, and kept the dollars local,” said Gonzales.

The new method also addressed the strict requirements of the gravity sewer crossings, which were constrained to a maximum 1.5% grade. “Given the strict grade requirements, SBU technology offered the best solution to avoid negative impacts to military activities and maintain residential access,” said Lawler.

**How it Works: The Robbins Small Boring Unit (SBU-A)**

The SBU-A is a type of hard rock and mixed ground cutting head mounted with disc cutters and used in conjunction with an auger boring machine (ABM). The SBU-A, available in diameters from 24 to 72 inches, consists of a circular cutterhead mounted with single disc cutters capable of excavating rock from 4,000 to over 25,000 psi UCS. For excavation, the SBU-A is welded to the lead steel casing. The ABM provides both torque and thrust to the cutting head, while a full-face auger...
is used for spoil removal.

In hard rock, disc cutters penetrate the rock face and create a “crush zone” through which fractures propagate. Material is then chipped from the face into openings in the cutterhead called muck buckets, which transfer the material to the auger. In mixed geology operation of the machine is the same, though the cutterhead may be fitted with a combination of tungsten carbide insert cutters, disc cutters, and drag bits to excavate the ground.

A contractor-designed steering system guided the SBU-A to within one hundredth of an inch design grade. Despite the mixed ground conditions, no disc cutters required changing after 820 total feet of boring.

The record-setting crossing was completed in early December 2009 with praise from all involved.

“Access limitations, environmental concerns, regulatory permitting, and public impact are serious considerations in an urban environment, and SBU technology is a great option for these conditions,” said Lawler.

**Factors Contributing to the Record-Breaking Project**

“The truth is that a record-breaking project is determined by many variables,” said Chris Sivesind, Robbins SBU Sales Manager - Western U.S. “This project had a number of factors in its favor: quality equipment, consistent geology, and most importantly an experienced crew.”

**ABM and SBU Design**

Five inch hex auger is an ABM improvement developed within the last 15 years to allow for long distance bores at high ABM horsepower and high torque. Other design improvements include improved steering accuracy, which allows for more precise installation of casings using a pilot tube boring system or hydraulic steering system.

In addition, the tool steel used for SBU disc cutters allows for excavation of a wide variety of ground types with fewer cutter changes and less downtime. “Towards the end of the 600 ft bore, they were utilizing only...
15% of the machine’s thrust capability,” said Sivesind of the Oregon crossings. “The relatively low force given the distance was a result of the bore path being fairly straight, and the SBU gage cutters effectively maximizing overcut throughout the entire crossing.”

Geologic Conditions

Whatever the ground conditions may be, consistent geology, such as the basalt encountered on the Oregon bores, seems to be a contributing factor for record-breaking projects. “Uniform geology, without a lot of fractures or clay seams, allows for longer and more accurate bores as well as optimum cutterhead utilization,” said Sivesind.

However, ground that is too hard or too soft can hinder progress. Very soft rock less than 3,000 psi UCS can clog the cutterhead, requiring slowed rotation and advance, particularly if groundwater makes the cutting face sticky. Very hard rock of 36,000 psi UCS or more requires higher thrust loading on the disc cutters, and can also slow progress and increase cutter changes. Extremely hard rock conditions often need larger diameter cutters of up to 14 inches, which allow for the higher thrust loads required to cut hard rock.

Contractor Experience

Contractor experience with multiple successful bores, as well as willingness to evaluate and manage risk, is critical to completing a record-breaking project. Most record-breaking jobs are a direct result of the contractor’s experience with multiple ABM and SBU projects at various diameters.

Ultimately, quality support and contractor willingness to attempt long crossings may have been the highest predictor of success for the Oregon crossings. Gonzales began the project with over 25 years of experience in trenchless boring, and felt that the field service provided was invaluable. “The technology worked very well for both crossings. The field service support we received was unmatched, and we hope to receive similar support for future jobs in hard rock.”

Multiple factors allowed the Robbins SBU-A to achieve a longer distance, including consistent geology and contractor experience.
Every workday, you get up, get dressed and get onto the business at hand: tackling the tasks that will help you and your company succeed. To those ends, NASTT is here to help. We want to equip you with the insight and know-how you need to enhance your professional career and advance your organization.

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And we continually strive to improve the quality of the entire educational experience for our attendees through course evaluations and feedback.

We’re particularly excited about coordinating these good practices courses with our regional chapters and with the help and support of our volunteer members. On Oct. 21, NASTT will be headed to Denver to host a trenchless technology course with its newly established Rocky Mountain Chapter. In early November, the Western Chapter will sponsor a pipe bursting course in South Lake Tahoe. We’ll round out the year with a HDD course, Nov. 18th in Edmonton, sponsored by the Northwest Chapter.

Please join us for these learning opportunities, or one of the many others we have scheduled for the remainder of 2010 and for 2011. Visit our web site at www.nastt.org for more information.

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- **Oct. 19, 2010**
  NASTT’s Lateral Good Practices Course – Martinez, CA
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- **Oct. 21, 2010**
  Trenchless Technology Good Practices Course – Denver, CO
  Sponsored by Rocky Mountain Chapter

- **Oct. 22, 2010**
  NASTT Rocky Mountain Chapter Fall Conference – Denver, CO
  Sponsored by Rocky Mountain Chapter

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- **Nov. 2010 (date TBD)**
  NASTT’s Pipe Bursting Good Practices Course – South Lake Tahoe, CA
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- **Nov. 17, 2010**
  NASTT Northwest Trenchless Conference – Edmonton, AB
  Sponsored by Northwest Chapter

- **Nov. 18, 2010**
  HDD Good Practices Guidelines Course – Edmonton, AB
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- **Jan. 26, 2011**
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Dec. 8-9
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Jan. 26
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