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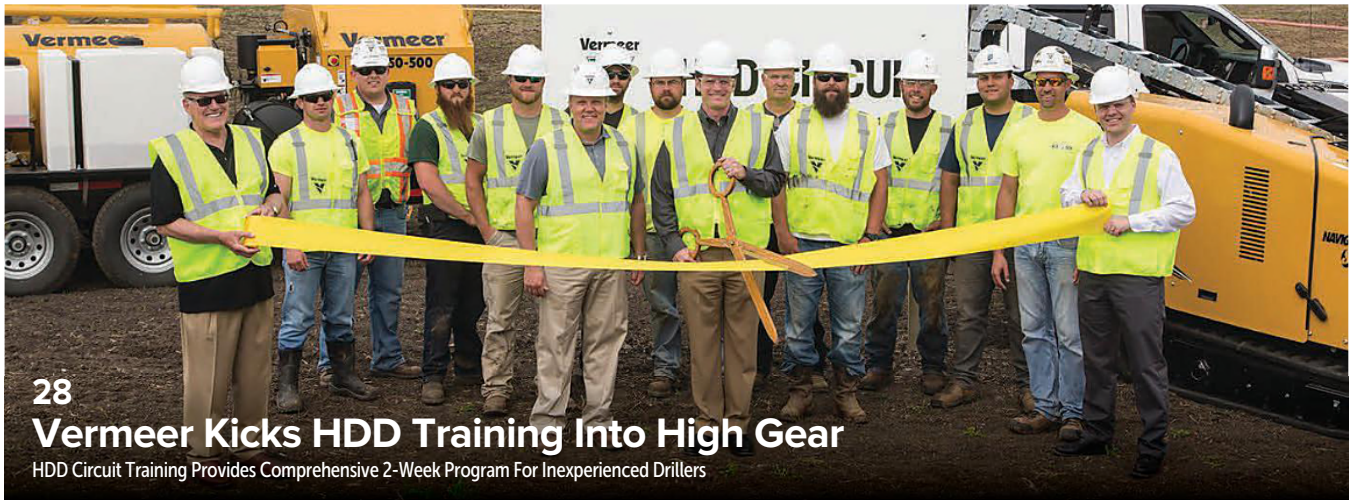
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DIRECTIONAL DRILLING

18 18th Annual Horizontal Directional Drilling Survey Diverse Markets Drive HDD Foward

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ON THE COVER

A worker looks over equipment on a large diameter water project in Atlanta, GA, last winter. (Photo by Sandy Buller, Buller Productions, bullerproductions.com)

EDITOR'S LOG



By Robert Carpenter, Editor-in-Chief

It's A Start

Since the inception of horizontal directional drilling (HDD), a dearth of training programs has resulted in on-the-job, on-the-fly training by contractors. While such training is not necessarily a bad thing, during the first golden age of telecom construction it did mean much inconsistency in the HDD process. Today in the second golden age of telecom, workforce issues have emerged as a major inhibitor to growth.

As the 1990s telecom boom accelerated, the absolute need to place fiber trunk lines in the ground often trumped quality work. Accidents and system installations with problems or even failures were not uncommon. Years later, a well-documented legacy of crossbores still generates major infrastructure issues for underground utilities.

Manufacturers tended to stay away from training. Fear of liability was certainly a key component of that decision but also the state of the industry was such that rather than invest in something that wasn't really one of their core areas, vendors preferred to leave training up to the contractor. Also, training was often part of the sales or value-added process that a dealer would offer customers.

That was also back in the day when hard iron was making quantum leaps forward every six months. Everyone was learning on the job and manufacturers, big and small with equipment serving markets and contractors of all sizes, were focused on investing in research and development to bring the latest and greatest advancements to market as quickly and efficiently as possible. Training was someone else's problem.

In all fairness, leaving the training up to contractors or working with dealers for training support seemed to be the preference of most contractors. They would train people their way, at the company's pace and schedule, and for specific roles as needed. Typically, contractors had to snag new hires from wherever they could, throw them into the field, and train on the go. Even then,

... training programs are emerging, predictably more so from the larger manufacturers with resources and a plethora of dealers to help, but ultimately all facets of the market are getting involved.

labor was tight. Employees were poached on a regular basis. But it was the experienced operators that were in such high demand and frequently switching jobs.

Further, everybody – inside and outside the industry – wanted a piece of the pie. Basically, if you had a used pick-up truck and \$5,000, even an inexperienced contractor could find financing to obtain a rig and necessary equipment for telecom work. No training, no experience, just enthusiasm; it was a clear recipe for disaster.

Of course, the unsustainable drive to light up fiber trunk lines around the country started to tumble by 2000 and in 2001 came to an unceremonious crash. Even the experienced HDD operators found themselves looking for new jobs at reduced wages as contractors were forced to tighten their belts just to survive – and by some assessments, as many of 50 percent didn't.

But the HDD industry and underground utility construction in general did rebound. The nation's dark fiber surplus has long since been exhausted as consumer needs – and appetites – for bandwidth has made fiber the new, necessary reality. More 'can't do without' tools and toys are introduced on a regular basis, steadily increasing demand. The mad rush to provide fiber to the premises has emerged as a more sustainable model. That pressure, combined with healthy gas distribution and electric markets, has again brought workforce issues to the forefront of the industry.

This time around, manufacturers are more in-tune with customer needs. Thus, training programs are emerging, predictably more so from the larger manufacturers with resources and a plethora of dealers to help, but ultimately all facets of the market are getting involved. The Distribution Contractors Association has launched a workforce initiation and is hoping to get other groups and associations involved in their initiative focused on underground utility installation and maintenance.

In this issue, two different but important approaches to worker training are presented. Ditch Witch (see special supplement) has launched a complimentary online HDD training program that works in tandem with their dealers for field support. Vermeer (see article on page 28) has developed an extensive – and intensive – two week HDD training program. These are substantially different approaches but nonetheless share a wholehearted and sincere commitment from Vermeer and Ditch Witch management.

While most vendors are unable to mount such cost-prohibitive programs for training, they all have opportunities and avenues they can pursue to meet the training needs of the industry's workforce. While finding trainable labor remains a major stumbling block in the big workforce picture, the emerging training programs represent a significant, potential game-changing start to tackling workforce issues.

Dan Vroom, Vermeer customer training lead and one of the developers of Vermeer's HDD Circuit Training Program, believes that "drilling is an art that you get or you don't. I got into it and just loved it," he said.

Enthusiasm is contagious and sometimes that's what it takes to make progress. It's a step, an important and big step, down the road to a long-term solution.

A handwritten signature in black ink, appearing to read 'Robert Carpenter', written over a white background.



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DeKalb Watershed Management Issues Contracts In Support Of Sanitary Sewer Program

The Department of Watershed Management (DWM) in DeKalb County, GA, will issue up to four design-build contracts, by late summer 2016. Each contract holds an approximate value of \$50 million and will be used for rehabilitation and improvements of sanitary sewers throughout the county's system to reduce and/or eliminate sanitary sewer overflows, in compliance with a Federal Consent Decree (CD) issued by the United States Environmental Protection Agency (EPA).

The upcoming contracts are in response to a Clean Water act settlement reached between DeKalb County and the EPA in December 2011, in the form of a CD requiring the county to develop and implement effective capacity, management, operations and maintenance programs for its wastewater collection system, including a continuing sewer assessment and rehabilitation program. The CD requirements set out a deadline for completion within 8.5 years of the date of entry; capital projects related to the CD are estimated at approximately \$285 million.

In late March, assessments of approximately one-third of the DWM's sewer system in DeKalb County were in progress, and the DWM estimated that upon completion, 15 to 30 percent of the system's components would need rehabilitation or capacity upsizing prior to June 2020.

The DeKalb County DWM is the primary provider of water and wastewater services in the county; the department protects public health, safety and welfare through the provision of safe drinking water and quality wastewater treatment. The department is among the largest water/wastewater utilities in Georgia and across the southeastern region of the U.S., serving more than 700,000 residents.

TTC Plans 2nd Auger Boring School

The Trenchless Technology Center will hold another auger boring school at the Louisiana Tech campus, Ruston, LA, from Oct. 3 – 7. Industry experts will serve as instructors for this special event.

Registration is now open. To find out more about the school and to register online, please visit the school web page ttcspecialty.schools.com/abs, or contact Jadranka Simicevic, TTC ABS Director, (318) 257-2744, jadranka@latech.edu

AEM's Sewer Cleaner Leadership Group Identifies Priorities

The Association of Equipment Manufacturers' (AEM) new Sewer Cleaner Leadership Group is one of approximately a dozen created in response to the association members' needs for executive-level, product-specific groups dedicated to the resolution of technical, regulatory, legislative or market-related issues. The group covers sewer cleaner trucks and trailers, including jetters and combination machines.

Eight representatives from six different companies attended the group's first meeting, during which the assembly identified its top priorities in aiming to provide a way for leaders of sewer cleaning equipment manufacturers to give direction on AEM programs.

The group named statistics program development, safety awareness and equipment standards development as its top three priorities. The Sewer Cleaner Leadership Group will develop a statistics program, investigate the need for safety materials and follow standards development currently underway for related industry products.

For more information on the Sewer Cleaner Leadership Group, contact John Somers, AEM director, product management – construction, mining and utility at 414-298-4172 or jsomers@aem.org.

Austin Utility Focuses On Using More Reclaimed Water

With infrastructure, wastewater and reclaimed water being hot button topics in Austin, TX, the city recently entered the latest \$5 million phase of an infrastructure project aiming to allow the city to use more reclaimed water.

The project will connect to the Capitol Complex Reclaimed Water Main project currently under construction in Austin. The reclaimed water is not potable, but it is clean and safe to use for applications such as irrigation, toilet flushing, manufacturing and cooling. Despite the hefty price tag, officials claim the water savings will allow the project to eventually pay for itself.

Last year, the system – which contains 50 miles of water mains – pumped 1.2 billion gallons of reclaimed water, which the city said was highly-purified wastewater that would ordinarily be discharged to the Colorado River.



Water Organizations, EPA Release Effective Utility Management Report

Eight heavy-hitters in the water and utility industries collaborated with the United States Environmental Protection Agency (EPA) to develop the Effective Utility Management (EUM) Report entitled, Taking the Next Step: Findings of the EUM Review Steering Group, which was announced at the National Water Policy Forum in Washington, D.C., April 11-13, 2016.

The EPA along with the American Public Works Association, the American Water Works Association, the Association of Metropolitan Water Agencies, the National Association of Clean Water Agencies, the National Association of Water Companies, the Association of Clean Water Agencies (ACWA), the Association of State Drinking Water Administrators and the Water Environment Federation announced the report aiming to identify refinements to the EUM framework, which includes 10 Attributes of Effectively Managed Utilities, or building blocks, of effectively managed water sector utilities and five Keys to Management Success.

The EUM Report is positioned as an enhancement of the EUM framework, and the organization partners are the best resources for local, state and federal governments, said Grayson.

Since 2007, the EUM Collaborating Organizations have worked on the EUM framework, findings and recommendations in the released report. In 2015, the aforementioned organizations asked a steering group of utility and state leaders to review the EUM framework. In addition, the steering group held two national webinars for the members of the collaborating organizations.

The key areas of change in the water sector since 2007 that were a driving factor behind the EUM Report findings include: accelerated adoption of automated and "smart" systems and data integration; growing climate variability and extremes; enhanced customer expectations and public awareness; expanded challenges associated with employee recruitment and retention; increased focus on resource recovery; continued regulatory requirements and operating condition changes; and greater consideration of storm water and watershed management.

For more information regarding the EUM Report, visit watereum.org.

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Flint: Problems Persist For Poisoned City By Chantel Green, Associate Editor

More than eight months have passed since the drinking water source in Flint, MI, was switched back to the Great Lakes, after a detrimental extended use of the Flint River – a decision that poisoned city residents, brought criminal charges against city and state officials and continues to threaten years of economic revitalization in Flint.

In April, the latest conundrum for Flint's water system was lack of use. Testing completed by Virginia Tech researchers, including Marc Edwards who heads the team, showed contamination to still be at problematic levels. In March, Edwards and his team sampled water at 22.8 parts per billion (ppb) of lead in Flint's water system – down from the 28.5 ppb recorded in August 2015, but still not low enough to fulfill the requirements of 15 ppb for at least 90 percent of the homes in the community, as set by the U.S. Environmental Protection Agency's (EPA) Safe Drinking Water Act (SDWA). According to the researchers, the system needs more chemicals such as orthophosphates and chlorine to move through pipelines and plumbing fixtures in order to combat lead contamination and bacteria growth; none of which can happen if the residents are not using the water supply frequently. Edwards told *The Detroit News* that "we have learned in the past few months it's probably going to take months or a year to get these deposits out of the pipes and clean those pipes out."

In an effort to move up the timeline for the delivery of safe potable water to Flint residents, Edwards said he will back a flushing program to begin moving water through the city's system at faster rates, despite that doing so would require residents to increase their usage.

In late April, Michigan Attorney General Bill Schuette announced criminal charges against three officials who were formerly responsible for maintaining safe water in Flint. Schuette discussed the charges during a press conference in downtown Flint, stating that the three officials in question tinkered with evidence, tweaked testing and misled county and federal officials, which played a part in the contamination of the city's drinking water.

Charges were filed against Mike Glasgow, 40, Flint's laboratory and water quality supervisor; Mike Prysby, 53, an official at Michigan's Department of Environmental Quality (DEQ); and Stephen Busch, 40, the Lansing, MI district coordinator for the DEQ's Office of Drinking Water and Municipal Assistance. Prysby began working in the Water Resources Division's Transportation and Flood Hazard Unit less than a month prior on March 28 – the day before Glasgow testified during a legislative hearing that Prysby told him – before the city switched to Flint River for water in 2014 – that phosphate wasn't required.

Prosecutors claim the charges filed

on April 20 are the tip of the spear in a deep investigation into government misconduct. Schuette claimed no specific targets in the continuing investigation, but also stated that no one has been ruled out, declining to say whether he anticipated an interview with Michigan Gov. Rick Snyder as a part of the exploration of misconduct.

The totality of all charges include felonies of misconduct in office and conspiracy in relation to tampering with evidence.

Busch faces five charges to include misconduct in office, conspiracy to tamper with evidence, tampering with evidence, engaging in a treatment violation that violates the Michigan SDWA, and engaging in a monitoring violation that violates the Michigan SDWA. He has been suspended without pay, according to Melanie Brown, Michigan DEQ spokeswoman.

Glasgow faces charges including two counts of tampering with evidence and willful neglect of office. Chief legal counsel for Flint, Stacy Erwin Oakes, said Glasgow was put on paid administrative leave.

Prysby faces six criminal charges including two charges of misconduct in office and one count each of conspiracy to tamper with evidence, tampering with evidence, engaging in a treatment violation that violates the Michigan SDWA, and engaging in a monitoring violation that violates the Michigan SDWA. Prysby was also suspended without pay, Brown said.

Busch and Prysby both pleaded not guilty to the charges against them, and were released on bond the same day charges were brought. At presstime, Glasgow had not yet been arraigned on the charges against him.

Amidst these charges, Snyder was in the early days of a pledge he made to drink filtered Flint water for 30 days, in an effort to encourage residents to begin drinking from the city's water system. He urged Flint residents to drink the water as long as a filter is in place, despite the EPA's warning that bottled water is safest for children under 6 and pregnant or breastfeeding women.

The most recent health scare is the mental health side effects. As reported by *The New York Times*, health care workers are attempting to help Flint residents with what many fear may be chronic consequences of the contamination crisis including profound stress, worry, depression and guilt.

The long-lasting effects of the water crisis in Flint are more expansive than the water and sewer industries could have imagined. The effects stretch across industries and into the homes of residents, nearly a year after ceasing to source water from the Flint River. The harsh spotlight serves as a worldwide warning to enact change in the treatment and reuse of water, and the importance of addressing the rehabilitation needs for underground infrastructure. ■



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Flint-Inspired Water Infrastructure Bill Takes First Step Forward

A Senate committee passed a bill authorizing a new \$100 million fund for cities like Flint, MI, which have drinking water emergencies on April 29. The bill also fully funds \$70 million (i.e. no separate appropriation is needed) for the Environmental Protection Agency's (EPA) Water Infrastructure Finance and Innovation Act (WIFIA) program, created in 2015 by Congress as a supplement to the Clean Water and Drinking Water State Revolving Funds (DWSRF). The WIFIA has not had the funds to issue any loans in its first two years of existence. The Obama Administration proposed a \$20 million appropriation for fiscal 2017.

The Flint amendment to the Senate Environment and Public Works' Water Resource Development Act (WRDA) is meant to provide a new pot of money for cities and counties who find, like Flint, that they have lead problems with drinking water piping. There is a universal agreement that existing lead service lines pose a health danger nationally, especially to vulnerable children, and that the financial resources available for cities to remedy that problem are clearly insufficient. A recent study conducted by the American Water Works Association estimates there are 6.1 million lead service lines utilized nationwide serving 15 to 22 million Americans. USA Today has reported that nearly 2,000 water systems across all 50 states have exceeded the EPA's lead action level within the past four years.

The House Transportation and Infrastructure Committee is expected to pass its own version of

a WRDA. But Justin Harclerode, the spokesman there, could not say whether it would include a Flint amendment.

Currently, states and cities could use DWSRF loans to address lead problems. But the magnitude of deteriorating water pipe infrastructure greatly exceeds the ability of the DWSRF to fund pipe repair and replacement, hence the need for an additional source of funds. The WIFIA funding, if Congress follows the lead of the Senate committee, will only be available for large projects in metropolitan areas.

President Obama proposed an increase for the DWSRF in fiscal 2017 to \$1.02 billion; it received \$863.2 million in fiscal 2016. But the CWSRF would be severely cut to \$979.5 million. House Democrats introduced the Assistance Quality and Affordability Act on Feb. 29, which would increase funding for the drinking water SRF to \$3.13 billion in fiscal 2017 and increase it 15 percent annually over the next four years. That bill has no chance of passage.

Federal funding is one issue; federal oversight of local water system safety is another. The federal law regulating local supervision of drinking water pipes has not been updated in 13 years, and won't be until at least 2017. It is called the lead and copper rule (LCR), and is administered by the EPA under the Safe Drinking Water Act. Under the LCR, all large water systems (serving more than 50,000 people) must treat their water to optimize corrosion control, or demonstrate they don't need to do so because their water isn't corrosive and they have no lead problems.

At hearings in the House Energy and Commerce Committee, both Republicans and Democrats pressed Joel Beauvais, deputy assistant administrator for the Office of Water, EPA, on why the agency was taking so long to make changes to the LCR via a proposed rule. "We certainly have a sense of urgency about the revisions and we also want to make sure that we get them right," he said.

He noted that the agency's forward progress had slowed because

the recommendations on LCR revisions made by the National Drinking Water Advisory Council came prior to the Flint incident. Those recommendations need to be updated. "I think stakeholders' understanding of where we need to go on this has evolved somewhat. So, we are working hard on that and we are going to get it done as quickly as we can," he added.

Currently, the LCR does not require localities to replace lead pipes. Beauvais was asked whether he thinks the EPA will propose replacement. "I do," he answered.

That was music to ears of Mae Wu, senior attorney in the Health and Environment Program at the Natural Resources Defense Council (NRDC). She also serves on the EPA's National Drinking Water Advisory Council.

"It is critical that the revised LCR contain an enforceable requirement to fully replace lead service lines on a strict timeline," she stated. "It is also critical that the service lines be replaced fully; that is, replacement of the service line up to the customers' home or residential building, including on the homeowner's property."

The American Water Works Association (AWWA) supports complete removal of lead service lines across the country.

Pipeline Safety Bill Heads For House Passage; Senate Bill Waiting

Two House committees passed nearly identical pipeline safety bills. Once they combine into a single piece of legislation the House will work with the Senate, which previously passed a bill, to come up with a single version for President Obama's signature.

All three bills pale beside the 2011 pipeline bill which contained many new regulatory mandates for the Pipeline and Hazardous Materials Safety Administration (PHMSA), a significant number of which have not been completed. In this new batch of bills, there are only two significant provisions. One in the two House bills gives PHMSA "emergency order" authority to close down a pipeline in the event of a significant leak. All three require PHMSA to

establish a regulatory program to prevent leaks from underground gas storage facilities.

The House bills were passed in late April by the House Energy & Commerce Committee (H.R. 5050) and the Transportation and Infrastructure Committee (H.R. 4937). Once they are joined together, they will be conferenced with the Senate's S. 2276 which passed on March 3.

The Senate bill does not include an emergency order provision. Brianna Puccini, spokeswoman for Sen. Deb Fischer, R-NE, chairman of the Senate Surface Transportation subcommittee and sponsor of the Senate's SAFE PIPES Act, declined to comment on whether Fischer supports emergency order authority for the PHMSA. Puccini says, "Senator Fischer looks forward to addressing the pipeline safety bill in the Senate as it continues through the legislative process."

The House bills allow PHMSA to impose "emergency restrictions, prohibitions, and safety measures by issuing an emergency order . . . without prior notice or an opportunity for a hearing, but only to the extent necessary to abate the imminent hazard." Other federal regulatory agencies have this authority; PHMSA never has had it. Before issuing such an order, PHMSA would have to consider its impact on the national or regional economy or national security and the owners and operators of pipeline facilities. Companies could file a petition for review which, if not answered by the agency within 30 days, would mean the order was nullified. The order could also be appealed in federal district court. An imminent hazard is defined as a substantial likelihood that death, serious illness or severe personal injury may occur or a substantial endangerment to health, property or the environment.

This provision, in a more draconian fashion, was proposed in the Transportation Committee bill, where the Interstate Natural Gas Association of America (INGAA) initially opposed it. Rep. Jeff Denham, R-CA, chairman of the Railroad, Pipelines and Hazardous Materials subcommittee, eventually rewrote the provision almost to INGAA's satisfaction. ■



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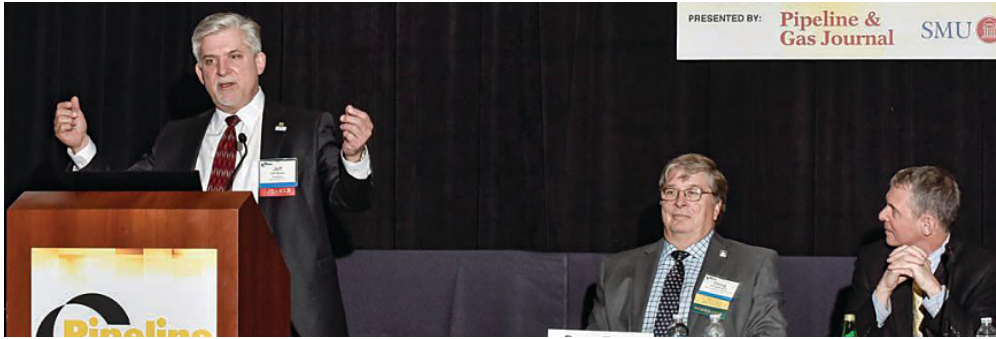
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Pipeline Opportunities Conference Focuses On Moving Forward



Top Left: Jeff Wiese, PHMSA, addresses the audience while Doug Evans, Gulf Interstate Engineering and Don Santa, INGAA, listen.

Top Right: Rob Gardner, economist for ExxonMobil's annual Energy Outlook, delivers the keynote address.

Bottom Left: Attendees pay close attention to the valuable information offered.

Bottom Right: Vacuworks President Bill Solomon queries one of the speakers as John Weaver of John Deere listens to a presentation.

If the attendance and tone of the speakers at the 12th annual Pipeline Opportunities Conference, held March 22, serves as a harbinger of what lies ahead for the energy business, things are starting to look up.

About 350 participants filled the J.W. Marriott Hotel in Houston's Galleria District to hear a range of experts discuss not only the challenges the industry faces going forward but perhaps more importantly, what sort of future awaits us in the wake of the oil price decline.

The event, titled "Where Do We Go From Here?" was sponsored by Pipeline & Gas Journal and the Interstate Natural Gas Association of America (INGAA), which represents North America's pipeline transmission companies.

"We were extremely pleased by the large turnout, especially considering all the economic challenges companies in the pipeline industry faced in the months leading up to the conference," said Pipeline & Gas Journal Editor Jeff Share.

Speakers for the conference were

chosen to provide timely analyses moving forward and tackle such critical issues as the effect of the unprecedented pressures faced by midstream operators. Doug Evans, president and CEO of Gulf Interstate Engineering, served as the event's moderator.

Kicking the morning session off for the third year was a panel from the Maguire Energy Institute at Southern Methodist University's Cox School of Business, featuring long-time energy experts Institute Director Bruce Bullock and Associate Director Bud Weinstein. They were joined by Gary Evans, chairman and CEO of exploration and production company Magnum Hunter Energy Resources.

Much-anticipated keynote speaker Rob Gardner, the economist who directs ExxonMobil's annual "The Outlook for Energy", was among the many highlights of the day. He pointed out the study's key findings included the prediction that the global energy environment, 25 years from now, will remain largely as it is

today. In other words, oil and natural gas will remain dominant.

The Outlook also projected during that period that oil and gas will combine to account for 57 percent of global energy, an increase of 1 percent from the 2014 level, and the use of natural gas through 2040 will increase a whopping 56 percent while use of oil will increase 25 percent.

Jeff Wiese, associate director for the federal Pipeline and Hazardous Materials Safety Administration (PHMSA), the agency's point man on pipeline safety, discussed one of the bright spots for the pipeline industry going forward – the continuation of pipeline integrity mandates in the form stiffened federal and state regulations. The guidelines require utilities to spend billions of dollars to upgrade their pipeline systems. Wiese was joined on the topic of politics and regulatory impacts by Don Santa, president and CEO of INGAA and the INGAA Foundation, who discussed news and possible changes on the Washington, D.C. front.

In the first afternoon session,

Nexant Consulting's Nelly Mikhael addressed, among other issues, another potentially bright spot for oil and gas pipeline-related business in the coming years – Mexico's decision to welcome foreign investors under its Energy Reform Act. She was joined on the panel by natural gas analyst Colette Breshears and senior LNG analyst Ted Michael, both of energy market data and intelligence provider Genscape.

Closing out the day, opportunities for midstream companies were examined by Katie Jolly, strategic planner at ARB Midstream; John Hayes, chief commercial officer for Boardwalk Pipeline Partners; and Curtis Cole, director of business development for Kinder Morgan-East Region.

The 13th Annual Pipeline Opportunities Conference will take place March 21, 2017, at the Omni Houston Hotel in Houston.

FOR MORE INFORMATION:
[Pipeline Opportunities Conference,](#)
[pipeline-opportunities.com](#)

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HITACHI

PIPE SELECTION CHART

Compiled by **Chantel Green** Associate Editor

Advanced Drainage Systems

4640 Trueman Blvd., Hilliard, OH 43026
P: 800-821-6710, F: 614-658-0204, W: www.ads-pipe.com,
E: info@ads-pipe.com
Contact: Tori Durlit

ADS, the world's largest manufacturer of corrugated HDPE drainage pipe products solutions for residential project to highway drainage in a cost-efficient manner.

Product	Type of Pipe	Pipe Diameter	Available Lengths
N-12 ST/WT	dual wall HDPE pipe	4" - 60"	13', 20'
N-12 per ASTM F2648 ST/WT	dual wall recycled HDPE pipe	4" - 60"	13', 20'
SaniTite HP WT	dual wall PP pipe	12" - 30"	13', 20'
SaniTite HP WT	triple wall PP pipe	30" - 60"	13', 20'
HP Storm	dual wall PP pipe	12" - 60"	13', 20'
AdvanEDGE	flat corrugated HDPE	12", 18"	100', 500'

AMERICAN

1501 31st Avenue North, Birmingham, AL 35207
P: 800-442-2347, F: 800-442-2348, W: www.american-usa.com
Contact: Maury Gaston

American's pipe is used for water and wastewater systems. American furnishes ductile pipe for HDD installations.

Product	Type of Pipe	Pipe Diameter	Available Lengths
American Spiral Weld	steel	66" - 144"	20' +
American Ductile Iron	ductile	4" - 64"	20' nominal

American Pipe & Plastics

PO Box 577, Binghamton, NY 13902
P: 607-775-4340, F: 607-775-2707, W: www.ampipe.com
E: cmunson@ampipe.com
Contact: Charles Munson

American Pipe & Plastics is a manufacturer of PVC conduit, conduit systems and fabricated accessories for the telecommunications, fiber optics and power utility markets. In addition, American Pipe & Plastics manufactures the AM-Liner® trenchless PVC pipeline rehabilitation system.

Product	Type of Pipe	Pipe Diameter	Available Lengths
AM-Liner®	PVC pipe liner	6" - 12"	6" - 2000', 10" - 685', 8" - 4050', 12" - 530'
AM-TEL	PVC	4"	20'
AM-Duct	PVC	1", 1 1/4", 1 1/2", 2", 3", 4", 5", 6", 8"	20'
AM-FO	PVC	1 1/4", 1 1/2", 2"	20'
AM-COM	PVC	1 1/4", 2", 3", 4"	20'

Arntzen Corp.

1025 School Street, Rockford, IL 61105
P: 800-821-3475, F: 815-964-0045, W: www.arntzenpipe.com
E: pipesales@arntzencorp.com
Contact: Richard Arntzen

Arntzen Corporation manufactures large diameter rolled and welded steel casing pipe with mills in Rockford and Woodstock, IL used in the underground construction industry.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Casing pipe	steel	24" - 192"	up to 80'

Asahi/America Inc.

655 Andover St., Lawrence, MA 01843
P: 800-343-3618, F: 800-426-7058, W: www.asahi-america.com
E: asahi@asahi-america.com
Contact: Jeff Baker

Chem Proline has been used for NSF-61 water applications using HDD, sand-free trenches in sizes up to 100", 150 psi. Consult Asahi for engineering assistance.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Chem Proline	PE	1/2" - 100"	16.4' standard, up to 1500'
Chem Prolok	PEXPE	1"x3" - 12"x16"	16.4'
Proline	PP	1/2" - 24"	16.4'
Super Proline	PVDF resin	1/2" - 12"	16.4'
Ultra Proline	E-CTFE (Halar)	1/2" - 4"	16.4'
Poly-Flo	PPxPP, PEXPE	1"x 1 1/2", 2"x3", 4"x6"	20', 40'
Duo-Pro	PP, PVDF, E-CTFE	1"x 3" - 24"x 32"	16.4'
Pro-Lock	PVC, CPVC	1"x 3" - 4"x 8"	20'
Air-Pro	PE	1/2" - 12"	16.4'

Berg Europe Corp.

10375 Richmond Ave., Ste. 425, Houston, TX 77042
P: 713-465-1600, F: 713-827-7423, W: www.bergeurope.com
E: koichi.konuma@bergeurope.com
Contact: Koichi Konuma

Product	Type of Pipe	Pipe Diameter	Available Lengths
Berg Steel Pipe	DSAW - long seam	24" - 64"	40' & DJ to 80'
Berg Spiral Pipe	DSAW - spiral	24" - 56"	up to 80'
Europipe	DSAW - long seam	20" - 60"	40' - 80'
TSA	DSAW - spiral	16" - 56"	up to 80'

Can-Clay Corp.

402 Washington St., Cannelton, IN 47520
P: 812-547-3461, F: 812-547-6514, W: www.canclay.com
E: info@canclay.com
Contact: Mark Bruce

Can Clay manufactures gravity sewer pipe with exceptional corrosion resistance with the longest life for use in microtunneling and open trench installations. Joints are rated up to 29 psi, 70 ft. water head. ISO 9001-2008 quality system certified.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Denlok	vitrified clay	6" - 48"	up to 10'
Tuff Guard	vitrified clay	15" - 36"	up to 10'
NoBel	vitrified clay	6" - 12"	up to 6'
CanOLok	vitrified clay	6" - 36"	up to 10'

Charter Plastics

221 S. Perry Street, Titusville, PA 16354
P: 800-486-7473, F: 814-827-1614, W: www.charterplastics.com
E: information@charterplastics.com

Charter Plastics is a manufacturer of High Density Polyethylene (HDPE) pipe for potable water, reclaimed water, sewer, geothermal, gas and irrigation and industrial applications. For quality, service and reliability, you can count on Charter Plastics.

Product	Type of Pipe	Pipe Diameter	Available Lengths
CTS	PE tubing	3/4" - 2"	coils
IPS	PE	3/4" - 24"	3' < coils, 4' > straight
DIPS	PE	3" - 4"	straight
Geothermal	PE	3/4" - 24"	coils & straight

Contech Engineered Solutions LLC

9025 Centre Pointe Dr., Ste. 400, West Chester, OH 45069
P: 800-338-1122, F: 513-645-7993, W: www.conteches.com
E: info@conteches.com; gunningham@conteches.com
Contact: Gaelyn Cunningham
Contech Engineered Solutions provides site solutions for the civil engi-

neering industry. The Contech portfolio includes bridges, drainage, erosion control, retaining walls, and stormwater treatment products.

Product	Type of Pipe	Pipe Diameter	Available Lengths
DuroMaxx	steel reinforced polyethylene	30" - 120"	14', 24'
SPR PE	In Situ Wound Steel Reinforced PE	30" - 118"	custom
A-2000	PVC	4" - 36"	12.5', 14', 22'
ULTRA FLO	Spiral Rib Pipe (steel & aluminum)	18" - 120"	20', 40'

Diamond Plastics

1212 Johnstown Rd., Grand Island, NE 68802-1608
P: 800-782-7473, F: 308-384-9345, W: www.dpcpipe.com
E: dbauer@dpcpipe.com
Contact: Dennis Bauer

Diamond Plastics produces solid wall and profile wall "Rieber" gasketed PVC pipe for pressure and gravity applications in sizes from 1/2" to 60".

Product	Type of Pipe	Pipe Diameter	Available Lengths
Trans-21/F679	PVC	16" - 48"	20'
PRO-21	PVC	30" - 60"	14', 20'
CORR 21	PVC	12" - 48"	14', 20'
Diamond C900/D3034	PVC	4", 10" - 15"	14', 20', 22'
Diamond Lok-21	PVC restrained joint	4", 10" - 15"	20'
Diamond IPS & AG	PVC	2" - 48"	20'

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11400 Parkside Drive, Ste. 300, Knoxville, TN 37934
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Contact: Dave Moore

Pressure pipe: AWWA pipe, Industrial, FM pipe, Polytough gas distribution, Polymain for force main applications, Geothermal and Golf/turf irrigation. Conduit: telecom, power, electrical, CATV, and enterprise.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Polypipe	HDPE pressure pipe	1/2" - 65"	coils or 40/50' sticks
GeoGuard	HDPE geothermal	3/4" - 12"	coils, loops, & 20/40/50' sticks
Smooth Cor	flexible HDPE conduit	3" - 6"	20' sticks
Perma Guard	HDPE conduit	1/2" - 24"	coils, reels or sticks

Flowtite-U.S. Composite Pipe South

18585 Samuels Rd., Zachary, LA 70791
P: 225-658-6166, F: 225-658-0947, W: www.uscpsouth.com
E: jleblanc@flowtitepipe.com
Contact: Jeff LeBlanc

Flowtite (FRP) is composed of 100% non-corrosive material throughout the entire pipe; and is proven effective in direct bury, slipline, penstock, hydro and irrigation systems.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Flowtite Pipe	FRP/GRP	18" - 157"	16' - 60'

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Gifhorner Strasse 59, Kneesebeck, 29379, Germany
P: +49 5834-50-232, F: +49 5834-50-320, W: www.butting.de
E: info@butting.de
Contact: Andrea Kiel

Product	Type of Pipe	Pipe Diameter
Longitudinally Welded	stainless steel	2" - 40"

Hancor Inc.

401 Olive Street, Findlay, OH 45840
P: 888-FOR-PIPE, F: 888-FAX-PIPE, W: www.hancor.com
E: drainage@hancor.com
Contact: Tori Durlit
Hancor manufactures HDPE and PP drainage pipe solutions for construction, agricultural, recreation, and sewer and irrigation markets. Our

focus is on issues critical to the customer including cost-efficiency, installation ease and performance.

Product	Type of Pipe	Pipe Diameter	Available Lengths
N-12 ST/WT	dual wall HDPE pipe	4" – 60"	10', 13', 20'
N-12 per ASTM F2648 ST/WT	dual wall recycled HDPE pipe	4" – 60"	13', 20'
N-12 HP WT	dual wall PP pipe	12" – 60"	20'
SaniTite HP WT	dual wall PP pipe	12" – 30"	20'
SaniTite HP WT	triple wall PP pipe	30" – 60"	13', 20'
AdvanEDGE	flat corrugated HDPE pipe	12", 18"	100', 400', 1600'

Hanson Pipe & Precast

300 East John Carpenter Frwy., Ste. 800, Irving, TX 75062
P: 972-653-5500, W: www.hansonpipeandprecast.com
E: info@hansonpipeandprecast.com

Product	Type of Pipe	Pipe Diameter	Available Lengths
Gravity Pipe	arch reinforced concrete	15" – 72"	
Gravity Pipe	circular non-reinforced concrete	10" – 36"	
Gravity Pipe	circular reinforced concrete	12" – 144"	
Gravity Pipe	elliptical concrete	18" – 144"	
Pressure Pipe	concrete cylinder	10" – 144"	
Pressure Pipe	low-head concrete	12" – 144"	
Welded	steel	32" – 124"	50'

HOBAS Pipe USA

1413 E. Richey Rd., Houston, TX 77073
P: 281-821-2200, F: 281-821-7715, W: www.hobaspipe.com
E: info@hobaspipe.com

Contact: Kimberly Paggioli

HOBAS pipes are unique – centrifugally cast, fiberglass reinforced, polymer mortar (CCFRPM). They are strong, light and inherently corrosion resistant with consistent dimensions and high stiffness.

Product	Type of Pipe	Pipe Diameter	Available Lengths
CCFRPM	fiberglass	18" – 126"	5', 10', 20'

IPEX

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P: 866-473-9462, F: 514-769-1672, W: www.ipexinc.com
E: marketing@ipexinc.com

IPEX offers the world's most extensive range of thermoplastic piping systems. With state-of-the-art manufacturing facilities and distribution centers across North America, the IPEX name is synonymous with quality and performance.

Product	Type of Pipe	Pipe Diameter	Available Lengths
TerraBrute	PVC	4" – 12"	20'

Iron Horse Progressive Services

1715 S. Whittle Ave., Olney, IL 62450
P: 618-392-6000, F: 618-392-6660, W: www.ihproserv.com
E: bbaker@ihproserv.com
Contact: Bret Baker

Product	Type of Pipe	Pipe Diameter	Available Lengths
Casing	steel	4" – 160"	any

ISCO Industries

100 Witherspoon St. 2West, Louisville, KY 40202
P: 800-345-ISCO (4726), F: 502-238-8165, W: www.isco-pipe.com
E: sales@isco-pipe.com
Contact: Tom O'Neill

ISCO has locations nationwide to meet all your HDPE piping needs. ISCO sells, rents, services and refurbishes McEroy fusion equipment.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Solid Wall ISCO	HDPE	0.5" – 63"	varies
Weholite Profile Wall	HDPE	54" – 120"	varies
Snap-Tite Culvert Liners	PE	8" – 63"	varies
Buttress Loc	PE	3" – 20"	varies

McWane Ductile

2266 South 6th Street, Coshocton, OH 43812
P: 800-800-6013, F: 740-622-8551, W: www.McWaneDuctile.com
E: mike.dodge@McWaneDuctile.com
Contact: Mike Dodge
McWane Ductile manufactures DIP for water systems and treatment plant applications at facilities in New Jersey, Ohio and Utah.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Tyton Joint	ductile iron	3" – 36"	18' nominal
TR Flex Restrained Joint	ductile iron	4" – 36"	18' nominal
Sure Stop 350 Restrained Joint	ductile iron	3" – 24"	18' nominal
Mechanical Joint	ductile iron	4" – 24"	18' nominal
Ball & Socket River Crossing	ductile iron	6" – 36"	18.5' nominal
Flange & Grooved Fabricated	ductile iron	3" – 48"	0.5' – 17.5'
Protecto 401 Lined	ductile iron	6" – 36"	18' nominal

Naylor Pipe Co.

1230 East 92nd St., Chicago, IL 60619-7997
P: 773-721-9400, F: 773-721-9494, W: www.naylorpipe.com
E: sales@naylorpipe.com
Contact: Michael Griffin

Temporary or permanent lines for high- and low-pressure air; high- and low-pressure water, ventilating lines, dewatering, drainage; including foundation piling and caissons.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Naylor Pipe			steel spiral weld
4" – 14GA – 96" – 1/2" wall		up to 80"	

North American Pipe Corporation

2801 Post Oak Blvd., Houston, TX 77056
P: 713-840-7473, W: www.northamericanpipe.com
E: jstott@northamericanpipe.com
Contact: John Stott

North American Pipe Corporation, a wholly owned subsidiary of Westlake Chemical, is a leading supplier of standard and specialty PVC pipe solutions serving multiple markets.

Product	Type of Pipe	Pipe Diameter	Available Lengths
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Well	PVC	2" – 24"	20'
Mining	PVC	3" – 24"	20' – 40'

Northwest Pipe Co.

5721 SE Columbia Way, Ste. 200, Vancouver, WA 98661
P: 360-397-6250, F: 360-397-6257, W: www.nwpipe.com
E: salesandmarketing@nwpipe.com
Contact: Yvonne Green

Manufacturer of welded steel pipe and fabricated fittings. A full line of coatings and linings serve the water works, power, industrial, force main and piling markets.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Water Pipe	steel-spiral or rolled and welded	up to 156"	up to 60'
Piling/Structural	steel-spiral or rolled and welded	up to 156"	up to 140'

Permalok Corp.

PO Box 10970, St. Louis, MO 63135
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E: dmittler@permalok.com
Contact: David Mittler

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Product	Type of Pipe	Pipe Diameter	Available Lengths
Permalok	steel	6" – 144"	10' – 50'

Premier Drill Pipe

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E: ray@premierdrillpipe.com
Contact: Ray Teseda

Premier has over 150,000 forged-end, inertia welds currently in service and have yet to experience a single failure! Ask us about our lifetime guarantee.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Forged-End, Inertia Welded	seamless steel alloy	1.35" – 4 1/2"	5' – 45'
One Piece Forged	seamless steel alloy	1.66" – 2.625"	5' – 15'

Stupp Corp.

12555 Danielson Rd., Baton Rouge, LA 70807
P: 800-933-7473, F: 225-775-7610, W: www.stuppcorp.com
Contact: Sharon Wallace

10.75 inch to 24 inch is elec. resistant welded straight seam; 24 inch to 60 inch is spiral weld.

Product	Type of Pipe	Pipe Diameter	Available Lengths
API 5L	steel	10.75" – 60" OD	80'

Underground Solutions Inc.

13135 Danielson St., Suite 201, Poway, CA 92064
P: 858-679-9551, F: 858-679-9555, W: www.undergroundssolutions.com
E: info@undergroundssolutions.com
Contact: Martin Scanlan

UGSI's Fusible PVC products contain a proprietary PVC formulation that, when combined with UGSI's patented fusion process, results in a monolithic, fully restrained, gasket-free, leak-free piping system.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Fusible C-900	PVC	4" – 12"	45'
Fusible C-905	PVC	14" – 30"	45', 36", 40'
Fusible PVC Pipe	PVC	4" – 30"	45', 36", 40'

United States Pipe and Foundry Co.

Two Chase Corporate Dr., Ste. 200, Birmingham, AL 35242
P: 866-347-7473, W: www.uspipe.com, E-mail: info@uspipe.com
Contact: Phil Goodwin

U.S. Pipe is the industry leader in ductile iron pipe products for the water and wastewater industry.

Product	Type of Pipe	Pipe Diameter	Available Lengths
TYTON JOINT	ductile iron	3" – 64"	18', 20'
TR FLEX	ductile iron	4" – 36"	18', 20'
HP LOK	ductile iron	30" – 64"	18', 20'
Mechanical Joint	ductile iron	3" – 24"	18', 20'

Uponor Infra Ltd.

6507 Mississauga Rd., Mississauga, ON L5N-1A6
Canada
P: 866-594-7473, F: 905-858-0208,
W: infra.uponor.ca; www.whoelite.com
E: nainfra-sales@uponor.com

Uponor Infra is the manufacturer of Weholite and Sclairpipe high density polyethylene (HDPE) piping systems. These systems are the ideal solutions for potable water, sanitary wastewater and culvert rehabilitation applications.

Product	Type of Pipe	Pipe Diameter	Available Lengths
Weholite	HDPE	18" – 132"	16.5', 25', 50'
Sclairpipe	HDPE	4" – 63"	50'
WehoGas	HDPE	1/2" – 12"	varies



TTC Plans Special Utility Investigations School

The Trenchless Technology Center (TTC) at Louisiana Tech University is launching another specialty school this summer – the TTC Utility Investigations School (UIS). TTC teamed with the American Society of Civil Engineer's Utility Engineering and Surveying Institute (UESI) to provide an intensive five-day course which will give attendees the knowledge and tools to provide competent utility investigations in accordance with accepted national standards.

This first of its kind, this course will cover all in the context of the American Society of Civil Engineering's (ASCE) 38 standard, utility system configurations, geophysics for finding utilities, proper records research, achieving utility quality levels, project documentation and more.

There has been little opportunity for instruction at the university level for practicing professionals

and students in utility risk management for existing project development. Most post-graduate instruction to-date has been self-directed. Generally, most knowledge and information has come from on-the-job training, conferences and introductory webinars, or one-day overview classes by the ASCE.

Jim Anspach, a founding governor of ASCE's UESI and chair of ASCE-38, has a special role in the development of this school. Anspach is a TTC advisor for the school and has been instrumental in developing the curriculum and identifying the best instructors.

"ASCE has recognized that Utility



James (Jim) Anspach, Founding Governor of ASCE's Utility Engineering and Surveying Institute, and Chair of ASCE-38, will serve as a special advisor for the TTC UIS.

Engineering is a missing task discipline from our educational curriculum. One important aspect of

that discipline, Utility Risk Management for Projects, is embodied in part through the use and proper application of the ASCE 38 Standard," he observed.

"Yet all too often, there is no avenue to learn the principles that govern the use of this standard. I am delighted that TTC and ASCE have begun this series of educational opportunities for those professionals and others under their direct responsible charge."

At the end of this course, students will receive five continuing education units (CEUs) and a Certificate of Completion.

More to come

This is the first of several similar planned courses in other aspects of utility risk management such as utility coordination, utility relocation design, utility asset management and more. The ultimate goal is to provide a path towards practicing in the field of utility engineering, with all its myriad individual components. As the nation's existing underground infrastructure continues to age, becoming more congested and dangerous to the public at large, utility engineering as an option of study and practice will continue to grow in importance.

Faculty for this school will consist of recognized experts in the field of subsurface utility engineering, applied geophysics and utility system design and operation. National Academy of Science Investigators will be on hand to discuss new tools and processes developed under several different initiatives. Many types of geophysical instrumentation will be available from manufacturers.

Instruction will be a mix of lecture and hands-on field work, followed by testing each day.

The locations of existing underground utilities are uncertain once they are buried and hidden from view. This uncertainty presents risk during planning, design, construction and operations/maintenance functions. These risks are significant. The assumption that utility owner records are complete, accurate and available for the use of design engineers has been proven false time and time again. This is not the fault of the utility owners. They had no reason, incentive or directive to create engineering quality records of their facilities tied to recoverable survey control.

Tools, responsibilities

Tools used to infer the existence and position of hidden underground utilities are varied, extensive and require professional judgment. The concepts are similar to those in the medical profession while imaging a patient's body. New technologies also exist in the imaging of utilities which will be covered in this school.

A professional's function is to make decisions taking into account uncertainty and risk. Underground utilities fall into this category. ASCE Engineers produces a national standard (its principles are now incorporated throughout the world) that directs the utility investigation professional how to collect, grade the uncertainty, and communicate that uncertainty. Studies by varied entities overwhelmingly show a high return on investment for competent utility investigations concluded at the right time during a project's development.

This school is designed for engineers and surveyors providing deliverables including results and depictions of utility investigations, employees of utility companies, state department of transportations and local highway agencies, regulatory agencies, local governments and more.

Registration

To learn more and register online, please visit the school web page ttcspecialtychools.com/uis or contact Jadranka Simicevic, TTC UIS director, 318-257-2744, jadranka@latech.edu.

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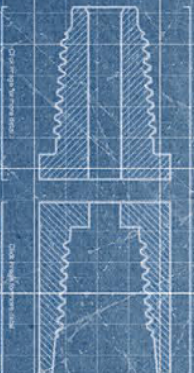


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18th Annual Horizontal Directional Drilling Survey

Diverse Markets

Drive HDD Forward

by Robert Carpenter Editor-in-Chief

Pipeline Work Slows But Diversification Keeps Big Rigs Active

To say that we are in confusing economic times would be an understatement, not only for the United States but the world in its entirety. The U.S. market confusions result primarily from a mix of political uncertainty, lackluster economic growth and performance, and the collapse of the oil and gas industry.

Fortunately, for several segments of the underground utility construction industry, life is good. Telecommunications construction in particular is surging at levels not seen since the 1990s. The drive to

provide fiber-to-the-premises continues to accelerate, driven by an overwhelming consumer and business appetite for bandwidth. In addition to the well-known giants such as AT&T and Google Fiber, telecommunication utilities of all sizes are engaging in massive installation and upgrade programs. In late 2015, communications technology behemoth Ericsson announced plans to essentially become a contractor and facilitate an even faster installation pace for fiber lines. The company claimed it

was making this radical move due to customer demand and that the current fiber network build-out was woefully behind schedule.

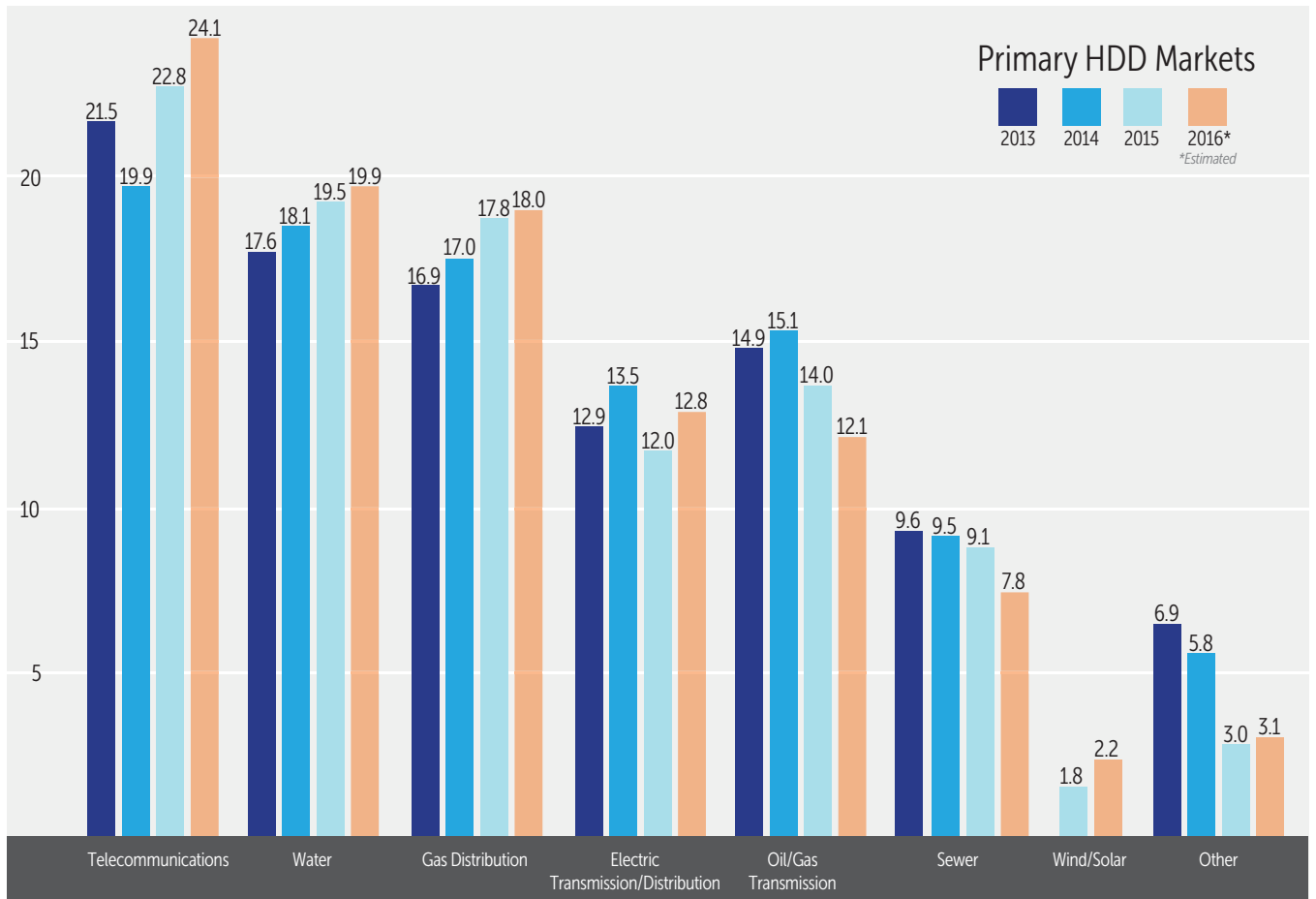
Other markets in the underground industry are extremely active and vibrant as well, such as gas and electric distribution. The workloads of the water industry, especially in lieu of the recent lead concerns, make new installation of mains a state and national legislative focus.

For those involved in horizontal directional drilling (HDD), these markets represent a perfect match

of technology and need. It is a technology segment of the underground infrastructure industry whose upside is virtually infinite.

In this healthy economic environment, telecommunication utilities are particularly motivated, anxious to provide services for growing audiences that have become restless with slower internet speeds or limited bandwidth. This has prompted the aggressive fiber-to-the-premises build-out we're experiencing now.

This fiber boom differs from the well-documented rise and fall of





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HDD Survey

telecom in the 1990s. Then, utilities were practicing the “build-it and they will come” strategy primarily focused on businesses. The bust started in 2000 due to extensive overbuilding for a telecommunications market place that was still in its infancy. But telecom did mature quickly – and continues to do so – rapidly growing its scope with the broad technological advances requiring massive increases in speed and capacity. HDD has proven consistently that it is an essential element necessary to keep up with the mad pace of construction.

This information and much more are detailed in the 18th Annual *Underground Construction HDD Survey* of the U.S. market. This exclusive industry research was conducted during March and April and targeted contractors and organizations that actively own and operate HDD drilling units. The number of completed surveys allowed for an accurate statistical portrayal of the market.

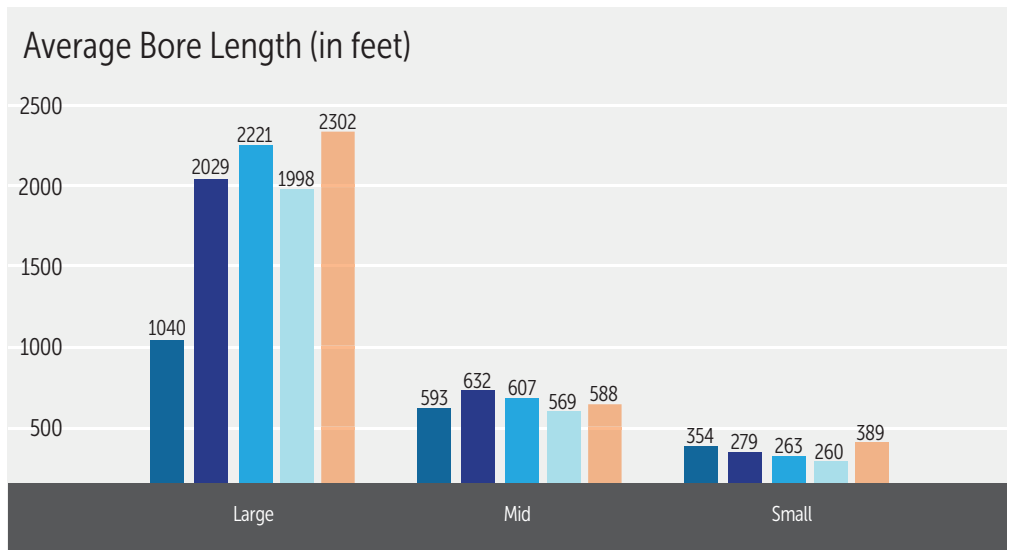
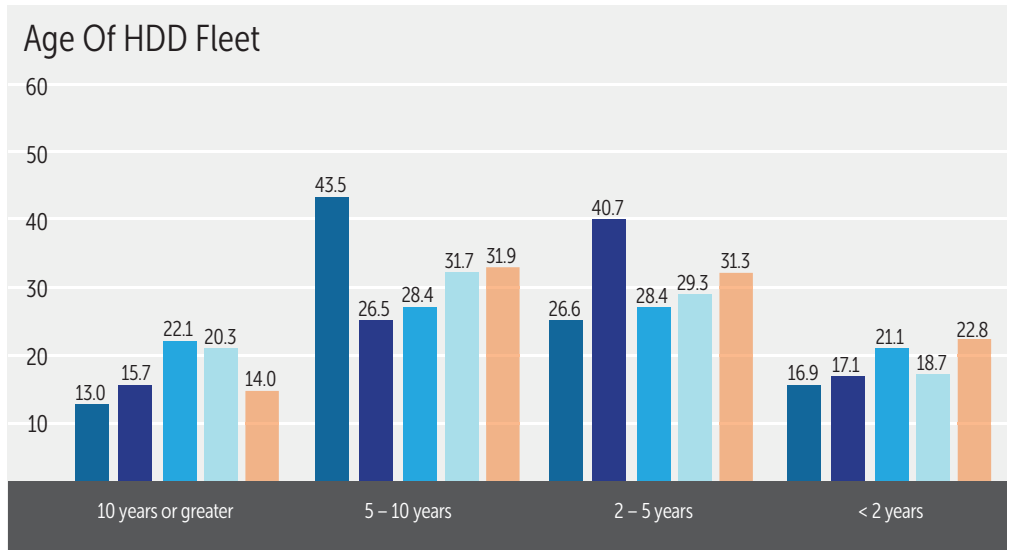
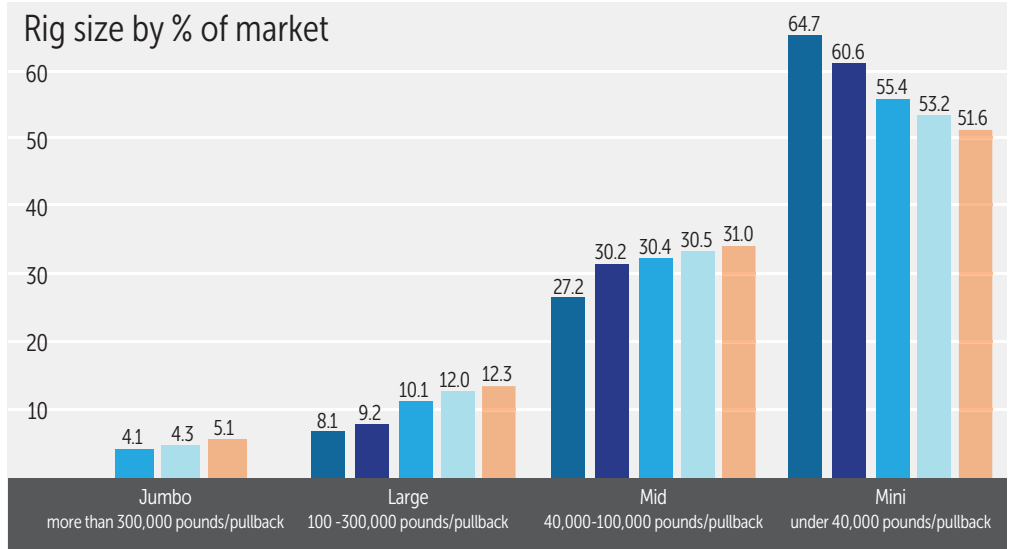
As mentioned earlier, gas distribution is going through its own renaissance period. While efforts to replace and upgrade antiquated cast iron pipe continue at a very strong pace – while keeping many businesses extremely busy – demand for new systems is placing additional stresses on contractors and directional drilling specifically.

Challenges

While this sounds like a great time to be an HDD contractor, the market is not without its drawbacks and challenges. A Southeast region contractor pointed out that “the biggest challenge facing the HDD market today is finding qualified, dependable drillers.”

There are efforts being made by several industry groups to make serious attempts to tackle the workforce issue for underground infrastructure. The Distribution Contractors Association has developed an initiative with fresh ideas, relevant data and possible courses of action. The association is hoping this program will be embraced and supported by other industry groups. HDD is certainly a key element of that initiative.

Specifically, for HDD, two leading equipment manufacturers, Vermeer Corp. and Ditch Witch, have launched



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HDD Survey

major programs aimed at helping relieve the void of proper training for HDD operators. These targeted training programs have different approaches but the sponsors are optimistic that their programs will be effective in helping to train effective drillers. The advantage these companies have is working jointly with many dealers scattered around the country, even the world, to support the corporate efforts.

The strong telecom market is having another benefit for contractors. In recent years, telecoms have been notorious for squeezing dollars out of the contractors working for them. Profit margins have been reduced substantially to the point that one small misstep on a project can often mean the difference between profit and loss for a contractor. Telecoms have also been reluctant to accept change orders – even when obviously justified.

But as the telecom work grows faster than the number of available contractors, the days of cheap or below-cost work are rapidly coming to an end. Increasingly, contractors are holding their ground on rates as they have plenty of other employment options. “We walked away this year from a company we have been working with quite some time. We had to – they kept wanting us to cut our prices to the point we couldn’t make money,” lamented a contractor from the Southeast. “We were able to do that [walk away] because we had several other companies wanting us to work for them. We’re now working a reasonable price. The company we used to work for has come back to us wanting to renegotiate, but it’s too late.”

For all the HDD work involved in telecom, gas and electric distribution, it generally encompasses mainly small- to mid-size rigs. Larger equipment does have an important and growing role to play in these markets, but the big driver for large rigs has been the oil and gas pipeline construction boom which has slowed dramatically since late 2014. As oil prices dropped from the \$90s to the \$20s, drilling quickly followed. Plans for major future pipeline projects are frequently being shelved.

Actual pipeline construction has slowed of course, but continued at a

fair volume through 2015 and into 2016. Most of the new shale oil and gas wells are located in non-traditional areas where pipelines are rare at best, nonexistent at worse. For owning companies, it was essential to complete projects and continue with some additional construction as there is no effective way to get product to market. Low prices do not support rail or trucking of mass quantities of oil or gas.

Large-rig HDD companies have kept reasonably busy for the past year. Many have had a solid of 2016 to date with ample work line up until later in the year. “We have enough work on the books to keep us pretty busy through most of the third quarter,” said one large rig HDD contractor. “That said, with pipeline construction continuing to slow,

we’re concerned about later in the year and into 2017.”

Diversification

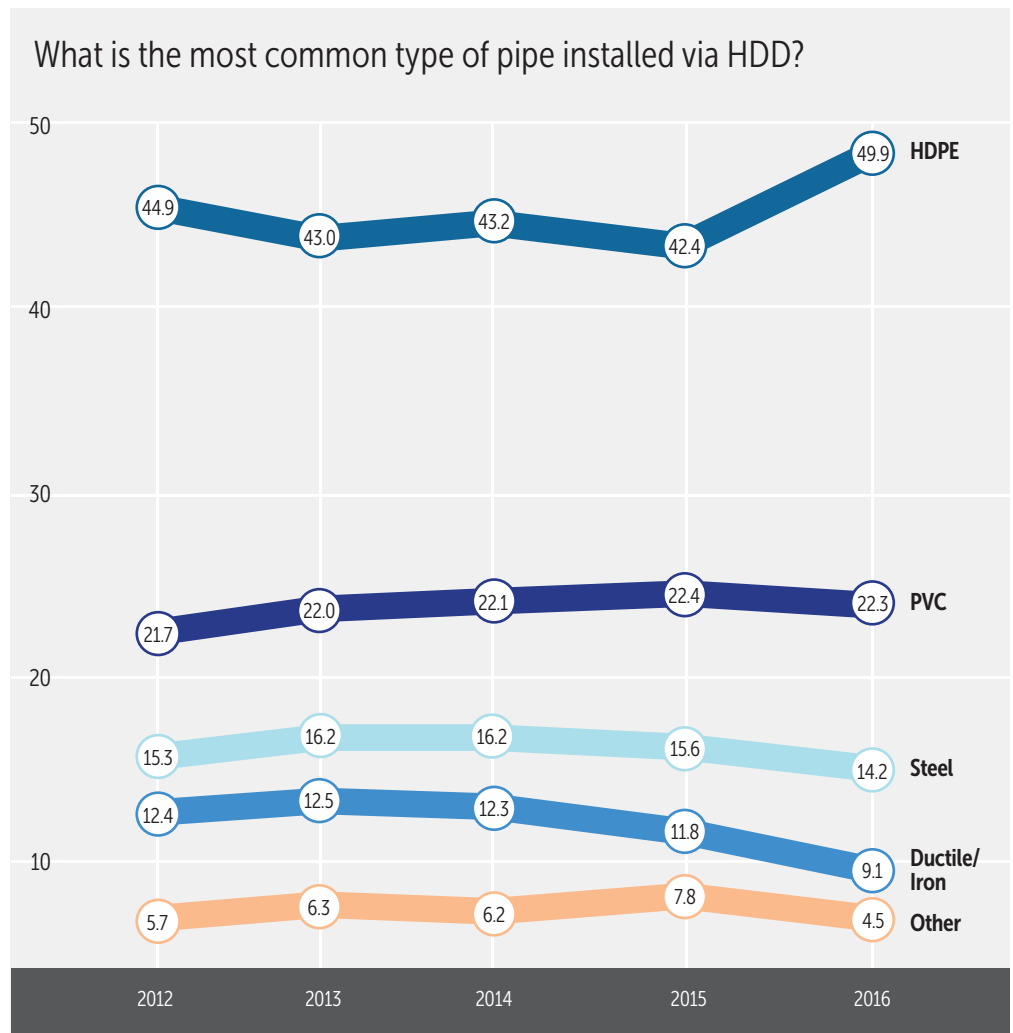
Before the oil and gas boom became all-consuming for so many companies, diversification had come to mid-to-large directional drilling. The fiber construction market growth generated substantial need for long crossings or large bundle pull-ins that were best suited for larger rig operations. The electric transmission industry is increasingly feeling the pressure to place the large tower infrastructure with underground cables. While technically feasible, cost is still an issue but there appears to be a strong future ahead for this type of work which generally requires larger rigs to perform.

Another area of expansion for

mid-to-large rigs continues to be the water market. Locating and transporting adequate water supplies have municipalities of all sizes scrambling for solutions. Large directional drilling has definitely become a major tool for engineers when designing water transmission projects.

A good indicator of the HDD market health is the confidence that survey respondents have for the role drilling currently plays with their work and perhaps even more importantly, how it will impact their market over the next five years. Contractors that actively utilize HDD as part of their equipment toolbox say that HDD accounts for about 52 percent of their work. In 2021, expect that to increase to almost 58 percent.

“I see the long term of HDD only





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HDD Survey

getting more common and open trenching in inner city becoming less,” said a Western state contractor. A Southwest contractor agreed: “I see the near and long-term market to keep increasing. There seems to be localized fiber booms going on and a ton of people flocking to the Google fiber work. But I hope it is not a repeat of the first fiber boom.” A contractor in the Southeast said, said “for us, business has been very good. The market was a bit slow last year but I see us catching up for the next couple of years.”

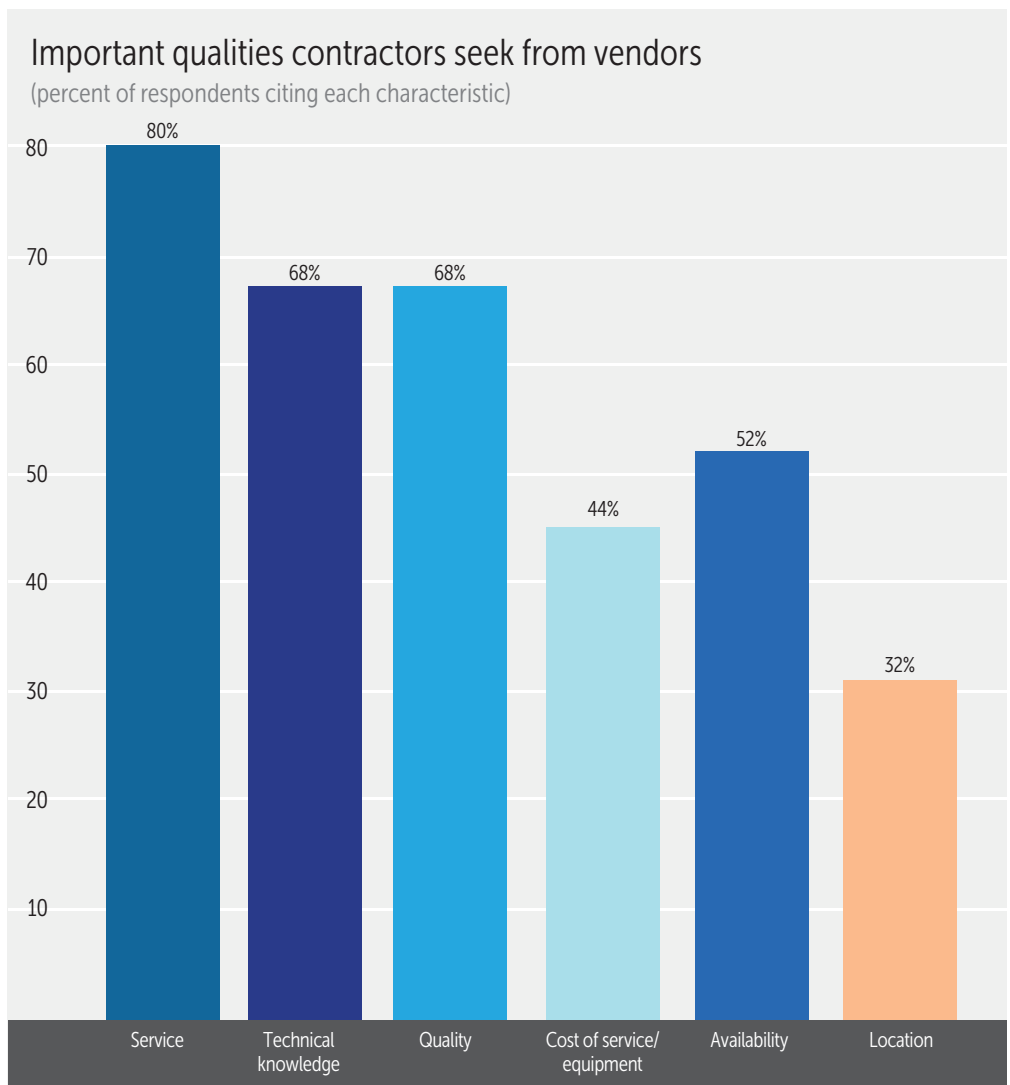
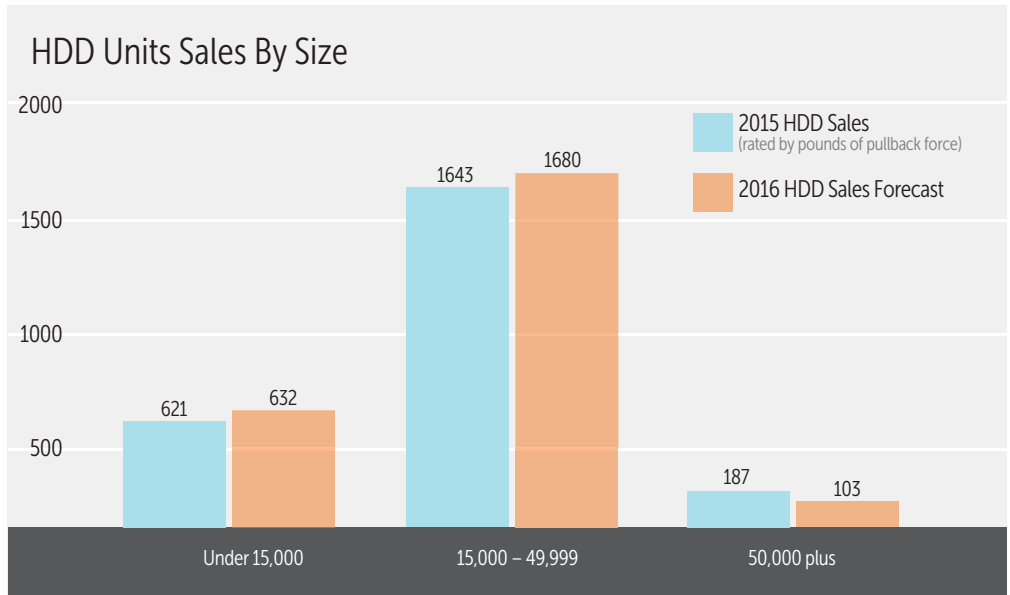
But strong markets are also bringing an influx of new contractors into the HDD arena – and that can create its own set of issues, according to several survey respondents.

Complained one Northeast contractor, “Companies are able to purchase used equipment at a fair price, but they really don’t know how to operate the equipment, and then underbid those that do know how to operate equipment properly.” Commented a Midwest contractor, “More companies are getting into the business every day.” A Southeast contractor summed up the issue in a succinct manner: “It means more drilling contractors to bid against.”

When asked what is the biggest challenge facing HDD today, there was no shortage of passionate responses. “Quite simply, design is the biggest challenge we face,” said a Southeast contractor. “Owners do not pay for proper design from the engineers. So engineers push all the design and liability to the HDD contractor – and the contractor accepts it. There needs to be more uniform standards of allocation of HDD risk and liability in the absence of proper design.”

A Texas contractor had distinct opinions on the challenges facing HDD. “Commoditization of the installation method is dropping prices; proper as-built procedures and consistency across all industries is needed; and improper design and inspection of trenchless crossings is a major problem.”

One Southwest contractor made a strong case for sharing risk on HDD projects. “Technology has increased our accuracy to steer and locate pipes and conduit through the sheer amount of utilities that are now



present, but the laws and regulations governing utility companies with respect to the tolerance that bores can be off and accountability of not showing up is way behind.

“There needs to be new laws passed to hold utility companies and contract locators fiscally liable for late and missed locates. Contractors pay heavily for hits and the rising cost of insurance – not to mention downtime waiting on past-due locate tickets. There needs to be some consequences for them if they fail on their part,” the contractor concluded.

Market size

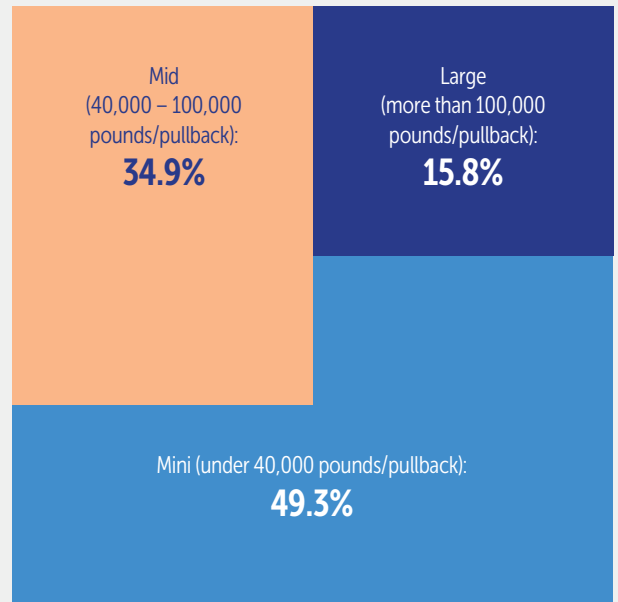
While the various primary market segment shares for HDD remain largely constant, predictable trends continue, according to survey information. It’s no surprise that telecom remains the single largest market segment for HDD with a 24.1 percent market share. That is still a noteworthy increase from 2015 when telecom market share was

at 22.8 percent. That strong market is not expected to change much for several years.

As mentioned earlier, water has become a steadily increasing partner of HDD applications. In fact, its 19.9 percent market share climbed again from 19.5 percent a year ago. While sewer applications are generally closely linked with water, the nature of gravity sewers requiring tight tolerances continue to be an inhibitor for HDD growth. Maintaining line and grade – while obtainable – still tends to be time-consuming, costly and tedious. The sewer market share is projected to drop from 9.1 percent in 2015 to 7.8 percent in 2016. Indeed, most of the major sewer work performed via HDD is largely limited to interceptor or pressure sewer projects.

Also remaining a strong market for HDD is gas distribution with a market share of 18 percent. That market segment will probably continue to increase in coming years as new gas installation projects are

For your next rig purchase, what size do you anticipate buying?



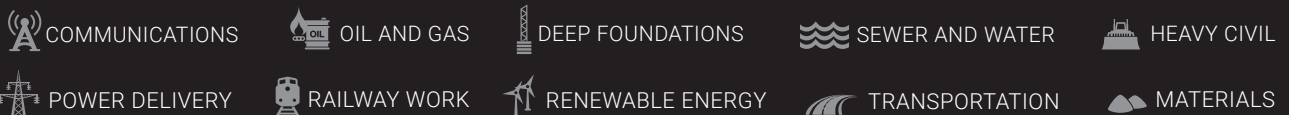
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being launched at a fast pace. Electric transmission and distribution construction may be approaching its peak in the near future but still accounts for 12.8 percent of the market.

The pipeline transmission and gathering market dropped from a 14 percent share in 2015 to a projected 12.1 percent in 2016. That decrease was anticipated as U.S pipeline work will be slowing over the next year.

Rigs and age

The size of HDD rigs is generally rated by pounds of pullback force and torque. The 2016 survey again reflected continuation of a trend towards larger rig sizes, whether a contractor is upsizing from a small- to mid-size unit or even to a large or jumbo rig (which generate pullback forces greater than 300,000 pounds). While large and jumbo rig sales will probably start seeing a reduction of sales in 2016 due to the slowdown in energy pipeline work, there has

been a steady expansion in applications and needs for larger HDD equipment for several years. Water markets, for example, frequently required large rigs to pull-in large HDPE, cast iron or PVC pipe diameters due to weight issues. Jumbo rig market sales should jump to 5.1 percent of total rig sales in 2016 and large rigs will grow from 12 percent to 12.3 percent.

Mini rigs (under 40,000 pounds of pullback) still dominate the market at a projected market share of 51.6 percent with mid-size rig sales growing to 31 percent.

The overall age of the HDD rig fleet is a good indicator of the economic health and growth of the industry. As more and more contractors have entered the industry or expanded their market presence to meet the demands for booming fiber, gas and energy markets among others, the active rig count has increased and gotten younger.

HDD rigs still in service that

are older than 10 years comprise 14 percent of the fleet, a major drop from a year ago (20.3 percent). Rigs 5 to 10 years old comprise 31.9 percent, units only 2 to 5 years old have grown to 31.3 percent and rigs less than two years of age jumped from 18.7 percent in 2015 to 22.8 percent of the market in 2016.

As the HDD market has matured, used and refurbished equipment sales have become big business. In 2016, 56 percent of contractors who plan to add new drilling units will strongly consider purchasing a used rig. The preferred size of used equipment to be considered is evenly split between mini- and mid-sized rigs at 44 percent each.

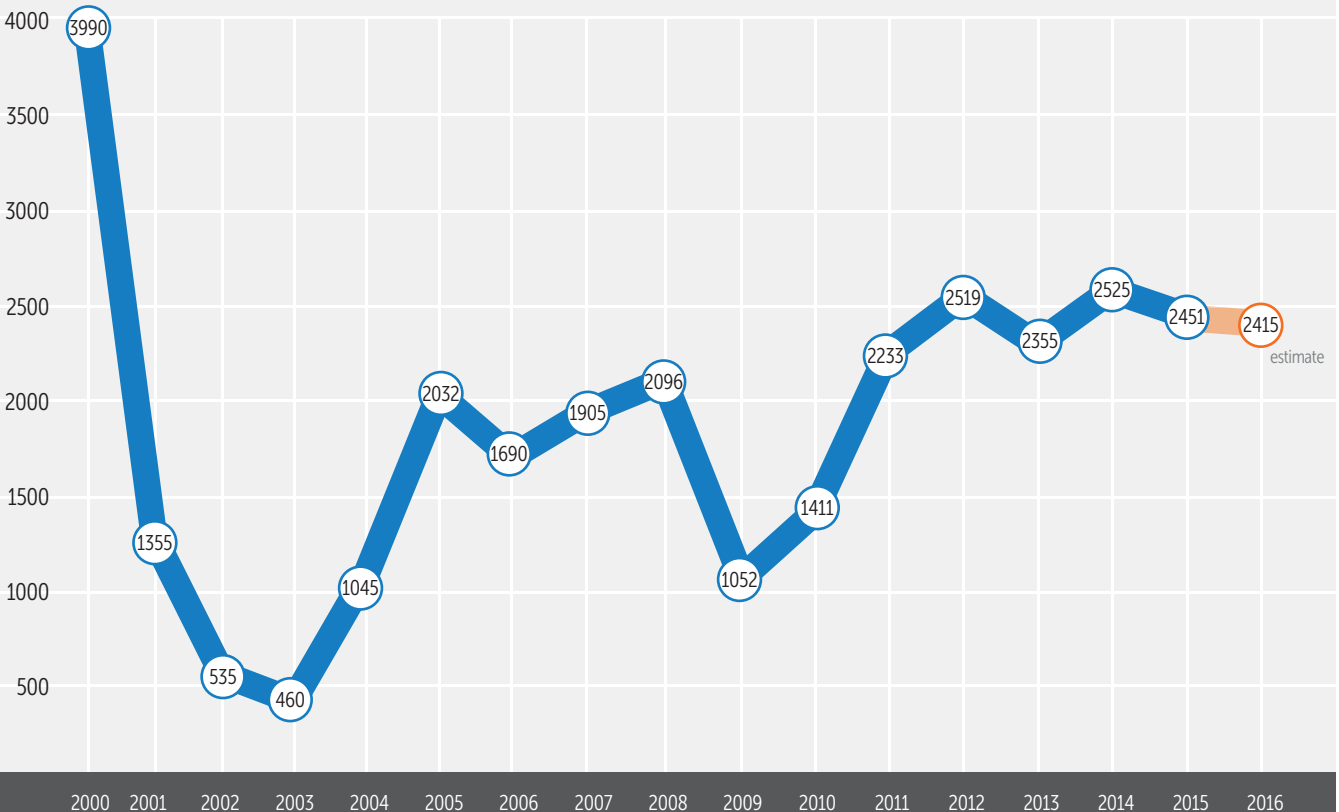
In 2015, contractors averaged buying about 1.5 units (all size classes) but are expecting to increase that average to almost two rigs per customer (all size classes) in 2016.

High density polyethylene (HDPE) pipe continues to be the number one pipe used for HDD work by

a large margin with a 49.9 percent market share. Newer PVC pipe joining methods such as fusible PVC and improved restrained joint technology have made PVC a strong contender in HDD applications as well. It claims a 22.3 percent market share followed by steel pipe at 14.2 percent and ductile iron at 9.1 percent.

Each year, we use the HDD Survey to ask contractors what qualities are most important from their HDD equipment/service providers. The service category, typically the strongest area named by contractors, jumped even more for this report, increasing to 80 percent from 71.4 percent. Service continues to dominate with 71.4 percent of contractors highlighting that quality. Technical knowledge and quality also were cited much more frequently by contractors, both registering at 68 percent of respondents. While cost of equipment remains important, it is notable that it was cited by only 44 percent of survey participants as a major issue in dealing with vendors. ■

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by Robert Carpenter Editor-in-Chief

Vermeer Kicks HDD Training

HDD Circuit Training Provides Comprehensive

It's well-documented that the construction industry is facing a severe labor crisis. Due to the strength of several core markets requiring dramatic increases in workforce, the underground utility infrastructure market is desperately seeking new skilled employees, particularly horizontal directional drilling (HDD) operators. HDD work requires a certain level of expertise which can make the difference between profit and loss on a project.

With the continued boom in telecommunications plus healthy gas and electric distribution markets, contractors are frantically seeking new personnel. But they are also

wrestling with how to train new or inexperienced employees in a compact time frame yet comprehensive manner that can immediately place personnel into productive roles on the HDD jobsite. Even providing on-the-job training can be extremely difficult with time constraints and inconsistencies in the training curriculum. Clearly, an effective training program for HDD personnel could be extremely valuable to contractors.

With those kinds of industry stresses facing not only its customers but the entire HDD market, Vermeer Corporation has developed what they believe is at least the beginning of a training solution. While

still growing and evolving, Vermeer personnel are hopeful they've created a program that can address overwhelming training demands for the HDD industry. *Underground Construction* recently spent a day at the second class of the new HDD Circuit Training school, held at Vermeer's main campus in Pella, IA.

Program launch

Tony Bokhoven, Vermeer industrial life cycle training manager, leads a group that handles the company's soft skill training, service training, sales training, service certification training for in-house technicians and

new customer training. His department conceptualized and quickly developed what evolved into HDD Circuit Training. The program is an intensive, two-week HDD operator training program.

"We're trying to create drillers, not employees limited to being just a locator, pot holer or operator," Bokhoven explained. "The idea is that you know how all aspects work and how critical they are to each step of the job."

"This is a non-steel offering for our customers that we believe can be of tremendous benefit," he added.

Historically, HDD manufacturers have shied away from this type of in-



Into High Gear

2-Week Program For Inexperienced Drillers

depth contractor training for a litany of reasons, including liability concerns and a preference to support dealer training efforts. But because the training issue has become so acute, Vermeer changed course and developed the HDD Circuit program.

"This was a big deal for us," Bokhoven admitted. "Traditionally we only train our dealers. For us to come up with something that was not going to circumvent our dealers but work alongside them engaging the customers was a big step for this company. This is not just a factory program. We are walking hand in hand with our dealers."

Bokhoven realizes the enormous

significance of the program he helped invent. "Mark Core [Vermeer's executive vice president and CMO] calls this a legacy program for the company – and it is. The company has identified that as a big priority," he said.

"In my 18 years here, I've seen dozens of these programs come and go around the industry. But the reason why this is going to be successful is that everybody understands that it isn't about generating profit," he stressed. "It's about the long-term stability of the industry. How is this going to affect the industry long-term and what value are we going to give to our customers? We recog-

nized that we have to start creating value beyond yellow iron."

Getting the first class launched in November 2015 was not without its challenges. Vermeer Customer Training Lead Dan Vroom, who was instrumental in developing the curriculum and addressing the many logistics necessary to launch the program, was left scrambling to find an adequate site for that inaugural class. He secured just enough land behind one of the manufacturing buildings and had to clear and level the area.

"It worked but it was pretty obvious that if we're going to do this a lot, that ground wasn't going to last

Above: Vermeer President/CEO Jason Andringa performs a ceremonial ribbon cutting signifying the kick-off of the first HDD Circuit Training Course, surrounded by Vermeer trainers and students.

very long," Bokhoven pointed out. "We're very thankful that the Vermeer family has a lot of farm land around this area. Bob Vermeer [chair emeritus of the Vermeer Corporation Board of Directors] has some farm land a couple of miles north of here that we were hoping to obtain. In talking with us, he said 'wouldn't you rather be closer to your training place? How about 11.5 acres here?'"



Vermeer HDD Training

“A guy like Bob Vermeer sees the value in what we’re doing and he’s willing to do whatever he can to support it. We’ve now got 11.5 acres adjacent to our campus. When I say this program is supported from the top down, I mean people like Bob, Mary Andringa [chair of the Vermeer Corporation Board of Directors] and Jason Andringa [Vermeer president and CEO] – they are all in on this deal. For us, that’s really cool and much appreciated.”

Investment

Another example of the willingness of Vermeer to invest in this program

is equipment. The plan is to annually provide four new drills, fresh off the assembly line and complete with assorted support equipment and tooling, for use in the classes. After a year, the drills would most likely either go into the company’s demonstration fleet or sold to a dealer.

The HDD Circuit Training Course is two full weeks of hands-on training where “we ask people to throw out everything they know and start over to learn what we believe is the correct way – the best practices way,” Bokhoven said. “We really take them back through some of the basics.

“As we started laying the training program out, it became pretty clear

that the best way to get students to understand the material was to create a jobsite, and put students through the paces as if they were working for a contractor each day. The beauty of this program is that we’re going to allow them to do it wrong – they can learn from their mistakes. Here at our site, there is no consequence if they do it wrong.”

Vroom added that the learning curb is steeper on the locating side of things.

“We teach the guys that the more utilities are going underground, the more it becomes critical to start using the underground space efficiently,” he said.

“We’ve got our own simulated area at the demo site with four buried utilities at various depths. The students have no idea where they utilities go or how deep they are. They have to physically map out where the utilities, then get a vacuum out for confirmation.”

The HDD Circuit program has training support from its industry partners. For example, Digital Control Inc. has an expert on site during much of the program to assist in locator training as does McLaughlin for vacuum excavator instruction.

For now, the plan is to hold one class a month with the exception of select “dark” months which will be

Students Praise Practical Value Of HDD Circuit Training Program

For the students of the new Vermeer Horizontal Directional Drilling (HDD) Circuit Training, the program is even more than they expected.

“It’s been a lot of fun,” said Chris Main, Atmos Energy, Independence, KS. “We’d been around it (HDD) but never really ran a machine before. Here, we get to operate the equipment – we’re learning a lot.”

“We’re learning the correct way,” added T.J. Reed, Atmos Energy, Olathe, KS

“Before, we were really just getting on-the-job training,” Aaron Adcox, Atmos Energy, Olathe, KS, pointed out. “They showed us a few things and you kind of figured it out. But now we’re getting fully trained.”

Cody Hensley, Atmos Energy, Independence, KS, came to the class for a very good reason: the company committed him to attend. But it has worked out for the best. “Now that we’re here, I’m glad they sent me – we’re learning so much.”

Adcox is a rig operator for Atmos. “Before [when drilling] I knew how to get there but I couldn’t explain it. Here, they’ve shown us how to actually draw up your plan and see your steps. We’re learning a technique.”

On the job back home, Adcox was focused on only one part of a drill. “Basically I was the locator and he [crew partner Reed] was on the machine; neither of us knew how to do the other’s job. So if I wasn’t at work, you can’t do anything. Now that we’re learning all areas of drilling, we can actually run two boring crews,” Adcox said.

“There’s really isn’t much time for cross training when we’re on a job. That’s what makes it nice about this training, we’re able to learn all parts of the job,” he added.

For Hensley, the dynamics of fluid management have been key. “Learning about mud has really helped me. Just getting to know and understand all the different tricks really helps a lot.”

The relaxed, educational environment generated with the HDD Circuit Training program has, at least in the minds of these students, been extremely effective.

“This has been pretty much stress free and you’re learning all the time,” Main emphasized.

Added Reed, “Nobody is really in a hurry. You’ve got time to stop, actually think about it, talk about it.”

Adcox explained that “you can experiment here, try different stuff and learn new ways. In the field you’re going to go with only what you already know.”



T.J. Reed



Aaron Adcox



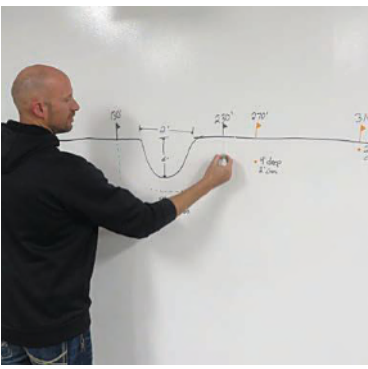
Chris Main



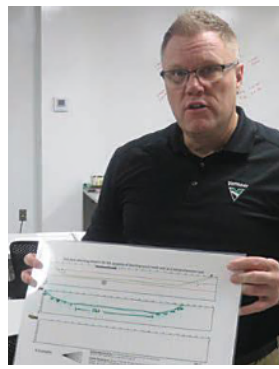
Cody Hensley

Main sees tremendous long-term value for anybody that goes through the class.

“I’ve already called my supervisor and told him we need to send more people up here. Even the guy we’ve got running the boring machine every day could come up here and learn something,” Main emphasized.



Dan Vroom, Vermeer customer training lead and lifecycle training, explains some of the nuances involved in designing a bore to students.



Vermeer Lifecycle Training Manager Tony Bokhoven shows a sample bore plan.



Above: Students are instructed on the proper use of the drill head.
Below: Four new directional drilling units are used by the HDD Circuit Training students.



Core Competencies

Students who complete the HDD Circuit two-week training course will be taught the following core competencies:

- HDD safety
- Recommended operator and safety guidelines
- Recognize unsafe behaviors
- Utility strike procedures
- Jobsite evaluation/setup
 - Efficient and safe drill operation best practice
- Utility locating
 - Locate existing utilities and best practice
 - Potholing
 - Vacuum excavate located utility and best practice
- Drilling fluid testing/mixing/best practice
 - Learn full process of testing and mixing drilling fluid and understand its importance in the process
- Drilling/Pullback process
 - Learn proper bore and pullback techniques including completing a bore to plan
- Drill head locating
- Equipment care/maintenance
 - Perform basic drill maintenance, inspection and understand correlation to machine performance

HDD Circuit Content Credit (2 week/72 hour credit)

- Class Education (12 hr)
- Pothole/Utility Locate (4 hr)
- Maintenance/Winterize (4 hr)
- Drilling (26 hr)
- Locating (26 hr)



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Vermeer HDD Training

used for evaluation and re-outfitting. Classes are already booked through July. "With that first class, there were a lot of 'aha!' moments," Bokhoven observed.

"Classes are limited to eight people so we can have four crews of two," Bokhoven explained. "That way, the students can learn all aspects of HDD, both drilling and locating. We believe that, at least for the time being, if we do more than one class a month, we may be rushing things. We want to make sure that we are prepared for each class and don't compromise quality of training.

"We know we can't get everyone trained," he continued. "But the ones we do train we want to have a really great experience. Right now, we're really focusing on the quality of classes rather than the quantity and we feel that limiting the classes to eight people best accomplishes that goal."

Basic training

If students have no HDD experiences the HDD Circuit Training program offers an excellent opportunity. "But if they have some experience, then we starting talking about having our dealers step in and helping more from a regional perspective," Bokhoven said. "Dan [Vroom] and his team have created field modules that our dealers can use. We feel like in the short term that is helping us get in front of a few more people that are asking for training."

Classes will not offer training for rock or difficult soil conditions, nor include recyclers or special tooling or other related variations frequently involved in more advanced boring.

"We've got great soils to learn in here in Pella, but there are many different types of soil conditions all over the country," Bokhoven observed. "We really don't have the time to devote to such diverse condi-

tions. We're teaching just the basics of good, comprehensive drilling. We may consider an advanced class in the future."

But that's where dealers can offer important, specific training. "The situational stuff – sand, cobble, things like that – we're counting on our dealers to help them with situational differences," Bokhoven said.

Due to liability limitations, Vermeer is accepting only students who are employed and covered under their company's insurance. But the HDD equipment manufacturer is more than willing to match potential employees with contractor openings.

"We've had people reach out to us through social media," Bokhoven recalled. "A downhole oilfield driller wanted to get trained as a directional driller, so we matched him up with a contractor who hired him and is going to send him to the school. We're telling contractors that you find the people you want, hire them and

then we've got a channel for their training."

The program does require both a time and financial commitment from participating contractors. "It's a tuition based class, \$4,000 per person plus hotel and related expenses. We figure the hard costs, minus wages, would probably be around \$5,500 to \$6,000," Bokhoven calculated.

"Interestingly enough, we've had contractors tell us that doing training the old way would have cost them twice that. When contractors have queried about the program, once I tell them all its encompasses, they don't even flinch about the cost. If we can make their employees more efficient when they return to the job, contractors are money ahead," he emphasized.

Testing

Like most detailed training courses, students are tested and evaluated.

"There are two tests that students



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are given when they complete the two weeks of training,” Bokhoven outlined. “First, we give them a pre-test when they get here. Then, we have them take a post-training test – the same test. The students have to score 80 percent to pass. We give them two chances to pass.

“If a student fails the first test, then one of the instructors would sit down with the student and go through the things that they failed, walk them back through to the right answer and make sure they understand that before having them re-test.”

“The second part of the testing is a hands-on piece where they have to plan a bore, then actually execute the bore. We also evaluate them on pre-selected criteria on a scale of 1-5. We give them a recommendation or a synopsis of their skill based upon our opinion of how they were as a driller and locator and other variables we check. We supply that report card to their contractor,” he said.

Upon successful completion of the class, students are presented with a certificate of completion and a laminated card to put in their wallet. “We give the card because it provides specific topics that students learned plus the training hours they spent on things like locating, drilling, etc.,” Bokhoven said.

Once students return home, follow-up continues to maximize the benefits of HDD Circuit Training. “We’re letting our dealers know right away who’s come to this class. They can follow up immediately to make sure things are going well,” Bokhoven said.

“Within the first 30 days after the class is finished, our trainers are making a phone call to talk to the students. Or we make sure they know how to reach out to us with questions or needs. We provide a lifeline.

“I’m reaching out to the contractor and I ask them lots of questions to see how they feel about the training we just finished with their employees. We’re committed to making sure the experience for them was worth way more than the expense,” he stressed.

As the program continues to be evaluated with each class, new opportunities also are embraced. “We’re going to do a class this year that will be all Spanish. We’ve got a couple of people on our staff that are fluent in Spanish and we’ve already translated all our materials. We recognize that we have to be versatile for the audiences that we train,” Bokhoven said.

How do you measure success?

In addition to the tests and evaluation, both Bokhoven and Vroom have goals they would like to see met that would define the HDD Circuit Program as truly successful.

“We want these students to be more valuable when they leave than when they came,” Vroom said.

For Bokhoven, in addition to being more efficient, complete drillers, “we want our drills to last longer in the hands of customers, locators to last

longer, tooling to last longer, etc. Part of what we teach them is how to get more value out of your products, and by knowing what can happen and avoiding it. It’s about making sure those assets are worth more at the end of the day,” he said.

“At the end of the first class there was a tremendous sense of accomplishment from the students. They were confident, they were ready to go.

That gives me a sense of security in knowing that they get it.”

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Underground Equipment Maintenance: 3rd In A Series

By Jeff Griffin, Senior Editor

Field Versus Shop Repairs, Maintenance For HDD Rigs

Owners and operators of horizontal directional drilling (HDD) equipment recognize the importance of keeping equipment in good operating condition. Well-maintained drill rigs perform better, are more productive, less likely to break down and maintain their value better than those that are poorly maintained.

However, the pressure of work schedules at times keeps machines in operation past scheduled maintenance. Equipment owners also must develop procedures that ensure equipment maintenance schedules are performed on time.

Equipment owners also must determine whether to self-perform maintenance or go to a third party, usually the nearest dealership of the manufacturer of the drill unit. That decision is influenced by many factors such as the number of HDD units operated, sizes of the machines, proximity to dealer facilities – to name just a few. Small operators may not have shop facilities or personnel to maintain and make repairs. Large contractors may have shops, mechanics and service trucks.

Underground Construction magazine asked representatives from construction companies of various sizes how they balanced the necessity of regular maintenance with

heavy workloads and who performed routine maintenance.

Networx

Networx Cabling Systems (NCS) President Bill Tippet said experience has taught him performing scheduled maintenance is not an option, but a necessity.

“When we got started,” he said, “our attitude was ‘go, go, go.’ There wasn’t time to interrupt work for service. However, we learned short-term pain [stopping to perform service] brings long-term gain. Patience and wisdom come with experience.”

Networx is based in northern Arizona, about three hours from equipment dealerships.

“We do all routine maintenance ourselves, but for any heavy stuff, we send the machine down to the dealership or they come up to us, depending on workload and scheduling requirements,” Tippet said.

Tippet uses factory replacement parts for the company’s drill units.

“We’ve found aftermarket products typically are not as good as those from the manufacturer,” he said.

The distance between NCS’s location and HDD dealerships affects immediate parts availability.

“Vermeer has put a parts locker in

the shop and regularly stocks it with the most-often needed replacement parts,” Tippet said. “That has significantly reduced shipping expenses.”

NCS operates four Vermeer and Ditch Witch drilling units, all with pullback of less than 50,000 pounds.

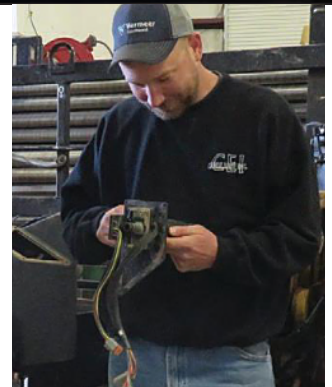
NCS has prime contracts with several local cable companies and provides excavation, directional drilling and other services to general contractors, electricians, plumbers and communications providers, as well as municipalities, state agencies and area gas utilities.

Triumph

For Houston-based Triumph Cabling Systems, regular maintenance is simple.

“We have our dealer do it,” said Henry Garcia, Triumph president. “They have the facilities and trained people who know what they are doing and do it every day. Our job is installing communications cabling, and we are very good at it. We do what we do and let the dealership keep our equipment in good condition.”

Triumph operates 20,000-pound Ditch Witch HDD equipment and has an equipment manager responsible for scheduling needed maintenance. The dealership has service



A maintenance worker for Cable East examines a part of an HDD rig.

trucks that perform scheduled maintenance of equipment on job sites, Garcia said.

Triumph Cabling Systems is a full service low-voltage network cabling and underground contractor, specializing in the installation of voice, data, fiber optic, DAS, audio/video, outside plant and underground services.

Drillworx

Drillworx Directional Drilling, Choctaw, OK, does cable replacements for the electrical service provider in the Oklahoma City metropolitan area. The company currently operates eight Ditch Witch HDD units, all in the 20,000-pound pullback class.

Left: Cable East maintains its HDD equipment in its own shop with company personnel.

"We do 90 percent of all maintenance," said owner Rick Winsett. "We also make repairs. We have a shop with three mechanics. If schedules permit, we bring equipment to the shop for maintenance. During busy times, we may make repair over the weekend. We also have two service tracks equipped to do maintenance in the field.

Cable East

Robert Wall, president of Cable East, Statham, GA, said his company has reached the size it can justify an in-house service department and shop.

"Our goal is to maintain equipment internally – HDD equipment, vehicles – everything," Wall said. "However, as equipment becomes more advanced, it's a challenge to keep our maintenance people and mechanics trained. We use as much technology as we can, GPS to monitor location, hours of operation, maintenance schedules, as well as diagnostic tools for repairs. Yet, we depend on dealers for parts and support."

Cable East is a specialist in telecommunications construction and currently operates 12 Vermeer HDD rigs ranging from 9,000 to 36,000 pounds pullback.

Gabe's

Gabe's Construction Co., Sheboygan, WI, is a fourth-generation family business serving the utility and pipeline industry since 1942. Gabe's services include HDD, telecommunications engineering, construction and locating, and underground utility civil work.

Gabe's operates large American Augers and Vermeer HDD rigs ranging from 140,000 pounds to 625,000 pounds of pullback and Vermeer utility HDD equipment from 7,000 to 80,000 pounds of pullback.

"Performing regular maintenance is very important to keep drilling and support equipment running so crews can stay productive," said Nick Atkin, vice president of operations.

Gabe's has a full-time shop manager and staff that service and repair HDD equipment.

"Preventive maintenance is performed both in the shop and in the field, depending on circumstances. Most repairs are done by the shop and/or crews with support assistance of dealers/vendors. If we encounter difficulties, we call the dealer to assist in getting the machine back up and running. Both factory and will-fit parts are used," Atkin explained.

"Utility rigs are repaired in shop unless there are electronic problems, and then we go straight to the dealer.

"If a rig comes back to the yard, we go through and do service and repair on it," Atkin said. "If on the job, it is serviced there. When a machine is in between jobs in a lay-down yard, it is serviced by a mechanic in a field truck before the next job.

"On maxi rig projects, the foreman notifies the HDD operations manager of any needs for service and or repair. Also for maxi-rigs, a semi-van trailer is used as an on-site shop/

warehouse for service and repairs. That's common among maxi-rig contractors, because keeping machines going on jobs with large crews with schedules is crucial. Basically, we need to be self-sufficient and get factory people involved if we are having an issue in which our crews/shop cannot fix or problem solve."

In conclusion, Atkin said it is much more efficient to be ahead of the curve in replacing/rebuilding equipment before a component is damaged or a machine fails.

FOR MORE INFORMATION:

Networx Cabling Systems
928-527-9858, www.networxcs.com/services

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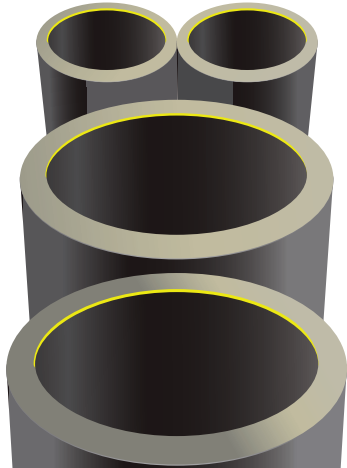
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By Rita Tubb, Executive Editor

Side-by-Side HDDs Prove Effective On Gas Line Replacement Project

Pacific Gas & Electric (PG&E) began work in September 2014 to replace two aging natural gas pipelines that cross Cache Creek near the town of Capay, CA. In September 2015, The HDD Company completed two horizontal directional drills (HDD) on the project, replacing the pipeline that had been exposed on the bottom of Cache Creek.

PG&E's Line 400 was permitted in 1960 and constructed in 1961-62. It is a 36-inch diameter pipeline that carries natural gas from Canada south through the Central Valley. The other pipeline, Line 401 was permitted in 1991 and constructed in 1992. It is a 42-inch diameter natural gas pipeline that runs parallel to Line 400. Both pipelines cross Cache Creek and PG&E decided to replace these installations with two new pipes that would be laid roughly 80 feet below Cache Creek using directional drilling.

The HDD Company's Operations Manager Jeremy King noted that construction on the project was under the direction of two contractors, prime contractor Barnard Pipeline and drilling subcontractor The HDD Company.

Early activities on the project included truck delivery of more than 5,000 feet of pipe for the project, and the stringing and welding of the pipe by Barnard Pipeline crews.

The pipe selected for the project was 36-inch 750"X65 and 42-inch 750"X70 Longitudinally Submerged Arc Welded (SAWL) steel pipe. While Barnard Pipeline's crews were stringing and welding the pipe, The HDD Company arrived to begin the directional drills.

King noted that the HDD contract covered two water crossings and the installation of two parallel

directionally drilled crossings, each 2,560 feet long to accommodate the installation of the 36-inch and 42-inch diameter steel pipe some 80 feet below the creek bed.

Change of plans

Initially, King said PG&E had requested the work be performed using one HDD rig and for crews to work around the clock to expedite project completion. Instead, King said The HDD Company recommended using two rigs: an American Augers 440 to install the 36-inch pipe; and the company's self-built Rig 3 (a 900,000-pound rig) to install the 42-inch pipe.

After PG&E agreed to the new plan, the two rigs were mobilized to the site in early May 2015 and set up side-by-side, approximately 70 feet apart.

According to King, the entry location on the south side of the creek was in an open area approximately 1,200 feet from the creek bank. The entry location offered ample space to set up both HDD spreads and support equipment, while the exit location, on the north side, offered sufficient space for Barnard's crews to string and weld the pipe.

Since plans called for the two crossings to be drilled simultaneously, the initial pilot bores were started by both rigs on June 3.

As for the crossings themselves, King said the 12 1/4-inch pilot bores carried out by both rigs went smoothly. Each pilot bore was completed in a little more than two weeks. The drill for the 36-inch pipe was backreamed to a final diameter of 48 inches and the drill for the 42-inch pipe was enlarged to 54 inches.

He described the soil conditions encountered as



clay and mudstone and the weather as ideal over the entire course of the project.

King said 8-inch mud motors were used for both pilot bores. For locating, they relied on magnetic high resolution guidance systems. They used high yield Wyoming bentonite drilling fluid furnished by Drilling Mud Direct LLC of Colorado. All excess fluids and cuttings were dried and hauled to a landfill site.

Completion

Working with eight people per shift, the final pipe pull of the 36-inch pipe was completed in early September and took only 12 hours to complete.

King said, "Despite being set back by a pipe failure on the 42-inch line, crews were able to fish the tooling out and continue the drill. Work progressed and the 42-inch pipe was successfully pulled in two weeks later."

As to the punch-through locations, he said the 36-inch drill was within .44 feet of the proposed exit location and the 42-inch drill was within 1.2 feet of the designated exit point. Final line tie-ins were carried out by Barnard's crews.

Noting that HDD began the two crossings in early May 2015, King said when the drilling was officially completed HDD was off site by mid-September.

He credits the team work of PG&E, Barnard Pipeline and The HDD Company with the project's success. "We had good communication, good planning and good execution throughout," he said.

The HDD Company was founded in 1999 by Neil Swope and then a portion of the company was sold to The Crossing Company in 2009. Today,

the combined companies own nearly 30 rigs making them one of the largest drilling contractors in North America. The combined companies specialize in challenging HDD projects that include major shore approaches and pipeline projects throughout North America.

FOR MORE INFORMATION:

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By Jeff Griffin, Senior Editor

Inrock's CrossView Monitors, Record Critical Rig Data

Inrock has introduced a new electronic data recording (EDR) system designed for horizontal directional drilling (HDD). The CrossView EDR system is available now for rent from Inrock.

"The oil and gas industries use such EDR systems," said Danny Crumpton, new business and technical sales manager. "But this is the first EDR designed specifically for the HDD market. The CrossView monitors critical drill rig information and presents it in real time to the drill operator and other interested parties on or off site.

"The on-site auxiliary viewer is wireless. There are remote viewers for off-site and web app for smart phone viewing of real-time data transmission."

CrossView is a system of sensors, computers and networking equipment that gathers data, presents it in an easy-to-use format, and shares information securely through remote or mobile interfaces.

Data is stored in a secure central server for review and historical analysis.

CrossView is designed for all brands and models of drill rigs with

Standard CrossView Components

Basic components of the CrossView system are:

- CrossView server;
- J-Box;
- Networking equipment;
- Touch screen monitor;
- Auxiliary viewer;
- Power conditioning & back up equipment; and
- Multiple sensors.

pullback of 100,000 pounds and larger.

Parameters

HDD parameters measured by CrossView include:

- Thrust and pull forces;
- Rotary torque;
- Spindle RPM and count;
- Force of bit;
- Penetration rate;
- Depth tracking;
- Pump pressure and volume;
- Pump strokes and total strokes;
- Cone revolutions; and
- Pit volume and volume totals.

Not only does CrossView provide

vital real-time information to the drill operator and on-site crew, but information is immediately available to other project stakeholders, including project supervisors, contractor management inspectors, engineers and project owners.

CrossView information allows operators to make better decisions during drilling to improve productivity. Records enable post-project analysis of data to identify areas for improvement and apply lessons learned for future operations. Alarms can be set for critical parameters, and records help visualize trends in order that changes can be made when necessary.

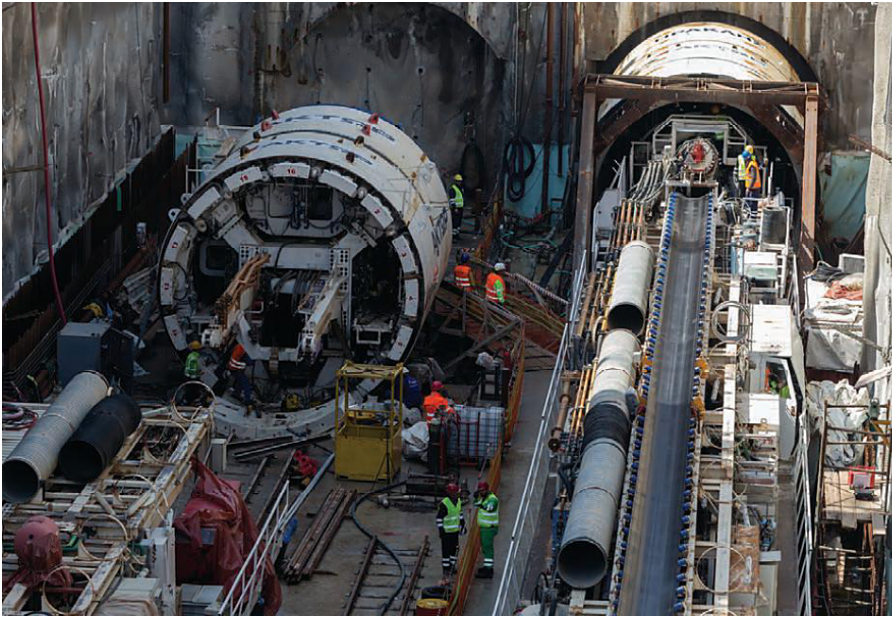
Security features protect data and allow management of information flow to various stakeholders. Information also provides accurate project data and records for project owners and engineers to facilitate planning of future HDD projects.

Crumpton said CrossView systems have been in the field for several months and are performing "above expectations."

FOR MORE INFORMATION:

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Much Ado About Drilling Fluids

Drilling Mud Can Be A Headache, But It's Vital To Successful HDD Jobs

Drilling fluid management for horizontal directional drilling (HDD) jobs has gotten muddy.

Regulations are on the rise. Disposal is usually a huge burden and it is adding to the already overwhelming amount of paperwork HDD contractors must complete.

Jim Watland can cite several examples to illustrate the points above. He is operations manager for Dakota Utility Contractors, a Texas-based company that does utility and pipeline installations using directional boring.

There's a recent job in Arkansas in which the project owner required all drilling fluid, or "mud," as it is often called, be hauled to a Class I landfill that takes hazardous waste. The nearest one to the jobsite was four hours roundtrip, and the disposal fee was up to \$1,000 per load.

There was another project in Corpus Christi, TX, where there was a concern the soil might be contaminated. All of the used drilling mud had to be placed in storage containers for another company to come in and test before it was hauled from the jobsite.

The paperwork required to show drilling fluid was disposed of prop-

erly could wipe out a small forest.

"It's very hard today to figure out what you're going to do with your mud," said Watland, a 26-year veteran of the HDD industry who now oversees 15 boring crews. "And it's very costly to dispose of."

Drilling fluid management, particularly regulations and disposal, is one of the biggest issues facing the HDD industry today, according to Jon Heinen, commercial business manager for pipeline at Vermeer Corporation. It's something that's getting a lot of attention. For example, Heinen went to Washington, D.C., in late 2015 with a group of industry leaders to talk to lawmakers about mud-related issues. Industry associations have committees reviewing the matter. There also are academic studies on drilling fluid disposal.

That's all great, but for contractors working on projects right now, drilling fluid management has become a major pain point. Heinen compared the problem to trying to obey traffic laws when the speed limit keeps changing on the same stretch of road.

"Every job is different," he said. "Every project owner has different

rules. Then every region in the U.S. is different. If a contractor is in this county, it's different than if he's in that county."

Get answers before bidding

For the best contractors, drilling fluid management starts long before a drill bit enters the ground. This is what Watland's checklist looks like before bidding on a job.

- Always determine where the crew will get water, which typically accounts for 96 percent or more of drilling fluid's makeup;
 - Estimate the amount of drilling fluid needed to complete the project. Watland largely relies on his 26 years of experience to do this, but he also uses calculators the industry has developed; and
 - Know how drilling mud must be disposed and where the location of the nearest dump site is, including the requirements from the project owner and the local and state governments.
- "Those are all important questions," Watland said.

Another question Dakota Utility Contractors is asking itself more often these days is whether it makes

sense to use a reclaimer on a project. A reclaimer can help improve jobsite productivity and reduce the amount of fluid needed on a job by removing solids and recycling the fluid.

The growing use of reclaimers is a trend Frank Canon has seen across the HDD industry. Canon spent 40 years with Baroid Industrial Drilling Products and is widely recognized as a leading expert in drilling fluids. He furthered his industry status by working closely with Vermeer to promote proper use of drilling fluids, especially when HDD was catching on in the 1990s, and now has his own consulting business, Frank Canon LLC.

"The difference in cost between disposing of solids that came off a reclaimer versus disposing of whole fluid can be tremendous," he said.

Train crew members

Watland said one of the top tips he'd offer other contractors regarding drilling fluid is to train crew members. He doesn't mean only mud technicians and drill operators. Everyone on his 15 HDD crews has been educated to some extent on drilling fluid.

They know how to test ground

conditions and how to check the viscosity, sand content and density or weight of drilling fluid. Those results help them determine if they need to change the makeup of the drilling fluid, such as increasing additive or adding thinners if mud is too heavy.

"Knowledge of my mud technicians and other crew members is very, very important and continually testing while we're drilling and reaming is important," Watland said.

Avoid inadvertent returns

When it comes to where drilling mud goes, what happens at a jobsite is just as critical as disposal.

A tip from Watland is to try to have the drill positioned lower than the exit pit so that gravity helps return mud and slurry back to the rig side.

Also, be sure to monitor drill, mud and downhole pressures. Inadvertent returns is a term to describe drilling fluid leaving the borehole,

with the biggest concern being it reaching the surface or a body of water. This often occurs when the downhole pressure is too high.

Take into account the ground conditions and the job specifications, such as the product being installed and its diameter, when selecting drilling fluid. This can help prevent inadvertent returns by controlling the downhole pressure and cleaning the hole out by suspending and carrying cuttings out of the hole.

Exploring other disposal options

Canon and Watland both believe that part of the reason scrutiny of HDD drilling fluids is increasing can be traced to the controversy over fracking in vertical drilling in the oil and gas industry. Canon, who worked in the oilfields before starting at Baroid, said the problem with confusing the two is vertical drilling uses fluids and methods that are not present in HDD operations.

"HDD is pretty much tied to a process called by the National Sanitation Foundation, or NSF," he said. "And NSF states that these drilling fluid products have to be tested to be nontoxic when in direct contact with potable water and used with manufacturers' recommendations."

In other words, many drilling fluid products meet the NSF standards for drinking water.

Canon said there are many studies showing drilling mud can be safely disposed of in places other than a landfill.

Land farming is one option that's been explored. The Environmental Protection Agency describes this as an above-ground process that involves spreading excavated soils in a thin layer and using naturally occurring micro-organisms to degrade waste material. An Oklahoma State University study found that "land application of spent HDD fluid is a viable option for disposal."

Another possibility is using slurry

that contains bentonite, which is a clay, to seal ponds that won't hold water, including those on farms.

Ultimately, it's up to regulators to decide whether any of these disposal methods are OK.

Although regulations and costs are on the rise, drilling fluids should be celebrated more than they are cursed. When used properly, drilling fluid can help improve an HDD crew's productivity, protect downhole tooling and stabilize a borehole. Canon said the evolution of drilling fluids has been one of the biggest stories in the HDD industry over the past couple of decades.

"We're just head and shoulders above what we had 20 years ago," he said.

FOR MORE INFORMATION:

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Compiled By Chantel Green, Associate Editor

EQUIPMENT SELECTION GUIDE

AUGER BORING

Company	Model	Type Drive	Weight (lbs)	Boring Diameter (in)	Pit Size (ft)	Total Thrust (lbs)	
American Augers	24/30-150	mechanical	4,050	4-30	10 x 33	150,000	
	36-600	mechanical	5,100	12-36	14 x 36	600,000	
	42/48-600	mechanical	5,100	12-48	14 x 36	600,000	
	48/54-900	mechanical	6,150	24-54	14 x 37	900,000	
	60-1200	mechanical	8,900	24-60	16 x 37	1,200,000	
	72-1200	mechanical	12,000	24-72	16 x 37	1,200,000	
	84/96-1800	mechanical	13,800	24-96	20 x 40	1,800,000	
	Barbco	24-150	mechanical	4,900	4-24	8 x 34	157,000
30-200		mechanical	5,573	4-30	8 x 34	213,000	
36-500		mechanical	9,800	4-36	8 x 34	500,000	
36-700		mechanical	10,500	4-36	8 x 34	738,000	
42-700		mechanical	11,500	4-42	8 x 34	738,000	
48-950		mechanical	14,000	12-48	8 x 34	950,000	
48-1100		mechanical	15,200	12-48	10 x 34	1,106,000	
60-1100		mechanical	16,000	12-60	10 x 34	1,106,000	
60-1200HD		mechanical	21,000	24-60	10 x 34	1,166,000	
72-1200		mechanical	22,500	24-72	10 x 34	1,166,000	
72-1800		mechanical	24,000	24-72	10 x 36	1,822,000	
84-1800		mechanical	27,000	24-84	10 x 36	1,822,000	
84-2600		mechanical	39,000	24-84	12 x 36	2,622,000	
96-2600		mechanical	45,000	36-96	12 x 36	2,622,000	
Bor-It Mfg.		12H*	hydraulic	960	2-12	3 x 9	30,000
		20D*	mechanical	2,200	4-20	4 x 28	51,500
	24**	mechanical	4,200	8-24	6 x 31	100,000	
	30**	mechanical	6,500	12-30	7 x 31	200,000	
	36**	mechanical	7,800	12-36	8 x 31	300,000	
	42**	mechanical	14,000	12-42	10 x 35	500,000	
	48**	mechanical	19,000	24-48	10 x 35	753,000	
	54**	mechanical	23,000	24-54	10 x 35	1,000,000	
	60**	mechanical	23,800	24-60	10 x 35	1,200,000	
	*includes master track; **machine splits for lighter lifts (master track not included)						
	McLaughlin	Mcl-12HB Zipper	hydraulic	320	3-10	7	24,500
		Mcl-24B	mechanical	3,000	4-24	32	115,000
Mcl-30/36B		mechanical	5,960	10-36	32	230,000	
Mcl-36/42C		mechanical	7,500	12-42	34	400,000	
Mcl-54/60		mechanical	7,600	16-60	35	950,000	
CBM 48		mechanical	17,000	16-48	N/A	60,000	
CBM = cradle boring machine							
The Robbins Company		ABM 36-630	mechanical	20,000*	12-36	12 x 35	630,000
	ABM 48-950	mechanical	23,000*	12-48	12 x 35	950,000	
	AMB 60-1270	mechanical	35,000*	24-60	16 x 38	1,270,000	
	ABM 72-1500	mechanical	45,000*	24-72	16 x 38	1,500,000	
*machine splits for lighter lifts (master track not included)							

BORING - HARD ROCK ATTACHMENTS

Company	Model	Casing Diameter (in)	Hex Size (in)	No. Cutters	Cutter Size (in)	Torque (ft/lbs)	Thrust Range (lbs)	
American Augers	24RH	24	4	9	6.5	7,800	94,995	
	30RH	30	4	11	6.5	11,900	116,105	
	36RH	36	4	13	6.5	16,900	137,215	
	42RH	42	5	14	6.5	25,800	168,880	
	48RH	48	5	19	6.5	32,900	200,545	
ICON Tunnel Systems/Bohrtec	FSBU16	16	3	N/A	N/A	7,800	45,000/90,000	
	FSBU24	24	3 or 4			7,800	45,000/90,000	
	FSBU30	30	4			11,900	45,000/90,000	
	FSBU36	36	4			16,900	65,000/130,000	
NOTE: Model FSBU is not designed with Cutters and is a Rock Attachment with Integrated DTH (Down the Hole Hammer). Hammers range in diameter size from 8"-16" depending on model.								
The Robbins Company	SBUA-24	24	3 (4" opt)	9	6.5	5,800/7,800	45,000/90,000	
	SBUA-30	30	4	9	6.5	5,800/7,800	45,000/90,000	
	SBUA-36	36	4	13	6.5, 9.5	12,600/16,900	65,000/130,000	
	SBUA-42	42	4	16	6.5, 9.5	19,300/25,800	85,000/170,000	
	SBUA-48	48	5 (4" opt)	19	6.5, 9.5, 11.5	24,600/32,900	95,000/190,000	
	SBUA-54	54	5 (4" opt)	21	6.5, 9.5, 11.5	30,600/40,900	105,000/210,000	
	SBUA-60	60	5	14	6.5, 9.5, 11.5	38,200/50,900	187,500/350,000	
	SBUA-66	66	5	15	11.5	47,100/62,800	200,000/375,000	
	SBUA-72	72	5	16	11.5, 14	64,100/79,800	225,000/400,000	
	SBU-M 48	50	N/A	19	6.5	N/A	190,000	
	SBU-M 54	56	N/A	21	6.5	N/A	210,000	
	SBU-M 60	62	N/A	14	11.5	N/A	350,000	
	SBU-M 66	68	N/A	15	11.5	N/A	375,000	
	SBU-M 72	74	N/A	16	11.5	N/A	400,000	
	SBU-M 78	80	N/A	16	14	N/A	640,000	
	SBU-RC 36	38	N/A	13	6.5	N/A	130,000	
	Note: Metric sizes available							

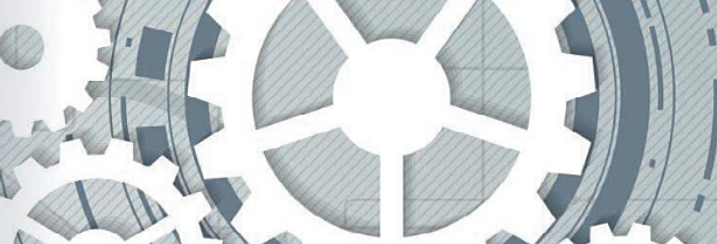
BACKHOE-LOADERS

Company	Model	Operating Weight (lbs)	Max. Reach (height to pin)	Backhoe Dig Depth	HP
Case	580N EP	15,810	18' 6"	15'	68
	580N	16,589	18' 4"	14' 9"	83
	580 Super N	17,269	18' 2"	14' 6"	95
	580 Super N WT	20,077	18' 3"	14' 6"	95
	590 Super N	20,532	19' 7"	15' 6"	108
Caterpillar	450F	24,141	14' 7"	17' 3"	127
	415F2	15,207	11' 11"	14' 3"	68
	416F2	15,207	11' 11"	14' 3"	87
	420F2	17,033	11' 11"	14' 4"	93
	420F2 IT	17,732	11' 11"	14' 4"	93
	430F2	18,364	13'	15' 4"	108
	430F2 IT	19,063	13'	15' 4"	108
John Deere	310L	15,039	17' 10"	14'	93
	310L EP	14,800	17' 10"	14'	70
	310 SL	16,549	18' 1"	14' 3"	99
	310SL HL	18,473	18' 1"	14' 10"-18' 1"	110
	3155L	18,039 lbs.	17' 10"	13' 8"	99
	410L	18,028 lbs.	19' 9"	15' 10"	113
	710K	23,802 lbs.	17' 10"	17' 10"	130
Kubota	BX25D-LA240A-BT602	2,700	8' 7"	6' 2"	20.4
	BX25-LA240-BT601	2,700	8' 6"	6' 2"	20.4
	B2320DT-LA304-BH65	1,433	9' 0"	6' 6"	20
	B2320DTWO-LA304-BH65	1,433		6' 6"	20
	B2320HSD-LA304-BH65	1,477	9' 0"	6' 6"	20
	B2620HSD-LA364-BH65	1,554	9' 0"	6' 6"	23.2, 26.1
	B2920HSD-LA364-BH65	1,554	9' 0"	6' 6"	26.1
	B2630HSD-LA403-BH77	3,429	10' 0.4"	7' 5"	23.3
	L3560-LA555-BH77	3,395	12' 5"	7' 5"	35
	B2650HSDC-LA534-BH77	2,293	10' 0.4"	7' 7"	23.3
	B2650HSD-LA534A-BH77	1,786	10' 0.4"	7' 7"	23.3
	B3350HSTC-LA534-BH77	2,447	10' 0.4"	7' 7"	29.6
	B3350HSD-LA534A-BH77	1,896	10' 0.4"	7' 7"	29.6
	B3350SUHSD-LA534A-BH77	1,874	10' 0.4"	7' 7"	29.3
	L3301F/DT/LA525/BH77	2,557 / 2,734	10' 0.4"	7' 7"	31.4
	L3301HST/LA525/BH77	2,778	10' 0.4"	7' 7"	31.4
	L3901F/DT/LA525-BH77	2,590 / 2,767	10' 0.4"	7' 7"	36.3
	L3901HST-LA525-BH77	2,778	10' 0.4"	7' 7"	36.3
	B26-TL500-BT820	4,001	11' 2"	8' 4"	23.3
	L4060-LA805-BH92	3,751	12' 5"	9' 2"	40
	L4701F/DT-LA765-BH92	3,219 / 3,296	12' 5"	9' 2"	44.8
	L4701HST-LA765-BH92	3,307	12' 5"	9' 2"	44.8
	L4760-LA1005-BH92	3,803	12' 5"	9' 2"	47
	L5060-LA1005-BH92	3,902	12' 5"	9' 2"	50
	L5460-LA1055-BH92	3,902	12' 5"	9' 2"	54
	L6060-LA1055-BH92	3,902	12' 5"	9' 2"	60
	MX4700HST	5,475	12' 3"	9' 2"	46
	MXS100DT-LA844-BH92	5,720	12' 5"	9' 2"	50
	MXS100F-LA844-BH92	5,475	12' 5"	9' 2"	50
	MXS100HST	5,475	12' 3"	9' 2"	50
L39-TL1000A-1-BT1000A	6,987	13' 4.9"	10' 1"	35.5	
L45-TL1000A-2-BT1000A	7,173	13' 4.9"	10' 1"	42.5	
M5140-LA1153-M4011	3,970	14' 5"	11' 1"	50	
MX4800HST-LA1065-BH92	5,475	12' 3"	9' 2"	46	
MXS200DT-LA1065-BH92	5,720	12' 5"	9' 2"	50	
MXS200F-LA1065-BH92	5,475	12' 5"	9' 2"	50	
MXS200HST-LA1065-BH92	5,475	12' 3"	9' 2"	50	
M6040-LA1153-M4011	4,079	14' 5"	11' 1"	60	
M6060-LA1154-M4011	4,079	14' 5"	11' 1"	63.5	
M7040-LA1153-M4011	4,610	14' 5"	11' 1"	70	
M7060-LA1154-M4011	4,610	14' 5"	11' 1"	71.0	
M8540-LA1353-M4011	5,401	14' 5"	11' 1"	85	
M8560-LA1353A-M4011	5,401	14' 5"	11' 1"	86	
M9540-LA1353-M4011	5,512	14' 5"	11' 1"	95	
M9960-LA1353A-M4011	5,512	14' 5"	11' 1"	89	
M59-TL1350-BT1200	8,345	15' 8"	12' 0"	57	
New Holland	B95C	16,416		14' 4"	97
	B95C TC	18,443		14' 4"	97
	B95C LR	16,105		15' 3"	97
	B110C	16,526		15' 3"	110

CABLE LAYING EQUIPMENT

Company	Model	HP	Operating Weight (lbs)	Max. Installation Depth (in)	Max. Reel Capacity (lbs)
BRON	150	225	36,500	60	8,000
	250	300	57,000	72	20,000
	450	440	81,000	88	38,000
	550	540	84,000	88	38,200





Ditch Witch	100SX	11	720	12	N/A
	410SX	49.6	3,910	18 blade, 36 chain	N/A
	RT45	42.2	4,200	63	N/A
	RT55	60	5,610	62	1,500
	RT80	74	11,580	62	2,000
	RT80 Quad	83	11,580	62	N/A
	RT100	100	8,880	97	N/A
	RT120	121	19,300	96	2,500
	RT120 Quad	121	26,200	96	2,500
	Zahn Plow	30	1,290	18	N/A
Felling Trailers	FT-14 R	8*	2,900**	12	***
	*w/electric start Honda 270; **on 3" diameter shaft; ***capacity for up to 120" reel				
Toro	Pro Sneak 365	35.5	2,770	36	300
	RT600	65	6,050*	60	2,500
	RT1200	121	14,000	84	3,780
*base unit					
Vermeer	RTX550	65/67	7,800	60	1,500
	RTX750	74	9,330	60	2,000
	RTX1250	120	13,920	72	3,000

CABLE PLOWS

Company	Model	HP	Max. Depth (in)	Max. Range (in)	Plow Offset Weight (lb)	Approximate
BRON	V65	50 - 75	38	42	2,100	
	V75-1	75 - 130	42	48	3,200	
	V75-2	120 - 150	48	51	4,200	
	V100	130 - 164	60	60	6,400	
	HS X-1	75 - 120	42	48	2,600	
	HS-I	170 - 250	66	66	8,700	
	HS-II	280 - 350	72	65	11,200	
	HS-III	320 - 500	78	72	14,750	
	HS-IIIR	N/A	72	138	21,500	

Ditch Witch (see listing under Cable Laying Equipment)
Toro (see listing under Cable Laying Equipment)
Vermeer (see listing under Cable Laying Equipment)

COMPACT TRACK LOADERS

Company	Model	HP	Operating Weight (lbs)	Rated Operating Capacity (lbs)	Machine Length (in)	Machine Height (in)	Machine Width (in)
Bobcat	T450	61	6,148	1,400	126.6	77.8	55
	T550	66	7,577	1,995	133	77.8	67.1
	T590	66	7,948	2,100	133	77.8	67.1
	T630	74	8,742	2,230	136.8	81.3	72.9
	T650	74	9,321	2,570	136.8	81.3	72.9
	T750	85	10,327	3,325	141.6	81.3	78
	T770	92	10,327	3,475	141.6	81.3	78
	T870	99.2	12,678	3,525	153.9	83.4	83

Note: machine length is w/bucket; machine width is over tracks.

Case	TR270	68	8,270	2,700	129.6	78.7	65.9
	TR310	68	8,880	3,100	129.6	78.7	74.3
	TR340	84	10,000	3,400	143.5	80.4	76.0
	TV380	84	10,550	3,800	143.2	80.4	76.0

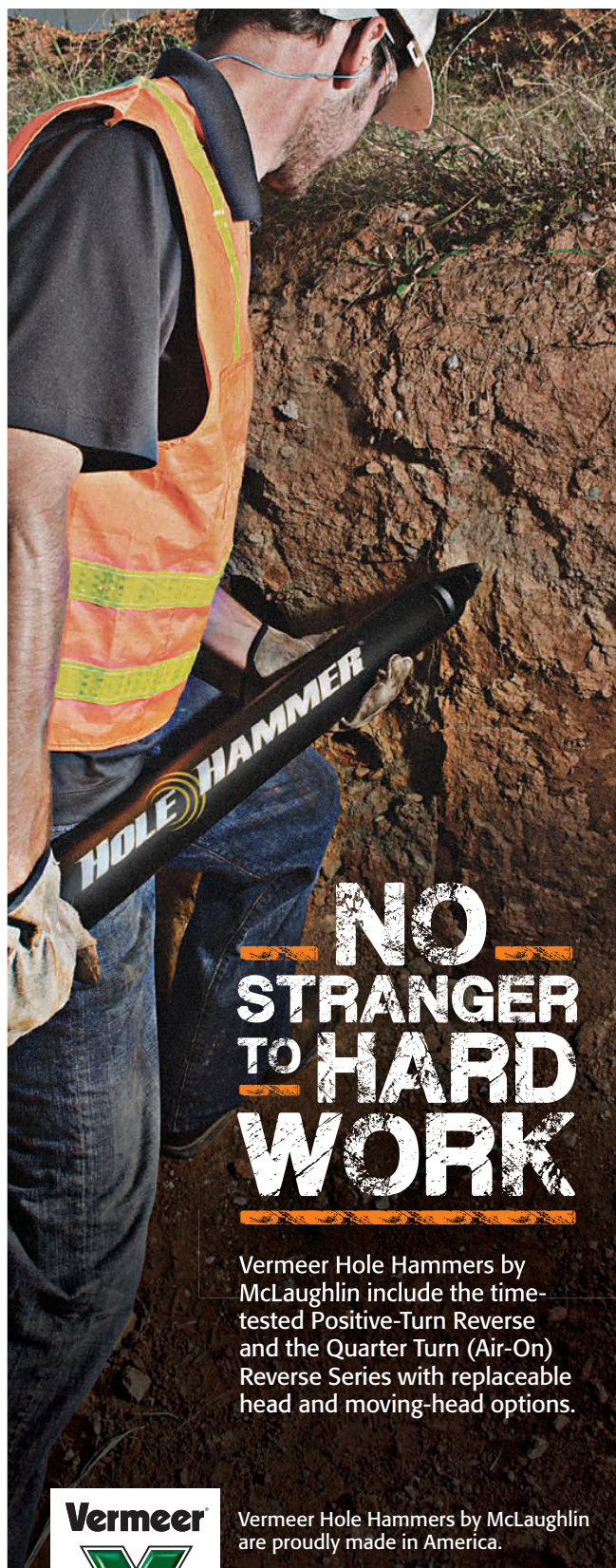
Caterpillar	239D	60	7,289	1,435	127	80	66
	249D	60	7,685	1,610	127	80	66
	257D	73	8,048	1,960	137.3	83.8	66
	259D	73	8,846	2,030	137.3	83.1	66 / 69
	279D	73	9,893	2,055	146.2	83.2	76 / 78
	277D	73	9,293	2,303	146.2	83.2	78
	289D	73	10,533	2,660	146.2	83.2	76 / 78
	287D	72.9	9,929	2,800	146.2	83.2	78
	297D2	95	10,692	3,290	155.2	83.2	76.2
	297D2 XHP	106	10,918	3,360	155.2	83.2	76.2
	299D2	95	11,275	3,200	154.7	83.6	76 / 78
	299D2 XHP	106	11,608	3,308	154.7	83.7	76

John Deere	CT315	45	6,800	2,206	124	77	61
	319E	69	9,440	2,150	136.8	80.6	71.8
	323E	74	9,440	2,590	136.8	80.6	71.8
	329E	83	11,500	2,900	144	84.7	78.9
	333E	97	11,800	3,300	144	84.7	80.7

Kubota	SVL75-2	74.3	9,039	2,300	140.8	82	66
	SVL90-2	92	11,023	3,010	148.2	83.4	77

New Holland	C227	70	8,200	2,700*	105.1	78.7	65.9
	C232	76	9,630	3,200*	117.8	80.4	76
	C238	84	10,100	3,800*	117.6	80.4	76

*50%



NO STRANGER TO HARD WORK

Vermeer Hole Hammers by McLaughlin include the time-tested Positive-Turn Reverse and the Quarter Turn (Air-On) Reverse Series with replaceable head and moving-head options.



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COMPACT TRACK LOADERS

Company	Model	HP	Operating Weight (lbs)	Rated Operating Capacity (lbs)	Machine Length (in)	Machine Height (in)	Machine Width (in)
Volvo	MCT85C	58.9	6,900	1,900	139	78.7	63
	MCT110C	72.6	10,216	2,250	145.3	82	72.8
	MCT125C	84	10,205	2,797	146	82	78
	MCT135C	92	10,663	3,020	149	82	78

CRAWLER DOZERS/TRACTORS

Company	Model	HP	Operating Weight (lbs)	Blade Capacity (cu. yd.)
Case	650L LT	74	16,250	1.69
	650L LGP	74	17,550	2.15
	650L WT	74	16,800	2.0
	750M LT	92	20,040	1.69
	750M WT	92	20,679	2.00
	750M LGP	92	21,180	2.22
	850M LT	112	21,560	2.35
	850M WT	112	22,330	2.53
	850M LGP	112	22,830	2.62
	1150M LT	127.4	31,134	3.75
	1150M WT	127.4	32,174	4.16
	1150M LGP	127.4	32,637	4.16
	1650M WT	150	38,650	5.28
	1650M XLT	150	37,750	4.28
	1650M LGP	150	39,550	5.28
	2050M LT	214	44,563	7.29
	2050M WT	214	46,891	7.15
	2050M XLT	214	45,414	7.15
	2050M LGP	214	48,773	7.12
	Caterpillar	D6K2 LGP	130	30,574
D6N DS-LGP (Tier 4i)		150	39,646	4.13
D6N DS-LGP Waste Handler (Tier 4i)		150	42,988	7.8
D6T LGP (Tier 4F)		207	50,490	4.83
D6T LGP Waste Handler (Tier 4F)		207	55,792	12.3
D7E LGP (Tier 4F)		238	62,886	7.7
D7E LGP Waste Handler (Tier 4F)		238	68,123	25
D8T LGP (Tier 4F)		312	82,496	12.9
D8T LGP Waste Handler (Tier 4F)		312	91,270	26.1
D3K2 LGP		80	18,442	2.17
D4K2 LGP		92	18,686	2.42
D5K2 LGP		104	20,992	3.06
D6K2 XL		130	29,346	4.01
D6N XL (Tier 4i)		150	36,392	4.16
D6N XL Waste Handler (Tier 4i)		150	38,224	4.16
D6T XL (Tier 4F)		207	46,263	6.94
D6T XL Waste Handler (Tier 4F)		207	51,563	14.3
D6T XW (Tier 4F)		207	48,034	6.6
D7E (Tier 4F)		238	57,441	8.98
D7E Waste Handler (Tier 4F)		238	63,537	17.6
D8T (Tier 4F)		312	86,900	11.3
D8T Waste Handler (Tier 4F)		312	85,650	26.1
D9T		410	94,265	17.7
D9T Waste Handler		410	109,705	37.6
D9T (Tier 4F)		436	95,917	17.7
D9T Waste Handler (Tier 4F)		436	110,471	37.6
D10T2		600	139,010	24.2
D11T		850	208,589	45
D11T CD	850	220,385	57	
D3K2 XL	80	17,465	1.99	
D4K2 XL	92	18,007	2.59	
D5K2 XL	104	20,313	2.86	
John Deere	450J	70	16,283-17,525	2.6
	550K	92	20,622	2.6
	650K	104	20,974	2.6
	700K	130	31,290	4.1
	750K	165	37,745	5.6
	850K	205	48,005	7.3
	850K WH	200	48,906	7.3
	1050K	350	95,000	12.7

DIRECTIONAL DRILLING RIGS, MINI (Under 50,000 pounds pullback)

Company	Model	Type Drive	Weight (lbs)	Boring Diameter Range (in)	Torque (ft/lbs)	Pullback (lbs)
Barbco	BD40HP	rack & pinion	27,000	varies	6,600	40,000
	JT5	hydraulic	3,690	2.5	550	5,000
Ditch Witch	JT9	hydraulic	7,120	3	1,100	9,000
	JT20	hydraulic	10,800	3.5 - 5	2,200	20,000
	JT25	hydraulic	20,200	3.5 - 5	4,000	27,000
	JT30	hydraulic	17,075	3.5 - 5	4,000	30,000
	JT30 AT	hydraulic	17,655	3.5 - 5	4,000	30,000
	*Operating weight varies depending on selected options.					
McLaughlin	MCL 10H (5')	hydraulic	1,100	3 - 12	1,030	13,250
	MCL 10H (7')	hydraulic	1,200	3 - 12	1,030	13,250

TT Technologies	Grundopit 40/60	hydraulic	440	2.1	442	8,800
	Grundopit K (24" Keyhole)		1,510	2.5	626	8,925
	Grundodril 4X	hydraulic	4,100	2.5	950	9,800
	Grundodril 15X	hydraulic	15,400	3.15	3,100	33,000
	Grundodril 18ACS		33,510	6.5	7,375	40,000
Toro	DD2024	quad rack & pinion	8,500		2,400	20,000
	DD4045	quad rack & pinion	20,000		4,500	40,000
	DD4050	quad rack & pinion	17,460	2.375	5,000	40,000
Vermeer	D6x6	chain	3,240	N/A	550	5,500
	D9x13 S3	rack & pinion	6,300	N/A	1,300	9,000
	D20x22 S3	rack & pinion	10,850	N/A	2,250	19,550
	D23x30 S3	rack & pinion	14,080	N/A	3,000 (2.38")	24,000
					2,600 (2.06")	
	D24x40 Series II	rack & pinion	20,200 - 22,250	N/A	4,200	28,000
	D36x50DR Series II	rack & pinion	28,900 - 29,300	N/A	5,500	38,000
	D40X55 S3	rack & pinion	23,380	N/A	5,500 (2.63")	40,000
					5,000 (2.38")	

DIRECTIONAL DRILLING RIGS, MID (50,000 - 100,000 pounds pullback)

Company	Model	Type Drive	Weight (lbs)	Boring Diameter Range (in)	Torque (ft/lbs)	Pullback (lbs)
American Augers	DD-110	rack & pinion	36,728	N/A	13,600	110,000
	DD-110S	rack & pinion	36,728	N/A	13,600	110,000
	DD-220T	rack & pinion	65,000	N/A	30,000	220,000
	DD-155T	rack & pinion	57,000	N/A	30,000	155,000
Barbco	BD60HP	rack & pinion	37,500	varies	12,500	60,000
	BD80HP	rack & pinion	38,000	varies	15,000	80,000
	BD100HP	rack & pinion	40,000	varies	15,000	100,000
Ditch Witch	JT60	rack & pinion	31,250	5	9,000	60,000
	JT60AT	rack & pinion	31,250	6.25	9,000	60,000
	JT100	rack & pinion	45,300	6	12,000	100,000
	JT100AT	rack & pinion	47,260			
*Operating weight varies depending on selected options.						
Vermeer	D60X90 S3	rack & pinion	39,392	N/A	9,000	60,000
	D100x140 S3 15' rod	rack & pinion	50,500 - 58,600	N/A	14,000	110,000
	D100x140 S3 20' rod	rack & pinion	50,500 - 58,600	N/A	14,000	110,000
	D220x300 S3	rack & pinion	74,000	N/A	30,750	242,100

DIRECTIONAL DRILLING RIGS, MAXI (over 100,000 pounds pullback)

Company	Model	Type Drive	Weight (lbs)	Torque (ft/lbs)	Pullback (lbs)
American Augers	DD-440T	rack & pinion	95,400	60,000	440,000
	DD-660RS	rack & pinion	100,300	80,000	660,000
	DD-1100RS	rack & pinion	105,300	100,000	1,100,000
Barbco	BD120HP	rack & pinion	48,500	20,000	120,000
	BD160HP	rack & pinion	55,000	30,000	160,000
	BD200HP	rack & pinion	62,250	35,000	200,000
	BD250HP	rack & pinion	66,500	45,000	250,000
	BD380	rack & pinion	87,760	60,000	380,000
Vermeer	D330x500	rack & pinion	90,000	50,000	330,000
	D500x500	rack & pinion	82,000	50,000	500,000
	D750x900	rack & pinion	101,000	102,500	784,000
	D1000x900	rack & pinion	101,000	102,500	1,000,000
	D1320x900	rack & pinion	101,000	102,500	1,360,000

EXCAVATORS, COMPACT (under 25,000 pounds)

Company	Model	Operating Weight (lbs)	HP	Bucket Capacity (cu. yd.)	Max. Digging Depth	Max. Reach (height to pin)	Machine Width	
Bobcat	418	2,593	10.2	0.54	6'	10' 2"	2' 3" - 3' 6"	
	E20	4,306	13.9	1.1	8' 6"	14' 0"	3' 3" - 4' 6"	
	E26	5,763	24.8	2.9	8' 6"	14' 11"	5' 1"	
	E32	7,183	33.5	3.9	10' 2"	16' 4"	5'	
	E32i	7,183	24.8	3.9	10' 2"	16' 4"	5'	
	E35	7,468	33.5	3.9	10' 2"	17' 2"	5' 9"	
	E35i	7,468	24.8	3.9	10' 2"	17' 2"	5' 9"	
	E42	9,246	42.7	3.9	10' 6"	17' 4"	5' 9"	
	E45	10,077	42.7	5.9	10' 10"	18' 7"	6' 5"	
	E50	10,677	49.8	5.9	11' 7"	19' 6"	6' 5"	
	E55	12,313	49.8	5.9	12' 11"	20'	6' 5"	
	E63	13,779	59.4	5.9	13' 6"	20' 5"	6' 6"	
	E65	18,960	59.4	9.5	15' 6"	23' 11"	7' 7"	
	Note: Bucket capacity is shown in cubic feet. Maximum reach is based on reach at ground level.							
	Case	CX31B	7,320	23	0.08 - 0.16	9' 3"	14' 1"	5' 1"
CX36B		8,212	23.1	0.08 - 0.24	10'	14' 7"	5' 7"	
CX55B		11,312	37.4	0.11 - 0.36	12' 10"	17' 8"	6' 5"	
CX75C SR		16,200	55	0.21 - 0.59	13' 7"	20' 7"	7' 7"	
CX80C		18,800	55	0.24 - 0.59	13' 9"	22' 9"	7' 7"	

Caterpillar	300.9D	2,170	18	0.49-0.95	5'8"	9'11"	2'5"-2'10"
	301.4C	3,241	17.7	0.60-2.0	7'4"	12'	2'11"-4'3"
	301.7D CR	3,726	17.7	0.60-2.0	7'7"	12'7"	3'3"-4'3"
	301.7D	4,068	17.7	0.60-2.0	7'3"	12'2"	3'3"-4'3"
	302.2D	4,464	17.9	0.60-2.0	8'2"	13'6"	3'3"-4'3"
	302.4D	5,115	17.7	1.24-3.24	7'11"	13'2"	4'6"
	302.7C	5,681	20.7	1.24-3.24	8'4"	14'8"	5'2"
	303E CR	7,782	23.5	1.6-6.96	9'	15'9"	5'1"
	303.5E CR	8,139	31.6	1.6-6.96	9'6"	16'8"	5'10"
	303.5E2	8,103	23.5	1.6-6.96	9'4"	16'6"	5'8"
	304E CR	8,838	40	1.9-9.9	10'3"	17'1"	6'5"
	304E2	8,655	40.2	1.9-9.9	10'3"	17'1"	6'4"
	305E CR	11,217	40.2	1.9-9.9	10'9"	17'10"	6'6"
	305E2 CR	11,334	40.2	1.9-9.9	10'9"	17'6"	6'6"
	305.5E2 CR	11,863	44.1	1.9-9.9	11'5"	18'6"	6'6"
	305.5E CR	11,938	44.2	1.9-9.9	11'4"	18'6"	6'6"
Note: bucket capacity is in cubic feet.							
Doosan	DX63-3	13,779	59	0.08-0.38	13'6"	20'5"	78"
	DX85R-3	18,960	59	0.13-0.53	15'6"	23'11"	91"
Note: Maximum reach is based on reach at ground level.							
Hitachi	ZX17U-5	3,790	14.5	0.02-0.05	7'2"	12'6"	3'3"
	ZX26U-5	6,110	20	0.05-0.16	8'6"	15'2"	4'11"
	ZX35U-5	7,760	23.3	0.05-0.22	11'4"	18'11"	5'9"
	ZX50U-5	10,560	35.9	0.08-0.31	12'7"	20'6"	6'7"
	ZX60USB-5	13,547	53	0.12-0.46	13'6"	21'6"	6'7"
	ZX75US-5	17,952	56.9	0.31-0.64	15'1"	22'2"	7'7"
	ZX85USB-5	19,244	56.9	0.4-0.66	14'1"	24'9"	7'3"
Hyundai	R17Z-9A	3,747	16.4	0.05	7'7"	12'9"	3'2"
	R25Z-9AK	5,690	24.9	0.09	7'11"	14'3"	4'11"
	R35Z-9	8,050	26.5	0.14	10'4"	17'2"	5'9"
	R55-9A	12,460	65.1	0.24	12'6"	19'9"	6'4"
	R60CR-9A	13,010	66.9	0.24	11'9"	19'9"	6'7"
	R80CR-9	18,190	59.6	0.37	13'7"	22'5"	7'7"
R80CR-9A	18,190	65.1	0.37	13'7"	22'5"	7'7"	
John Deere	17G	3,790	14.5	1.5 cu. ft.	7'2"	12'6"	3'3"
	26G	6,110	20	2.3 cu. ft.	8'6"	15'2"	4'11"
	35G	7,760	23.3	4.0 cu. ft.	10'	17'1"	5'9"
	50G	10,560	35.9	5.7 cu. ft.	11'7"	19'7"	6'7"
	60G	13,547	53	6.8 cu. ft.	12'4"	20'5"	6'7"

Kobelco	SK175R	3,640	15.2	1.24-1.57	7'1"	12'9"	3'3"	
	SK275R	5,870	21.3	2.82	8'4"	15'3"	4'7"	
	SK355R	8,200	28.4	3.88	10'1"	17'2"	4'7"	
	SK555RX	11,050	37.4	5.65	12'10"	20'6"	6'4"	
	SK755R	17,100	55	0.14-0.46	15'	25'5"	8'	
	SK85CS	18,700	55	0.14-0.46	13'9"	23'9"	8'	
	Kubota	K008-3	2,200	10.1	0.3-0.78	5'8"	9'11"	2'10"
		U17	3,703	15.2	0.49-1.5	7'7"	12'7"	4'1"
		KX018-4	3,747	15.2	0.49-1.5	7'9.7"	12'8"	4'3.2"
		U25S	5,625	19.8	1.0-3.3	9'3"	15'4"	4'11"
		KX71-35	6,305	24.3	1.9-4.25	9'9"	16'0"	4'11"
KX91-352		7,110	28.3	1.9-4.25	10'5"	16'10"	5'1"	
KX91-352		7,540	28.3	1.9-4.25	10'5"	16'10"	5'1"	
Angle Blade								
U35-4		8,129	25.1	1.9-4.25	9'8.9"	16'11.3"	5'6.9"	
U35-4		8,478	25.1	1.9-4.25	9'8.9"	16'11.3"	5'6.9"	
Angle Blade								
KX040-4	9,195	40.9	1.9-6.6	11'2.6"	17'9"	5'6.9"		
KX040-4	9,545	40.9	1.9-6.6	11'2.6"	17'9"	5'6.9"		
Angle Blade								
KX040-4	9,900	40.9	1.9-6.6	11'2.6"	17'9"	5'6.9"		
6-in-1 Blade								
U55-4	11,915	47.6	3.0-8.5	11'10"	19'6"	6'5"		
KX057-4	12,200	47.6	3.0-8.5	12'8"	20'1"	6'5"		
U55-4	12,335	47.6	3.0-8.5	11'10"	19'6"	6'5"		
Angle Blade								
KX057-4	12,620	47.6	3.0-8.5	12'8"	20'1"	6'5"		
Angle Blade								
KX080-4	18,280	65.5	6.5-13.5	15'1.1"	23'6.3"	7'2.6"		
DX080-4	19,140	65.5	6.5-13.5	15'1.1"	23'6.3"	7'2.6"		
Angle Blade								
Sany America	Sany SY16C	3,858	15.6	N/A	7'8"	12'10"		
	Sany SY35U	8,333	27.4	N/A	10'2"	17'6"		
	Sany SY75C	16,050	54.3	0.21-0.42	14'7"	20'6"		
New Holland	E18B	3,638	15.2	0.05	7'1"	12'9"	4'	
	E27B	5,557	21.3	0.1	8'4"	14'10"	4'	
	E35B	7,960	28.4	0.12	10'1"	16'9"	5'	
	E50B	10,275	40.8	0.21	11'9"	18'1"	6'	
	E55Bx	12,295	39	0.1-3.6	12'10"	18'11"	6'5"	

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EXCAVATORS, COMPACT

(under 25,000 pounds)

Company	Model	Operating Weight (lbs)	HP	Bucket Capacity (cu. yd.)	Max. Digging Depth	Max. Reach (height to pin)	Machine Width
Volvo	EC20C	4,277	16.8	1.06 - 4.06	7'4"	13'	3'3"
	ECR25D	5,489	20.9	0.097	9'1"	15'1"	5'1"
	ECR38	7,355	27.6	1.30 - 5.40	8'10"	15'8"	5'4"
	EC35C	7,848	36.3	1.51 - 5.78	11'3"	16'7"	5'4"
	EC55C	12,566	47.1	2.8 - 8.3	12'4"	19'7"	6'4"
	ECR58D	12,550	47	0.91 - 0.31	12'11"	20'5"	6'7"

EXCAVATORS, LARGE

(over 25,000 pounds)

Company	Model	Operating Weight (lbs)	HP	Bucket Capacity (cu. yd.)	Max. Digging Depth	Max. Reach
Case	CX130C	27,999	100	0.32 - 1.12	19'9"	28'4"
	CX145CSR	31,967	100	0.43 - 1.02	19'8"	28'2"
	CX160CLC	38,001	124	0.36 - 1.28	19'9"	29'10"
	CX130D	31,400	102	0.32 - 1.12	26'10"	26'10"
	CX160D	34,400	112	0.32 - 1.12	30'4"	30'4"
	CX210D	48,973	160	0.55 - 1.76	21'0"	31'11"
	CX235CSR	56,907	160	0.55 - 1.53	21'8"	31'7"
	CX250D	56,909	177	0.68 - 1.90	22'8"	33'2"
	CX250D LR	63,523	177	1.38 - 1.77	47'9"	59'9"
	CX300D	67,271	207	0.72 - 2.42	23'4"	34'5"
	CX350D	82,483	268	0.88 - 2.72	24'1"	36'0"
	CX470C	105,300	362	2.03 - 3.37	25'4"	38'7"
	CX700B	153,400	463	2.47 - 5.91	27'7"	42'4"
	CX800B	178,575	532	2.47 - 5.91	28'6"	45'5"
	Caterpillar	308E CR SB	18,371	65	3.5 - 14.8	13'7"
308E2 CR SB		18,431	48.5	3.5 - 14.8	13'6"	23'
314E CR		32,600	89	0.39 - 0.97	19'6"	28'6"
312E		33,080	91	0.27 - 1.0	19'10"	28'3"
316E		38,801	113	0.46 - 1.19	21'7"	30'5"
318E		41,010	113	0.59 - 1.40	21'7"	30'5"
321D LCR		53,704	148	0.61 - 2.05	22'	32'1"
320E		54,450	153	0.61 - 2.08	22'1"	30'9"
324E		55,395	194	0.75 - 2.46	22'4"	33'2"
320E RR		56,440	152	0.61 - 2.08	22'1"	32'4"
329E		64,060	232	0.75 - 2.46	23'9"	35'
336F		80,617	316	1.23 - 3.52	24'7"	36'2"

336E H	81,600	308	1.23 - 3.52	24'7"	36'2"
349EF	105,400	425	1.2 - 5.0	25'	38'5"
311F RR	27,300	70	0.27 - 1.0	18'4"	26'7"
323F LES	56,438	156	0.61 - 2.08	22'1"	32'4"
335F L	87,946	192	0.83 - 2.58	22'9"	34'9"
374F	156,461	472	4.97 - 6.0	31'8"	46'8"
390F	156,461	524	4.0 - 8.5	38'8"	56'7"
320E LR	54,450	153	0.80	38'4"	51'6"
324E LR	64,990	194	0.75	48'4"	60'6"
329E LR	68,958	232	0.75	48'5"	60'5"

Doosan

DX140LC-5	32,783	113	0.30 - 0.85	20'1"	27'11"
DX140LCR-5	34,987	113	0.30 - 0.85	19'7"	27'11"
DX180LC-5	43,224	129	0.38 - 1.26	20'	29'7"
DX225LC-5	52,086	162	0.61 - 1.45	21'7"	31'10"
DX225LC-5 SLR	55,731	162	0.30 - 0.85	38'2"	50'
DX235LCR-5	56,019	181	0.61 - 1.45	21'10"	31'7"
DX255LC-5	57,752	184	0.61 - 1.45	22'4"	32'9"
DX300LC-5	68,764	267	0.66 - 2.70	23'11"	34'6"
DX300LC-5 SLR	72,462	267	0.38 - 0.98	45'2"	57'
DX350LC-5	80,654	313	1.00 - 3.26	24'8"	35'11"
DX420LC-5	94,799	338	1.52 - 3.26	25'4"	37'
DX490LC-5	112,206	373	2.13 - 3.96	25'6"	38'11"
DX530LC-5	116,576	373	2.13 - 3.96	24'	37'6"
DX530LC-3 SLR	117,112	373	1.13 - 1.80	49'7"	63'9"

Note: Maximum reach is based on reach at ground level; SLR = super-long reach.

Hitachi

ZX17U-5	3,790	14.5	0.02 - 0.05	7'2"	12'6"
ZX26U-5	6,110	20	0.05 - 0.16	8'6"	15'2"
ZX35U-5	7,760	23.3	1.3 - 5.9	11'4"	18'11"
ZX50U-5	10,560	35.9	2.1 - 8.3	12'7"	20'6"
ZX60USB-5	13,547	53	5.1 - 12.5	13'6"	21'6"
ZX75US-5	17,952	56.9	0.31 - 0.64	15'1"	22'2"
ZX85USB-5	19,244	56.9	0.4 - 0.66	14'1"	24'9"
ZX130-6	26,674	101	0.47 - 0.99	19'11"	28'5"
ZX135US-6	32,820	101	0.47 - 0.99	19'7"	28'7"
ZX160LC-6	38,366	116	0.47 - 1.17	21'4"	30'1"
ZX180LC-6	40,419	116	0.51 - 1.31	23'2"	32'1"
ZX210-6	46,586	160	0.9 - 1.29	21'4"	30'4"
ZX210LC-6	47,548	160	0.9 - 1.29	21'4"	30'4"
ZX245USLC-6	56,170	159	0.51 - 1.55	21'9"	32'6"
ZX250LC-6	55,689	177	1.0 - 1.9	25'0"	35'3"
ZX300LC-6	64,375	249	0.9 - 1.6	25'10"	36'5"
ZX350LC-6	77,360	271	1.3 - 2.78	26'10"	38'3"

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Hitachi	ZX380LC-6	82,276	271	1.3 -2.78	26'10"	38'3"
	ZX470LC-6	110,804	362	1.8 - 4.2	27'2"	40'3"
	ZX670LC-6	154,103	463	1.7 - 6.6	30'0"	44'8"
	ZX870LC-6	188,716	512	2.0 - 7.6	31'5"	48'0"
	EX1200-6	246,917	740	8.8	26'5"	43'10"
	EX1200-6 Shovel	251,327	740	8.5	15'8"	N/A
	EX1900-6	423,280	1,039	5.7	26'10"	48'6"
	EX1900-6 Shovel	421,075	1,039	19.6	19'5"	N/A
	EX2600-6	556,000	1,500	22.2	27'1"	52'8"
	EX2600-6 Shovel	556,000	1,500	21.6	12'3"	N/A
	EX3600-6	791,500	1,994	29	28'2"	57'9"
	EX3600-6 Shovel	795,900	1,994	30	12'	N/A
	EX5600-6	537,000	3,000	44.5	28'11"	63'8"
	EX5600-6 Shovel	533,000	3,000	38	15'9"	N/A
EX8000-6 Shovel	1,787,900	3,880	52.3	13'5"	N/A	

Hyundai	R125LCR-9A	27,560	100	0.59	16'7"	24'10"
	R145LCR-9A	32,610	116	0.93	18'1"	28'4"
	R235LCR-9A	53,620	157	1.75	22'	32'2"
	R140LC-9A	30,820	116	0.93	20'	28'4"
	R160LC-9A	39,240	128	1.16	19'11"	29'1"
	R180LC-9A	41,560	128	1.37	19'11"	29'1"
	R220LC-9A	49,640	157	1.75	20'5"	32'3"
	R260LC-9A	56,880	178	1.96	23'	33'5"
	R300LC-9A	68,260	212	2.42	24'3"	34'10"
	R330LC-9A	74,960	268	2.75	24'2"	35'11"
	R380LC-9A	86,200	290	3.03	24'8"	38'3"
	R480LC-9A	108,420	352	3.96	25'7"	40'11"
	R520LC-9A	114,820	352	4.19	26'11"	40'9"
	R1200LC-9A	118,000	352	8.76	26'3"	43'11"

John Deere	75G	17,952	56.9	0.41	13'6"	21'1"
	85G	18,821	56.9	0.41	13'1"	23'8"
	130G	29,489-31,896	97	0.65	19'11"	28'10"
	135G	30,617-32,819	97	0.65	19'7"	29'1"
	160G LC	39,685	121	0.81	21'4"	30'7"
	180G LC	44,317	121	1.09	23'2"	32'7"
	210G/210G LC	49,139-50,463	159	1.19	21'11"	32'7"
	245G LC	56,167	159	1.04	21'9"	33'2"
	250G LC	55,736	188	1.38	25'	35'10"
	290G LC	66,338	188	1.75	25'10"	37'
	350G LC	76,557	271	2.3	26'10"	38'11"
	380G LC	82,012	271	2.3	26'10"	38'11"

Hitachi	470G LC	108,952	367	3.06	27'2"	41'
	470G LC ME	108,423	367	3.06	20'5"	35'8"
	670G LC	158,045	463	4.04	30'	45'5"
	670G LC ME	157,803	463	4.04	23'4"	38'9"
	870G LC	193,255	532	4.57	31'5"	48'11"
	870G LC ME	193,232	532	4.57	23'5"	40'6"

Kobelco	SR140 SRLC	33,100	92.8	0.31 - 0.90	19'7"	28'4"
	ED160 Blade Runner	35,700	92.8	0.31 - 0.90	19'1"	28'10"
	SK210LC	48,500	157	0.92 - 1.22	22'	31'11"
	SK230SRLC	55,100	157	0.67 - 1.22	21'7"	31'3"
	SK260SRLC	59,300	157	0.67 - 1.22	21'9"	31'9"
	SK260LC	56,890	176	1.05 - 1.83	23'	33'3"
	SK350LC	81,800	270	1.57 - 2.09	24'10"	36'3"
	SK500LC	111,400	345	1.77 - 3.14	25'7"	38'10"
	SK850LC	181,440	510	1.78 - 7.06	31'10"	46'11"
	SK210LC Long Arm	48,500	157	0.92 - 1.22	23'10"	33'4"
SK260LC Long Arm	56,890	184	1.05 - 1.83	25'2"	35'6"	

Sany America	Sany SY135C	29,760	97.9	0.7 - 0.9	18'1"	27'2"
	Sany SY215C	51,193	155	0.52 - 1.83	21'8"	32'5"
	Sany SY235C	51,809	195	0.52 - 1.83	22'2"	33'4"
	Sany SY335C	79,860	290	0.52 - 2.3	24'2"	36'5"

Volvo	ECR88D	20,080	55	0.10 - 0.43	14'10"	23'7"
	EC140D	29,460	113	0.27 - 0.95	18'2"	26'10"
	ECR145D	33,430	172	0.52 - 1.18	18'1"	26'11"
	EC160D	38,320	139	0.33 - 1.31	19'10"	28'11"
	EC220D	48,800	172	0.68 - 2.75	22'1"	32'1"
	ECR235D	54,350	172	0.52 - 1.18	20'7"	31'11"
	EC250D	56,190	202	0.63 - 2.42	22'11"	33'1"
	EC300D	67,260	227	0.68 - 2.64	24'1"	34'6"
	ECR305C L	76,930	192	1.70 - 2.55	22'10"	34'3"
	EC340D	77,240	279	1.77 - 3.92	26'8"	38'4"
	EC380D	85,800	279	1.77 - 3.92	26'8"	38'4"
	EC380E	94,800	302	1.1 - 3.3	26'6"	37'9"
	EC480E	100,310	277	1.2 - 2.7	30'1"	43'2"
	EC480D	105,600	328	2.31 - 4.97	29'8"	43'6"
	EC700C L	152,150	424	3.17 - 8.63	27'7"	42'4"

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- Off-site duct bank assembly is possible, allowing for labor savings
- A safer installation - less time is needed in the trench
- Do more work outside of the ditch instead of in the ditch
- Cannot fall or tip over
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- Fits all types and sizes of conduit
- Any configuration and conduit separation can be maintained



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EXCAVATORS, WHEELED

Company	Model	Operating Weight (lbs)	HP	Bucket Capacity (cu. yd.)	Max. Digging Depth	Max. Reach	Travel Speed (mph)
Caterpillar	M313D	33,270	128	0.24 - 1.20	17'4"	27'10"	23
	M315D	37,633	137	0.50 - 1.65	18'8"	29'5"	21
	M322D	49,052	165	0.57 - 2.05	21'3"	33'10"	15.6
	M318F	42,549	169	0.5 - 1.65	19'4"	30'2"	22
	M320F	46,385	169	0.5 - 1.65	20'7"	32'	22
Doosan	DX140W-5	31,526	124	0.30 - 0.71	14'8"	24'2"	23
	DX190W-5	43,431	168	0.50 - 1.22	18'9"	29'8"	21.8
	DX210W-5	46,077	174	0.67 - 1.67	19'4"	31'10"	21.7
Hitachi	ZX190W-5*	44,530	159	0.52 - 1.97	19'2"	31'5"	21.7
	ZX190W-5**	45,300	159	0.52 - 1.97	19'5"	31'1"	21.7
	ZX230W-5*	52,030	159	0.52 - 1.97	20'8"	33'9"	17.1
	ZX230W-5**	53,220	159	0.52 - 1.97	20'2"	32'11"	17.1

*monoblock boom; **2-piece boom; NOTE: all modes are front blade, rear outrigger.

Hyundai	R55W-9A	5,910	0.24	11'6"	19'7"	6'4"	
	R140W-9A	30,200	0.93	15'11"	25'3"	8'2"	
	R180W-9A	40,960	1.37	19'5"	28'4"	8'2"	
	R210W-9A	45,200	1.75	20'11"	32'	8'4"	
John Deere	190D W*	44,029	159	0.92	19'2"	31'5"	21.7
	190D W**	45,636	159	0.92	19'5"	31'1"	21.7
	220D W*	49,888	159	0.92	20'8"	33'4"	17.1
	220D W**	52,003	159	0.92	19'11"	32'8"	17.1

*monoblock boom; **2-piece boom. NOTE: all models are front blade, rear outrigger.

Volvo	EW160D*	35,715 - 40,125	150	0.94 - 1.33	18'5"	29'	22
	EW180D*	39,900 - 44,750	169	0.92 - 1.30	20'1"	31'4"	22
	EW210D*	43,430 - 50,265	169	0.92 - 1.30	21'3"	32'7"	18.5

*monoblock boom

GROUND PENETRATING RADAR

Company	Model	Antenna Freq.	Display Type	Max. Target Depth	Max. Survey Length	GPS	Battery Life	Unit Weight (lbs)
Subsite Electronics	2450 GR	250 MHz/700MHz	Xplore Tablet PC	19/8'	unlimited	yes	PC = 4 hours	73.9
							GPR = 10 hours	
US Radar	Seeker Spr 100	100	10.4**	100'	unlimited	yes	5hr x 2	50
	Seeker Spr 250	250	10.4**	50'	unlimited	yes	5hr x 2	90
	Seeker Spr 270	270	10.4**	48'	unlimited	yes	5hr x 2	90
	Seeker Spr 400	400	10.4**	16'	unlimited	yes	5hr x 2	90
	Seeker Spr 500	500	10.4**	15'	unlimited	yes	5hr x 2	90
	Seeker Spr 900	900	10.4**	6.5'	unlimited	yes	5hr x 2	50
	Seeker Spr 1000	1,000	10.4**	6'	unlimited	yes	5hr x 2	50
	Seeker Spr 2000	2,000	10.4**	2'	unlimited	yes	5hr x 2	50
	Q5C	500/400 MHz	10.1**	15'	unlimited	yes	5hr x 2	50
	Quantum Imager	200/400/900 MHz	10.4**	30'	unlimited	yes	5hr x 2	70

*Full Color Daylight Readable Touchscreen; **Handheld Full Color Daylight Readable Touchscreen

Sensors & Software	Noggin 250	125 - 375 MHz	Data Video Logger			yes	N/A	6.5 kg (14)
	LMX 100	125 - 375 MHz	Data Video Logger			no	9 Ah	22 kg (48.5)

HDD MUD SYSTEMS

Company	Model	Mud Storage Capacity (gal)	Mud Cleaning Capacity (gpm)	Pump Type	Mixing Method	Shaker Screens	Desander, Desilter Cones	Mounting Option (skid/trailer)
American Augers	MCM-4000	4,000	560	N/A	jet	yes	yes	both
	M-500P	6,000	500	tri-plex	jet	yes	yes	rockover
	MCR-10000	10,000	900	centrifugal	jet	yes	yes	rockover
	MCD-1000	10,000	1,000	centrifugal				
	P-350	N/A	N/A	tri-plex				
	P600	N/A	N/A	tri-plex	N/A	N/A	N/A	skid
	P750	N/A	N/A	quintiplex	N/A	N/A	N/A	skid
Ditch Witch	MR90	450	90	centrifugal	venturi	2	yes	both
Elgin Separation Solutions	KEMTRON 100HD2	500	65 - 130	centrifugal	venturi/jet	yes	yes	both
	KEMTRON 200HD2	500 or 1,000	65 to 195	centrifugal	venturi/jet	yes	yes	both
	KEMTRON 400HD2	2,350	400	centrifugal	venturi/jet	yes	yes	both
	KEMTRON 600HD2	4,000	600	centrifugal	venturi/jet	yes	yes	both
	KEMTRON 800HD2	5,000	800	centrifugal	venturi/jet	yes	yes	both
	KEMTRON 1500HD2	9,000	1,500	centrifugal	venturi/jet	yes	yes	rockover
McLaughlin	McL-230P	230	N/A	high pressure reciprocating	agitator	no	no	skid
Mud Technology	MCT-450	2,400	450+	centrifugal	jet	yes	yes	both
	MCT-550	3,300	500+	centrifugal	jet	yes	yes	both
	MCT-750	3,300	800+	centrifugal	jet	yes	yes	both
	MCT-800	5,000	800+	centrifugal	jet	yes	yes	both
	MCT-1000	6,500	1000+	centrifugal	jet	yes	yes	both
	MCT-1500	6,500	1500+	centrifugal	jet	yes	yes	both
	MCT-2000	6,500	2000+	centrifugal	jet	yes	yes	both
	MPCT-800	5,130	800+	triplex	jet	yes	yes	trailer
	MPCT-1000	7,000	1000+	triplex	jet	yes	yes	trailer
	MPCT-1500	6,270	1500+	triplex	jet	yes	yes	trailer
	MTP-475	N/A	N/A	triplex	N/A	N/A	N/A	skid
	MTPEWS-440	N/A	N/A	triplex	N/A	N/A	N/A	skid
	MTPEWS-446	N/A	N/A	triplex	N/A	N/A	N/A	skid
	RST 1200	1,200	400+	centrifugal	jet	yes	yes	trailer
	RST 1400	1,400	400+	centrifugal	jet	yes	yes	trailer
	TP 7.5		500+	trash pump				
	TP 10		625+	trash pump				
TP 15		700+	trash pump					
TP 20		800+	trash pump					

2016 EQUIPMENT SELECTION GUIDE

TT Technologies	DS225	225	N/A	diaphragm	centrifugal pump	N/A	N/A	skid
	DS500	500	N/A	piston	tank propeller	N/A	N/A	skid
	DS1000	1,000	N/A	piston	tank propeller	N/A	N/A	skid
	GS225 Combo	225	N/A	diaphragm	tank propeller	N/A	N/A	skid
	GS225	225	N/A	diaphragm	centrifugal pump	N/A	N/A	skid
Toro	FM330	500/1,000	330	centrifugal	venturi/jet	no	no	both
Tulsa Rig Iron	MCS-330	2,200	240+	centrifugal	venturi/jet	yes	yes	trailer
	MCS-355	3,000	350+	centrifugal	venturi/jet	yes	yes	both
	MCS-425	4,900	400+	centrifugal	venturi/jet	yes	yes	trailer
	MCS-750	9,000	1,000+	centrifugal	venturi/jet	yes	yes	rockover
	MCS-1000	6,400	700+	triplex	venturi/jet	yes	yes	rockover
	TT-100			Triplex				Skid
	TT-150			Triplex				Skid
	TT-250			Triplex				Skid
	TT-540			Triplex				Skid
	TT-560			Triplex				Skid
	TT-660			Triplex				Skid
	TT-680			Triplex				Skid
Vermeer	MX125	300 or 500	N/A	centrifugal	venturi/recirculation	N/A	N/A	modular
	MX240	750 or 1,000	N/A	centrifugal	venturi/recirculation	N/A	N/A	modular
	R9x12T	8,650	600	centrifugal	venturi/recirculation	4	3/10", 16/5"	trailer
	R400T	6,375	600	centrifugal	venturi/recirculation	3	2/10", 10/5"	trailer
	R600HC	8,560	400	centrifugal	venturi/recirculation	4	2/10", 12/5"	trailer

KEYHOLE EQUIPMENT

Company	Model	Core Diameter (in)	Core Depth (in)	Power Source (hydraulic/gas)	Mounting Option
McLaughlin	Compact Core Drill CS418	6, 8, 10, 4-18	12	hydraulic pump, 25-hp Kohler engine	vacuum excavator Vermeer vac w/sliding offset
	CS418B	4-18	24	25-hp Kohler ECH740 Command Pro EFI	trailer
SIMCO	255PTC	2 - 18	36+	hydraulic	medium pickup/truck w/flat bed, trailer w/25hp Kubota diesel
Utilicor Technologies	Series 500 Heavy Duty Coring Unit	2 - 24	30	PTO/hydraulic	medium duty truck
	MD-300 Multi-Directional Coring Unit	2 - 24	30	PTO/hydraulic	medium duty truck
	Minicor-2 Skid Steer Coring Attachment	2 - 24	30	auxiliary hydraulic	skid steer
	MC-450 Skid Steer Coring Attachment	2 - 18	30	auxiliary hydraulic	mini track loader/skid steer
	MPX-SS Multi-Platform Coring Unit	2 - 24	30	26 HP EFI gas / hydraulic	trailer/pickup truck/flat deck
	ROVER Self-Propelled and Towable Coring Unit	2 - 24	30	26 HP EFI gas / hydraulic	towable & self-propelled

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LOCATORS (WALKOVER & UTILITY)

Company	Model	Type	Operating Voltage	Battery Life (hrs)	Audio Output Frequency (kHz)	Weight (lbs)	Operating Temp.	Overall Length (in)	
DCI (W)	DigiTrak F5	Receiver	Lithium Ion	8 - 12	1.3, 8.4, 12, 18.5, 19	8.0	-4°F to 140°F	15	
	DigiTrak F2	Receiver	Lithium Ion	10 - 14	12, 19	7.7	-4°F to 140°F	15	
	DigiTrak SE	Receiver	NIMH	5 - 7	12	7.7	14°F to 149°F	15	
	DigiTrak Aurora	Remote	120-028V DC	N/A	N/A	6.4	-4°F to 140°F	11.5	
	DigiTrak FSD	Remote	Lithium Ion	14 - 18	N/A	6.2	-4°F to 140°F	9.5	
	DigiTrak SED	Remote	NIMH	8 - 12	N/A	4.5	-4°F to 140°F	8.5	
	F5DLpx	Transmitter	3.6V Lithium	30	12, 19	1.9	-4°F to 140°F	19	
	F5Dp 19/12	Transmitter	2 C-Cell	20	12, 19	1.65	-4°F to 220°F	15	
			Fluid Pressure	3.6V Lithium	50				
	F5Dp 12/1.3	Transmitter	2 C-Cell	20	12, 1.3	1.65	-4°F to 220°F	15	
			Fluid Pressure	3.6V Lithium	50				
	5XD 19/12	Transmitter	2 C-Cell	20	12, 19	1.4	-4°F to 220°F	15	
				3.6V Lithium	40				
	5XD 12/1.3	Transmitter	2 C-Cell	20	1.3, 12	1.4	-4°F to 220°F	15	
				3.6V Lithium	40				
	5X 18.5	Transmitter	2 C-Cell	20	18.5	1.4	-4°F to 220°F	15	
				3.6V Lithium	40				
	5X 8.4	Transmitter	2 C-Cell	20	8.4	1.4	-4°F to 220°F	15	
				3.6V Lithium	40				
	FX 19	Transmitter	2 C-Cell	20	19	1.4	-4°F to 220°F	15	
				3.6V Lithium	40				
	FXL 19	Transmitter	3.6V Lithium	30	19	1.9	-4°F to 220°F	19	
	FX 12	Transmitter	2 C-Cell	20	12	1.4	-4°F to 220°F	15	
				3.6V Lithium	40				
	FXL	Transmitter	3.6V Lithium	30	12	1.9	-4°F to 220°F	19	
	FS	Transmitter	1 - AA Cell	12	12	0.5	-4°F to 180°F	8	
	ST	Transmitter	2 C-Cell	20	12	1.4	-4°F to 220°F	15	
				3.6V Lithium	40				
	SES	Transmitter	1 - AA Cell	12	12	0.5	-4°F to 180°F	8	
	EDF	Transmitter	2 C-Cell	20	12, 1.5	1.4	-4°F to 220°F	15	
				3.6V Lithium	40				
	ET	Transmitter	2 C-Cell	20	12	1.4	-4°F to 220°F	15	
	EXL	Transmitter	3.6V Lithium	30	12	1.9	-4°F to 220°F	19	
ECP	Transmitter	12 - 28 V DC	N/A	12	1.9	-4°F to 180°F	19		
ES	Transmitter	1 - AA Cell	12	12	0.5	-4°F to 180°F	8		
Radiodetection (W)	DrillTrack G2	Receiver	6 C-alkaline	12	8, 33	8.8	-4°F to 220°F	39.3	
	RD385	Receiver	12 AA-alkaline	30	8, 33	5.0	-4°F to 220°F	25	
	SDS:	Transmitter	1 AA-alkaline	10	33	0.6	-4°F to 220°F	8	
	Short range datasonde								
	MDS:	Transmitter	2 C-alkaline	20	8	1.8	-4°F to 220°F	15	
	Medium range datasonde								
	LDS:	Transmitter	2 C-alkaline	12	8	1.8	-4°F to 220°F	15	
	Long range datasonde								
	MDF:	Transmitter	2 C-alkaline	20	8, 33	1.8	-4°F to 220°F	15	
	Medium range dual frequency datasonde								
	LDF:	Transmitter	2 C-alkaline	12	8, 33	1.8	-4°F to 220°F	15	
	Long range dual frequency datasonde								
	G2M:	Transmitter	2 C-alkaline	20	8, 33	1.8	-4°F to 220°F	15	
	Medium range dual frequency datasonde								
	G2L:	Transmitter	2 C-alkaline	12	8, 33	1.8	-4°F to 220°F	15	
	Long range dual frequency datasonde								
	Subsite Electronics (U)	150R	Receiver	2 C-cell alkaline	40	N/A	2	4°F to 122°F	12
		150T	Transmitter	6 C-cell alkaline	40	N/A	3	4°F to 122°F	12
250R		Receiver	6 C-cell alkaline	40	33	5	4°F to 122°F	11.5	
250T		Transmitter	6 C-cell alkaline	40	33	5	4°F to 122°F	12	
830R		Receiver	2 D-cell alkaline	75	83	5.1	4°F to 122°F	12.1	
830T		Transmitter	6 D-cell alkaline	150	83	4.6	4°F to 122°F	11.1	
UtiliGuard		Receiver	D-cell selectable alkaline	30	0.05-200	4.8	4°F to 122°F	27.2	
UtiliGuard		Transmitter	D-cell selectable alkaline	100	0.256-200	7.7	4°F to 122°F	12	
TK		Receiver	4 C-cell alkaline	12	29	9	-4°F to 176°F	30	
TKD		Receiver	4 C-cell alkaline	12	12, 29	9	-4°F to 176°F	30	
TKQ		Receiver	4 C-cell alkaline	12	1.5, 12, 20, 29	9	-4°F to 176°F	30	
TD		Remote	12V DC	N/A	N/A	2	-4°F to 176°F	7	
TDR		Remote	12V DC	N/A	N/A	2	-4°F to 176°F	7	
			2 C-cell	16					
TX		Beacon Transmitter	3.6V Lithium	60	29	2	-4°F to 176°F	17.8	
			2 C-cell	16					
TXH		Beacon Transmitter	3.6V Lithium	60	29	2	-4°F to 176°F	17.8	
			2 C-cell	16					
TXU		Beacon Transmitter	3.6V Lithium	60	12, 29	2	-4°F to 176°F	15	
			2 C-cell	16					
TXQ	Beacon Transmitter	3.6V Lithium	60	1.5, 12, 20, 29	2	-4°F to 176°F	17.8		
		2 C-cell	16						
TXQG	Beacon Transmitter	3.6V Lithium	60	1.5, 12, 20, 29	2	-4°F to 176°F	17.8		
Heath Consultants (U)	Sure-Lock All Pro	Transmitter	lead acid 6 VCD, 7 AH	10-100	8.1, 81, 480	8	-25°F to 150°F	9.25	
	Sure-Lock All Pro	Receiver	6 AA-alkaline	90-120	8.1, 81, 480	4.4	-25°F to 150°F	30.5	
	Sure-Lock Utility Pro	Transmitter	6 D-alkaline	110-190	81	4	-25°F to 150°F	8.1	
Heath Consultants (U)	Sure-Lock Utility Pro	Receiver	6 AA-alkaline	90-120	81	4.4	-25°F to 150°F	30.5	
	Magna-Lock	Magnetic	6 1.5V AA	100		3	0°F to 120°F	24	
	Split-Lock	Transmitter	4 C-alkaline	50	126	3.5	-5°F to 158°F	8.5	
	Split-Lock	Receiver	4 C-alkaline	50	126	3.5	-5°F to 158°F	8.5	
McLaughlin (U)	Vision FLX	Utility/Fault Finder	12V	24	9.5, 38, 80, FF	4.7	-4°F to 122°F	26	
	Vision GX	Utility	9V	24	9.5, 38, 80	4.7	-4°F to 122°F	26	
	Verifier G3	Utility	9V	18	9.5, 38	4.7	-4°F to 122°F	26	
	Vision LX	Utility	9V	18	9.5, 38 80	4.7	-4°F to 122°F	26	

*transmitter data listed

Schonstedt (U)	Model	Type	Drive	Weight (lbs)	Boring Diameter (in)	Max. Bore (ft)	Pit Size	Cycles/Minute	Temp Range
	XTpc-82	Pipe/Cable	19V	12	82	2.8	-4°F to 140°F	27.7	
	XTpc-33	Pipe/Cable	19V	12	33	2.8	-4°F to 140°F	27.7	
	XT512	Sonde/Camera	19V	12	0.512	2.7	-4°F to 140°F	27.7	
	Ga-92XT	Magnetic	19V	24	N/A	2.4	-13°F to 140°F	26	
	Ga-72Cd	Magnetic	2.9V	60	N/A	2.5	-13°F to 140°F	34.5	
	Ga-52Cx	Magnetic	2.9V	40	N/A	2.5	-13°F to 140°F	42.3	
	MPC-800	Pipe/Cable, Magnetic	2.9V	12/24	82	16	-13°F to 140°F	27.7	

PIERCING TOOLS

Company	Model	Type Drive	Weight (lbs)	Boring Diameter (in)	Max. Bore (ft)	Pit Size	Cycles/Minute
Footage Tools	U215	pneumatic	23	2	150	3 x 6	400
	U262	pneumatic	56	2.5	150	3 x 6	400
	U300	pneumatic	75	3	150	3 x 6	400
	U400	pneumatic	108	4	150	3 x 6	400
HammerHead Trenchless Equipment	2.50" RH PP DF	pneumatic	50	2.64	100	4 X 7.6	385
	2.50" RH SR	pneumatic	50	2.64	100	4 X 7.6	385
	2.50" RH SR MT	pneumatic	52	2.64	100	4 X 7.6	385
	2.50" RH PP DF MT	pneumatic	51	2.64	100	4 X 7.6	385
	2.50" RH PP SW DF	pneumatic	31	2.64	75	4 X 7.6	600
	2.50" RH PP SW DF MT	pneumatic	35	2.64	75	4 X 7.6	600
	3.00" CAT PP DF	pneumatic	69	76.00	150	4 X 7.6	370
	3.00" AH PP DF	pneumatic	67	76.00	150	4 X 7.6	370
	3.00" RH PP DF	pneumatic	67	76.00	150	4 X 7.6	370
	3.00" RH SR	pneumatic	67	3.00	150	4 X 7.6	370
	3.00" RH PP DF MT	pneumatic	67	76.00	150	4 X 7.6	370
	3.00" RH SR MT	pneumatic	67	3.00	150	4 X 7.6	370
	3.00" RH PP SW DF	pneumatic	50	3.00	75	4 X 7.6	484
	3.00" RH PP SW DF MT	pneumatic	54	3.00	75	4 X 7.6	484
	3.50" CAT PP DF	pneumatic	71	3.50	150	5 X 7.6	370
	3.50" RH PP DF	pneumatic	71	3.50	150	5 X 7.6	370
	3.50" RH PP DF MT	pneumatic	71	3.50	150	5 X 7.6	370
	4.00" RH PP DF	pneumatic	131	3.88	150	6 X 7.6	317
	4.00" RH PP DF MT	pneumatic	133	3.88	150	6 X 7.6	317
	4.00" CAT PP DF	pneumatic	148	3.96	150	6 X 7.6	330
	4.00" RH SR	pneumatic	136	3.88	150	6 X 7.6	370
	4.00" RH SR MT	pneumatic	136	3.88	150	6 X 7.6	370
	4.38" CAT PP DF	pneumatic	102	4.38	150	7 X 7.6	315
	5.125" SR	pneumatic	214	5.25	150	8 X 7.6	333

5.125" CAT PP DF	pneumatic	257.4	5.13	150	8 X 7.6	362
5.125 PP DF	pneumatic	244.8	5.13	150	8 X 7.6	334
5.50" SR BU	pneumatic	170	5.50	150	6 X 7.6	370

5.50" SR BU MT	pneumatic	170	5.50	150	6 X 7.6	370
5.625" PP BU DF	pneumatic	247.9	5.63	150	8 X 7.6	334
5.75" SR	pneumatic	305	5.88	150	8 X 7.6	300

RH-replaceable head; SR-screw reverse; PP-Power Port; AH-Active Head; BL-boltless; CAT-Catamount; SW-Sidewalker; AR-air reverse; BU-bulbed; DF-debris free; MT-MoleTrac

Hudco	Model	Type Drive	Weight (lbs)	Boring Diameter (in)	Max. Bore (ft)	Pit Size	Cycles/Minute
	HP200	pneumatic	28	2	75	1 x 4	500
	HP200Q	pneumatic	28	2	75	1 x 4	500
	HP310	pneumatic	78	3.1	150	2 x 5	500
	HP310Q	pneumatic	78	3.1	150	2 x 5	500
	HP300SS	pneumatic	50	3	75	1 x 4	600
	HP312	pneumatic	78	3.1	150	2 x 5	500
	HP400	pneumatic	136	4	200	2 x 6	400
	HP400Q	pneumatic	136	4	200	2 x 6	400

TT Technologies	Model	Type Drive	Weight (lbs)	Boring Diameter (in)	Max. Bore (ft)	Pit Size	Cycles/Minute
	Grundosteer 70	pneumatic	85	3	200	2 x 7	400
	P45 Grundomat 1-3/4	pneumatic	20	1-3/4	75	1 x 3.5	580
	P55 Grundomat 2	pneumatic	31	2	75	1 x 3.5	480
	P65 Grundomat 2-1/2	pneumatic	55	2-1/2	100	2 x 4	460
	P65-PK Grundomat	pneumatic	41	2-1/2	100	2 x 3.5	640
	P75 Grundomat 3	pneumatic	70	3	150	2 x 5	400
	P75-PK Grundomat 3	pneumatic	62	3	100	2 x 4	460
	P85 Grundomat 3-1/3	pneumatic	101	3-1/3	150	2 x 5	390
	P85-PK Grundomat 3-1/3	pneumatic	88	3-1/3	100	2 x 4	480
	P95 Grundomat 3-3/4	pneumatic	143	3-3/4	200	2 x 5	320
	P95-PK Grundomat 3-3/4	pneumatic	123	3-3/4	150	2 x 5	360
	P100 Grundomat 4	pneumatic	148	4	200+	2 x 5.5	320
	P100-PK Grundomat 4	pneumatic	124	4	200	2 x 5	400

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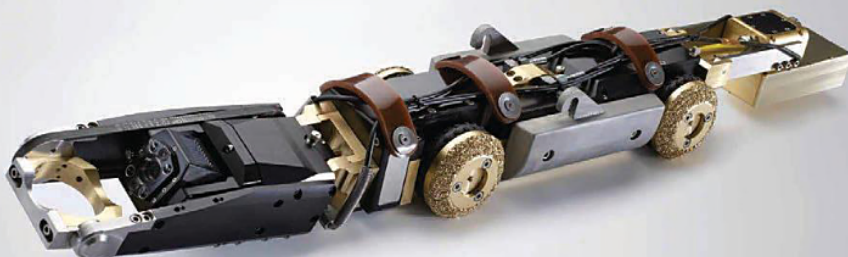
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PIERCING TOOLS

Company	Model	Type/Drive	Weight (lbs)	Boring Diameter Range (in)	Max. Bore Length (ft)	Pit Size (ft)	Cycles/Minute	
	P110 Grundomat 4-1/4	pneumatic	215	4-1/4	200+	2 x 5.5	325	
	P130 Grundomat 5	pneumatic	258	5	300+	2 x 6	340	
	P145 Grundomat 5-3/4	pneumatic	370	5-3/4	300+	2 x 7	310	
	P160 Grundomat 6-1/4	pneumatic	437	6-1/4	300+	2 x 7	320	
	P180 Grundomat 8	pneumatic	573	7	300+	2 x 8	280	
	McLaughlin	Hole Hammer VHH180	pneumatic	18	1.8	100	1x37	580
		Hole Hammer VHH180RT	pneumatic	19	1.8	100	1x38	580
		Hole Hammer VHH200	pneumatic	29	2	100	1x38	480
		Hole Hammer VHH200RT	pneumatic	29	2	100	1x39	480
Hole Hammer VHH250		pneumatic	48	2.5	100	1x48	460	
Hole Hammer VHH250RT		pneumatic	49	2.5	100	1x49	460	
Hole Hammer VHH300		pneumatic	71	3	100	1x53	400	
Hole Hammer VHH300RT		pneumatic	72	3	100	1x54	400	
Hole Hammer VHH330		pneumatic	91	3.3	100	1x53	400	
Hole Hammer VHH330RT		pneumatic	92	3.3	100	1x54	400	
Hole Hammer VPT200		pneumatic	28	2	100	1x46	470	
Hole Hammer VPT250		pneumatic	58	2.6	100	1x39	385	
Hole Hammer VPT250 Short		pneumatic	34	2.5	100	1x39	385	
Hole Hammer VPT250 RT		pneumatic	57	2.6	100	1x39	385	
Hole Hammer VPT300		pneumatic	76	3	100	1x57	370	
Hole Hammer VPT 300 RT	pneumatic	74	3	100	1x57	370		
Hole Hammer VPT400	pneumatic	136	4	100	1x64	370		
Hole Hammer VPT500	pneumatic	214	5.25	100	1x80	333		

PIPE FUSION

Company	Model	Input Voltage Required	Min. Power Required	Pipe Diameter Range (in)	Wheel/Track	
GF Piping Systems	BS4	120 VAC/240VAC	3 KW	1/2 IPS - 4 IPS	No wheel cart	
	14M	120 VAC/240 VAC	3 KW	3/4 CTS - 4 DIPS	opt wheel cart	
	28CQ	120 VAC/240 VAC	4 KW	2 IPS - 8 DIPS	opt wheel cart	
	28HP	120 VAC/240 VAC	4 KW	2 IPS - 8 DIPS	wheel	
	28EP	120 VAC/240 VAC	7 KW	2 IPS - 8 DIPS	wheel	
	414CQ	120 VAC/240 VAC	5 KW	4 IPS - 14 IPS	wheel	
	414HP	120 VAC/240 VAC	5 KW	4 IPS - 14 IPS	wheel	
	414EP	240 VAC	7 KW	4 IPS - 14 IPS	wheel	
	4145C	240 VAC	self contained	4 IPS - 14 IPS	wheel	
	414HD	240 VAC	self contained	4 IPS - 14 IPS	4WD/steering	
	6205C	240 VAC	self contained	6 IPS - 20 IPS	wheel	
	824EP	240 VAC 3 phase	12 KW, 240V	8 IPS - 24 IPS	wheel	
	1442EP	208 VAC 3 phase Y 208V 3 phase Y	40 KW,	14 IPS - 42 IPS	wheel	
	Integrity Fusion Products	1 Fuse 105	240 VAC	7 KW	1/2 IPS - 48 IPS	no
		McElroy				
	McElroy	Mini-Mc	100 - 120V, 50/60Hz, 1Ph 200 - 240V, 50/60Hz, 1Ph	300 Watts	1/2 CTS - 1 IPS	no
1LC (locking cam)		100 - 120V, 50/60Hz, 1Ph 200 - 240V, 50/60Hz, 1Ph	100 Watts	1/2 CTS - 1 IPS	no	
2LC (locking cam)		100 - 120V, 50/60Hz, 1Ph 200 - 240V, 50/60Hz, 1Ph	800 Watts	1/2 CTS - 2' IPS	opt wheel cart	
2CU (combination unit)		100 - 120V, 50/60Hz, 1Ph 200 - 240V, 50/60Hz, 1Ph	800 Watts	1/2 CTS - 2 IPS	no	
Pit Bull 14		100 - 120V, 50/60Hz, 1Ph 200 - 240V, 50/60Hz, 1Ph	2.5 KW	1 IPS - 4 DIPS	opt wheel cart	
Pit Bull 26		100 - 120V, 50/60Hz, 1Ph 220 - 240V, 50/60Hz, 1Ph	3 KVA, 2.5 KW	2 IPS - 6 DIPS	opt wheel cart	
Pit Bull 28		220 - 240V, 50/60Hz, 1Ph	1.75 KW	2 IPS - 8 DIPS	no	
DynaMc 28 HP (hand pump)		100 - 120V, 50/60Hz, 1Ph 220 - 240V, 50/60Hz, 1Ph	3 KVA, 2.9 KW	2 IPS - 8 DIPS	no	
DynaMc 28 EP (electric pump)		100 - 120V, 50/60Hz, 1Ph 220 - 240V, 50/60Hz, 1Ph	3 KVA, 2.9 KW	2 IPS - 8 DIPS	no	
Rolling 28		100V, 50/60Hz, 1Ph 110V, 50Hz, 1Ph 120V, 60Hz, 1Ph 208 - 240V, 60Hz, 1Ph	4.1 KVA, 3.7 KW 3.4 KVA, 3.2 KW 3.5 KVA, 3.2 KW	2 IPS - 8 DIPS	wheel	
Rolling 28 HP		120V, 50/60Hz, 1Ph	3.28 KVA, 3 KW		wheel	
TracStar 28		on-board generator	self-contained gas	or 2 IPS - 8 DIPS	track	
Pit Bull 250		240V, 60Hz, 1Ph/220 - 240V, 50/60Hz, 3Ph	3 KW	63mm - 250mm	no	
DynaMc 250 HP (hand pump)		220 - 240V, 50/60Hz, 1Ph	4.2 KVA, 4.2 KW	63mm - 250mm	no	

DynaMc 250 EP (electric pump)	100 - 120V, 50/60Hz, 1Ph 220 - 240V, 50/60Hz, 1Ph	4.2 KVA, 4.2 KW	63mm - 250mm	no
DynaMc 250 Auto	100 - 120V, 50/60Hz, 1Ph 220 - 240V, 50/60Hz, 1Ph	3 KVA, 3 KW	63mm - 250mm	no
Rolling 250	220 - 240V, 50Hz, 1Ph	5.2 KVA, 4.8 KW	63mm - 250mm	wheel
TracStar 250	on-board generator self-contained diesel	self-contained gas	or 63mm - 250mm	track
Pit Bull 412	240V, 50/60Hz, 1Ph	3 KW	4 IPS - 12 DIPS	no
DynaMc 412 HP (hand pump)	220 - 240V, 50/60Hz, 1Ph	4.2 KVA, 4.2 KW	4 IPS - 12 DIPS	no
DynaMc 412 EP (electric pump)	100 - 120V, 50/60Hz, 1Ph 220 - 240V, 50/60Hz, 1Ph	4.2 KVA, 4.2 KW	4 IPS - 12 DIPS	no
DynaMc 412 Auto	110 - 200V, 50/60Hz, 1Ph 220 - 240V, 50/60Hz, 1Ph	3 KVA, 3 KW	4 IPS - 12 DIPS	no
Rolling 412	220 - 240V, 50/60Hz, 3Ph	6.2 KVA, 5.8 KW	4 IPS - 12 DIPS	wheel
TracStar 412	on-board generator	self-contained diesel	4 IPS - 12 DIPS	track
Pit Bull 618	220 - 240V, 50/60Hz, 1Ph	3 KW	6 IPS - 18 OD	no
Rolling 618	220 - 240V, 50/60Hz, 3Ph on-board generator	8.0 KVA, 7.4 KW self-contained gas	6 IPS - 18 OD	wheel
TracStar 618	on-board generator	self-contained diesel	6 IPS - 18 OD	track
Pit Bull 500	240V, 50/60Hz, 1Ph	4 KW	180mm - 500mm	no
TracStar 500	on-board generator	self-contained diesel	180mm - 500mm	track
MegaMc 824	220 - 240V, 50/60Hz, 3Ph	29.8 KVA, 28.1 KW	8 IPS - 24 OD	wheel
TracStar 630	on-board generator	self-contained diesel	8 IPS - 24 OD	track
MegaMc 1236	220 - 240V, 50/60Hz, 3Ph	39.4 KVA, 37.7 KW	12 IPS - 36 OD	wheel
TracStar 900	on-board generator	self-contained diesel	12 IPS - 36 OD	track
TracStar 1200	on-board generator	self-contained diesel	16 OD - 48 OD	
MegaMc 1648	220 - 240V, 50/60Hz, 3Ph	45 KVA, 43.8 KW	16 OD - 48 OD	wheel
MegaMc 2065	220 - 240V, 50/60Hz, 3Ph 380 - 415V, 50Hz, 3Ph	50 KVA, 48.8 KW 65 KVA, 61 KW	20 OD - 65 OD	wheel
MegaMc 1600	220 - 240V, 50/60Hz, 3Ph 380 - 415V, 50Hz, 3Ph	65 KVA, 61 KW	500mm - 1,600mm 20 OD - 65 OD	wheel
Talon	on-board generator	self-contained diesel	54 OD - 2,000 mm OD	

PIPE JACKING/MICROTUNNELING

Company	Model	Type Drive	Weight (lbs)	Boring Diameter Range (in)	Max. Bore Length (ft)	Pit Size	Total Thrust
Akkerman	TBM 420	hydraulic	10,000	51-55	1,000	12x20	400T
	TBM 480	hydraulic	5,800	58-62	1,000	12x20	400T
	TBM 48 SC	hydraulic	15,000	48-52	1,000	12x20	400T
	TBM 540	hydraulic	14,500	65-69	1,000	12x20	800T
	TBM 600	hydraulic	23,000	72-76	1,000	12x20	800T
	TBM 660	hydraulic	20,000	79-83	1,000	12x20	800T
	TBM 720	hydraulic	26,280	86-90	1,000	12x20	1,200T
	TBM 780	hydraulic	32,300	93-100	1,000	12x20	1,200T
	EX 50		varies	87-170	unlimited	20x30	1,200T
	MTBM SL30C	electric	13,000	30-38	500	10x14	400T
	MTBM SL34C	electric	16,000	34-42	500	10x14	400T
	MTBM SL36C	electric	18,500	36-44	500	10x14	400T
	MTBM SL44C	electric	21,500	44-52	1,500	10x14	400T
	MTBM SL46C	electric	23,500	48-56	1,500	10x14	800T
	MTBM SL51C	electric	25,500	51-59	1,500	10x14	800T
	MTBM SL60C	electric	36,000	60-72	1,500	12x14	1,200T
	MTBM SL74C	electric	36,000	74-102	1,500	12x14	1,200T
	MTBM SL72P	electric	23,000	72+	1,500+	varies	1,200T
	MTBM SL86P	electric	25,000	86+	1,500+	varies	1,200T
	MTBM SL100P	electric	29,000	100+	1,500+	varies	1,200T
	MTBM SL114P	electric	33,200	114+	1,500+	varies	1,200T
	GBM 240A		4,500	4.25 - 24	400+	10x10	100T
	GBM 308A		6,000	4.25 - 28.5	400+	8x8	100T
	GBM 339A		6,600	4.25 - 31.5	400+	9x9	100T
	GBM 4800 Series		13,000	4.25 - 48	400+	12x12	265T
	NOTE: Pit size assumes pipe length is 8 ft.						
Herrenknecht	BM150DT	hydraulic	varies	6 - 11	varies	1.2M	15T
	BM150D	hydraulic	varies	6 - 11	varies	1.5M	25T
	BM300	hydraulic	varies	12 - 22	varies	2M	75T
	BM500	hydraulic	varies	19.7 - 38.6	varies	3.2M	160T
	AVN250	hydraulic	varies	14.29 - 16.34	varies	2M	115T
	AVN300	hydraulic	varies	16.34 - 22.24	varies	3M	260T
	AVN400	hydraulic	varies	22.24 - 26.18	varies	3M	260T
	AVN500	hydraulic	varies	26.18 - 30.12	varies	3M	260T
	AVN600	hydraulic	varies	30.12 - 34.45	varies	3M	260T
	AVN700	hydraulic	varies	34.45 - 38.38	varies	3.2M	260T
	AVN800	hydraulic	varies	38.38 - 43.70	varies	3.2M	260T
	AVN800	hydraulic	varies	43.70 - 50.98	varies	4.5 x 3.5M	340T
	AVN 1000	hydraulic	varies	50.98 - 60.63	varies	4.5 x 3.5M	340T
	AVN 1200	hydraulic	varies	57.11 - 72.44	varies	5 x 4M	340/520T
AVN1500	hydraulic	varies	72.44 - 77.17	varies	5 x 4M	varies	
AVN1600	hydraulic	varies	74.01 - 85.04	varies	5.5 x 4.5M	varies	
NOTE: BM equipment complete with self-contained generator; BM150DT can be operated from collector sewer. Other diameters available.							
ICON Tunnel Systems/ Bohrtec	BM400	hydraulic	5,511	8" - 24"	0-500'	10'	100T
	BM500	hydraulic	12,100	8" - 40"	0-500'	12'	150T
	BM400LS	hydraulic	6,930	8" - 36"	0-500'	16'	150T
	BM400LSC	hydraulic	8,599	8" - 36"	0-500'	13.5'	200T
	BM600LS	hydraulic	9,460	8" - 48"	0-500'	20'	262T
	BM600LSC	hydraulic	12,345	8" - 48"	0-500'	16'	262T
	BM800L	hydraulic	17,636	8" - 57.5"	0-500'	22-24'	320T
	BM800LS	hydraulic	17,636	8" - 57.5"	0-500'	22-24'	320T
	NOTE: Max Bore Range varies depending on project geo-tech and soil data; Pit Size Lengths are approximate and assume a 2 meter pipe length.						

The Robbins Company	Model	Drive	Capacity (lbs)	Weight (lbs)	Length (ft)	Width (ft)	Height (ft)
DN250	electric	varies	14.5	varies	varies	147T	
DN300	electric	varies	16.2	varies	varies	147T	
DN400	electric	varies	22.24	varies	varies	196T	
DN450	electric	varies	24.22	varies	varies	196T	
DN500	electric	varies	26.18	varies	varies	294T	
DN600	electric	varies	30.71	varies	varies	294T	
DN800	electric	varies	43.7	varies	varies	392T	
DN900	electric	varies	47.64	varies	varies	392T	
DN1,000	electric	varies	50.98	varies	varies	392T	
DN1,200	electric	varies	59.25	varies	varies	588T	
DN1,350	electric	varies	65.35	varies	varies	588T	
DN1,500	electric	varies	71.26	varies	varies	588T	
DN1,600	electric	varies	75.98	varies	varies	784T	
DN1,800	electric	varies	84.65	varies	varies	784T	
DN2,000	electric	varies	95.47	varies	varies	784T	
DN2,200	electric	varies	107.28	varies	varies	1,176T	
DN2,400	electric	varies	119.1	varies	varies	1,176T	
DN2,600	electric	varies	123.11	varies	varies	1,176T	
DN3,000	electric	varies	142.72	varies	varies	1,568T	

*Electric drive is infinitely variable via variable frequency drive.
 *MTBM can typically be up sized by 20% depending on geology and other factors.
 *Shaft dimensions are dictated by pipe length and jacking frame design.
 *Non standard machine diameters are available

PIPELAYERS

Company	Model	HP	Operating Weight (lbs)	Lifting Capacity (lbs)
Caterpillar	PL61	125	37,480	40,000
	PL83	310	106,807	160,000
	PL87	366	120,119	214,000
Midwestern Mfg.	M10R-JD410K/CAT 420E	107/89	18,000	10,000
	M16R-JD444K/CAT 930H	124/149	26,500	16,000
	M33R-JD744K/CAT 980H	304/318	45,000	33,000
	M510C-JD450J/CAT D4K	70/92	23,000	10,000
	M515C-JD550K/CAT D4K	85/92	24,000	15,000
	M520C-JD650/CAT D5K	101/104	26,000	20,000
	M540C-JD700K	125	42,000	40,000
	M540CK-CAT D6K (2)	125	40,000	40,000
	M550C-CAT D6N	150	50,000	50,000
	M560C-JD750K	165	48,000	60,000
	M572C-CAT D6T	205	65,000	90,000
	M572CXL-JD850K	205	70,000	100,000

M583C-JD1050J/CAT D8R	335/305	105,000	140,000
M594C-CAT D9H	410	128,500	200,000
561MMC-CAT 561*	105	35,000	40,000
571MMC-CAT 571*	200	50,800	60,000
572MMC-CAT 572*	200	61,300	90,000
583MMC-CAT 583*	300	90,300	140,000
594MMC-CAT 594*	410	123,600	200,000

*hydraulic conversion kits

Volvo	Model	Capacity (lbs)	Weight (lbs)	Length (ft)	Width (ft)	Height (ft)
PL4608		315	126,708	176,370		
PL4611		315	150,220	242,500		
PL3005D		227	77,407 - 79,818	78,350		

PIPE LIFTING/HANDLING

Company	Model	Capacity (lbs)	Pipe Diameter (in)	Dimensions (beam)	Weight (lbs)	Carrier Type
LaValley Industries	DHS	20,000	4 - 24	83" x 22" x 45.3"	2,100	12-20 metric ton excavator
	DH	30,000	4 - 24	83" x 33" x 64"	2,892	20-36 metric ton excavator
	DHL	40,000	20 - 48	112" x 46" x 69"	3,650	36-49 metric ton excavator
	DHXL	50,000	28 - 56	112" x 46" x 70"	4,000	65-75 metric ton excavator
	DHXXL	60,000	40 - 60	129" x 46" x 71"	5,000	80-90 metric ton excavator
Vacuworx	MC3	6,600	4 - 12	5'3" L; 6'4" H*	925	hydraulic excavator, crane, pipelayer, wheel/track loader
	MC5	11,000	4 - 18	7'3" L; 6'H*	1,350	hydraulic excavator, crane, pipelayer, wheel/track loader
	RC10	22,000	4 - 108	9'L; 6'H*	1,971	hydraulic excavator, crane, pipelayer, wheel/track loader
	RC12	26,400	4 - 108	9'L; 6'H*	1,980	hydraulic excavator, crane, pipelayer, wheel/track loader
	RC16	35,200	4 - 108	9'L; 6'6"H*	2,324	hydraulic excavator, crane, pipelayer, wheel/track loader
	RC20	44,000	4 - 108	9'L; 7'H*	2,418	hydraulic excavator, crane, pipelayer, wheel/track loader

*with lug



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PIPE RAMMING

Company	Model	Type Drive	Weight (lbs)	Boring Diameter Range (in)	Max. Bore Length (ft)	Surface Launch (ft)
HammerHead	4" RH SR	air	136	2 - 4	300	2 X 5
	5.125" SR	air	214	4 - 8	300	2 X 5
	5.50" SR	air	170	2 - 4	300	2 X 5
	5.75" SR	air	305	6 - 12	300	3 X 30
	7" AR	air	511	8 - 20	300	3 X 30
	8" AR	air	900	8 - 24	300	3 X 30
	12" AR	air	1,568	12 - 30	300	3 X 30
	16" AR	air	2,701	16 - 48	300	3 X 30
	20" AR	air	5,750	20 - 54	300	3 X 30
	24" AR	air	9,831	24 - 72+	300	3 X 40
34" AR	air	27,500	36 - 180	300	3 X 40	

RH-replaceable head; SR-screw reverse; AR-air reverse.

Note: Maximum ramming varies based on pipe diameter installed, ground conditions and ramming tool used.

Poweram	Model	Type Drive	Weight (lbs)	Boring Diameter Range (in)	Max. Bore Length (ft)	Surface Launch (ft)
2020	hydraulic	1,300	up to 12	300+	2' x 7' 3"	
1425	hydraulic	400	up to 4	100+	3' x 4' 4"	
1825	hydraulic	615	up to 6	150+	3' x 4' 2"	
1915	hydraulic	1,000	up to 12	200+	3' x 6'	
7000	hydraulic	3,400	up to 16	500+	3' 6" x 11"	

TT Technologies	Model	Type Drive	Weight (lbs)	Boring Diameter Range (in)	Max. Bore Length (ft)	Surface Launch (ft)
Mini-Atlas	air	132	2 - 8	50	3 x 20	
Titan	air	302	8 - 15	80	3 x 30	
Mini-Olympus	air	385	4 - 16	80	3 x 30	
Olympus	air	507	8 - 20	115	3 x 30	
PCG180 Reversible	air	490	8 - 20	115		
Hercules	air	811	12 - 20	130	3 x 30	
HV220 Reversible	air	945	12 - 20	130	3 x 30	
Mini-Gigant	air	1,014	8 - 24	115	3 x 20	
Gigant	air	1,356	15 - 32	165	3 x 30	
PCG210	air	866	10 - 20	150	3 x 30	
PCG270 Reversible	air	1,540	15 - 32	165	3 x 30	
Koloss	air	2,601	20 - 48	230	3 x 30	
Goliath	air	5,434	24 - 56	265	3 x 30	
Goliath Reversible	air	5,434	24 - 56	265		
Taurus	air	10,580	56 - 78	265	3 x 30	
Apollo	air	25,000	56 - 122	300	3 x 30	

SKID STEER LOADERS

(MINI CRAWLERS/ALL SURFACE LOADERS)

Company	Model	HP	Operating Weight (lbs)	Lift Capacity (lbs)	Max. Reach (height to pin) (in)	Bucket Capacity (cu. ft.)	
Bobcat	S70	23.5	2,795	700	94.5	4.7	
	S450	49	5,027	1,300	109.5	10.8	
	S510	49	6,213	1,650	114.5	14	
	S530	49	6,480	1,850	119	14	
	S550	61	6,213	1,750	114.5	14	
	S570	61	6,480	1,950	119	14	
	S590	66	6,593	2,100	119	14	
	S630	74	7,610	2,180	121	15.4	
	S650	74	8,061	2,690	124	15.4	
	S750	85	8,730	3,200	132	15.4	
	A770	92	9,460	3,325	132	15.4	
	S770	92	9,175	3,350	132	15.4	
	S850	92	10,008	3,950	144	22.4	
	Case	SR130	45.8	5,180	1,300	112	11.3 - 23.3
		SR160	57	5,645	1,600	112	11.3 - 23.3
SR175		64	6,270	1,750	122	11.3 - 23.3	
SV185		57	6,570	1,850	120	13.1 - 27.5	
SR210		68	6,970	2,100	123	13.1 - 27.5	
SR240		68	7,400	2,400	125.1	14.1 - 27.5	
SR270		84	8,117	2,700	125.1	14.1 - 27.5	
SV280		68	8,090	2,800	130	14.1 - 27.5	
SV300		84	8,655	3,000	130	14.1 - 27.5	
Caterpillar	226D	60	5,705	1,550	111	12.7	
	232D	60	6,213	1,850	118	12.7	
	236D	73.2	6,559	1,800	122.9	14	
	242D	73.2	6,980	2,150	121.1	14	
	246D	72.9	7,424	2,150	124.2	15.4	
	262D	72.9	8,011	2,700	124.9	15.4	
	272D2	95	8,768	3,400	127.1	15.4	
	272D2 XHP	106	9,255	3,650	128.6	16.7	
Ditch Witch	SK350	20	1,660	1,030	70.4	4.2	
	SK752	24.8	2,926	860	83	varies	
	SK850	37	3,100	860	83	9 (varies)	
	SK850 Footings	36.9	3,840	N/A	57	N/A	
	John Deere	313	45	5,150	1,260	109	
315		45	5,200	1,500	115		
318E		63	3,178	1,950	120.2		
320E		69	7,150	2,190	121.5		
326E		69	8,200	2,700	125.4		
328E		83	8,770	2,800	126.6		
332E		97	9,610	3,200	127		

Hyundai	HSL650-7A	46.6	5,787	1,433	114.8	10.9
	HSL850-7A	72.7	7,381	1,892	121.3	13.1
New Holland	L213	43	5,000	1,300	112	N/A
	L215	49	5,300	1,500	112	N/A
	L218	57	5,930	1,800	120	N/A
	L220	57	6,470	2,000	121	N/A
	L223	68	7,380	2,250	129.5	N/A
	L225	76	7,900	2,500	129.5	N/A
	L230	84	8,300	3,000	131.1	N/A
Vermeer	S450TX (diesel)	24.8	2,300; 2,430	1,430	72	4 - 6
	S800TX (intl.)	35	2,950; 3,065	2,400	84.5	6
	S800TX (dom.)	40	2,950; 3,065	2,400	84.5	6
	S725TX	24.8	2,880; 3,020	2,145	84.5	4 - 6
	CTX50	25	2,100; 2,245	1,715	72	4 - 6
Volvo	MC60C	47	6,153		22	
	MC70C	59	6,355		22	
	MC85C	59	6,724		33.8	
	MC95C	59	7,054		33.8	
	MC110C	84	7,954		23	
	MC115C	84	8,232		34	
MC135C	92	9,054		35		

TRENCHING MACHINES, CHAIN

Company	Model	HP	Max. Dig Depth (in)	Max. Dig Width (in)	Operating Weight (lbs)	
Ditch Witch	C16X	16	36	6	1,895	
	C24X	22	36	6	1,915	
	C30X	31	48	6	2,100	
	RT16	16	36	6	1,020	
	RT16 w/tracks	16	36	6	1,020	
	RT20	20.8	36	6	1,120	
	RT20 w/tracks	20.8	36	6	1,120	
	RT24	22.3	48	8	1,120	
	RT24 w/tracks	22.3	48	8	1,238	
	RT45	39	63	12	4,200	
	RT55	60	62	12	5,610	
	RT80 Quad	83	62	12	10,710	
	RT115	115	97	24	7,980	
	RT115 Quad	115	97	24	15,240	
	RT120	115	97	24	19,300	
	RT120 Quad	121	97	24	19,300	
	R300 Zahn 2wd	30	36	8	1,048	
R300 Zahn 4wd	30	48	12	1,290		
SK850 Footings	35.1	36	6-16	3,840		
Tescmec USA	TRS-775**	220	96	24	43,000	
	TRS-885**	205	60	18	46,000	
	TRS-975**	300	120	36	70,000	
	TRS-985**	335	72	24	78,000	
	TRS-1150**	440	144	36	117,000	
	TRS-1150XHD**	440	168	42	116,000	
	TRS1075**	335	120	36	90,000	
	TRS-1085**	335	96	28	95,000	
	TRS-1100**	385	144	36	110,000	
	TRS-1175XHD**	440	144	42	147,000	
	TRS-1475**	630	192	48	240,000	
	TRS-1675**	800	288	72	275,000	
	M3*	350	144	40	135,000	
	M5*	440	168	42	161,000	
	*mechanical design; **hydraulic design					
	Toro	Pro Sneak 365	35.5	36	6	2,770
		RT600	65	60	16	6,050*
RT1200		121	84	18	14,000	
TRX-16		16	48	6	1,114	
TRX-20		20	48	6	1,133	
TRX-26		26	48	8	1,248	
*base unit						
Trencor	T1060	350	144	36	85,000	
	T1360	440	142	42	148,000	
	T1460	630	240	54	185,000	
	T1660	800	300	60	250,000	
	T1760	950	360	72	325,000	
Vermeer	RTX100	13	30	6	910	
	RTX150	20.5	36	6	1,000	
	RTX250	25	48	8	1,550	
	RTX450	49	60	12	6,205	
	RTX550	65/67	60	12	7,800	
	RTX750	74	60	12	9,330	
	RTX1250	125	72	12	13,820	
	XTS1250	120			17,950	
	T555 III	185	96	24	31,000	
	T558 III	185	72	24	52,000	
	T655 III	250	96	26	56,000	
T755 III	275	120	36	75,000		
T855 III	350	144	36	94,000		

T858 III	350	96	30	98,000
T955 III	415	144	42	109,000
T1055 III	415	168	42	124,000
T1155 III	540	192	42	170,000
T1255 III	600	216	48	205,000

TRENCHING MACHINES, ROCKSAW

Company	Model	HP	Max. Digging Depth (in)	Max. Digging Width (in)	Operating Weight (lbs)
Tesmec USA	TRS-975	300	48	12	68,000
	TRS-1075	335	48	12	90,000
	TRS-1100	385	54	14	105,000
	TRS-1275	540	60	16	150,000
Vermeer	RTX550	65/67	60	12	7,800
	RTX1250	120	72	12	13,820
	T555 III	185	36	6	31,000
	T855 III	350	54	14	94,000

TRENCHING MACHINES, WHEEL

Company	Model	HP	Max. Digging Depth (in)	Max. Digging Width (in)	Operating Weight (lbs)
Buckeye	7200	350	7'4"	24"	50,000
	9200 RT	400	7'4"	30"	57,500
	9200 Magnum Tracked	400	8'	30"	90,000
	9200 T	550	9'	48"	12,000
Ditch Witch	C12	12	24	6	1,195
	C14	13.5	24	6	1,191
	C16	16	30	6	1,528
	RT30	24.8	42	8	3,050
	RT45	42.2	63	12	4,200
	RT55	62	62	12	5,610
	RT80	74	62	12	11,580
	RT80 Quad	83	62	12	11,580
	RT100	100	96	24	19,300
	RT120	121	96	24	19,300
	RT120 Quad	121	96	24	19,300
Tesmec USA	TRS-1075	335	96	40	90,000
	TRS-1175XHD	440	108	54	147,000
	TRS-1375	540	108	66	175,000
	TRS-1575	630	120	72	242,000
	TRS-1675	800	120	93	275,000
Trencor	T1360W	440	108	66	150,000

VACUUM EXCAVATORS

Company	Model	Air/Water	HP	Capacity (gal)	Compressor (cfm/psi)	Vacuum (cfm/Hg)	Mounting Option
AmeriVac Group	MV700		300	650*/1,250**	3,000	16"	truck
	MV700T		300	1,300*/1,250**	3,000	16"	truck
	MV1000TW		300	1,300*/1,250**	3,000	16"	truck
	MV1000TD		300	650*/1,900**	3,200	16"	truck
	MV1400		370	1,300*/2,500**	3,200	16"	truck
	*water; **debris						
Ditch Witch	FX20	water	27	150	N/A	543/15	trailer
	FX25	water	31	500	N/A	543/15	trailer
	FX30	water	25	500/800	N/A	500/15	trailer
	FXT30	air	25	200/400	10 Series - 200/200 12 Series - 300/250	500/15"	truck



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VACUUM EXCAVATORS

Company	Model	Air/ Water	HP	Capacity (gal)	Compressor (cfm/psi)	Vacuum (cfm/Hg)	Mounting Option
Ditch Witch	FX50	water	49	800/1,200	N/A	1,020/15"	trailer
	FXT50	air	49	500/800	10 Series - 200/200 12 Series - 300/250	1,020/15"	truck
	FX60	water	74	800/1,200	N/A	1,027/16"	trailer
	FXT60	water	74	500/1,200	N/A	1,027/16"	truck
	FX65	water	74	500/800/1,200	N/A	1,215/16"	trailer
	FXT65	air	74	500/800	10 Series - 200/200 12 Series - 300/250	1,027/16"	truck
	MV800	water	31	100	NA	543/15"	trailer
McLaughlin	VSK25-100G	Water	24	100	n/a	575/10	skid/truck
	V25 Gas	Water	24	500, 800, 1,200	n/a	575/15	skid/truck/trailer
	VX30 Gas	Water	31	500, 800, 1,200	n/a	575/15	trailer
	VX30	Water	31	250, 300, 500, 800	n/a	575/15	skid/truck/trailer
	VX50	Water	49 Tier 4 Final	500, 800	n/a	1,025/15	trailer
	VX70*	Water	67	500, 800, 1,200	n/a	1,025/15	skid/truck/trailer
	VX80	Water	85	500, 800, 1,200	n/a	1,025/15	skid/truck/trailer
	VX100XT AIR	Both	99	500, 800, 1,200	110 psi x 185 cfm	1,200/15	skid/truck/trailer
	MEGA Vac	Both	99	1,600, 2,000, 2,200, 2,600, 3,000	n/a	1,200/23**	skid/truck
	ECO 50 Truck Vac	Water	49 Tier 4 Final	500, 800	n/a	1,025/15	truck/trailer
	ECO 70/80	Water	67 hp/85 turbo hp	500, 800, 1200		1,025/15	truck/trailer
	ECO 100XT Air	Air/Water	99 hp	500, 800, 1200	185 cfm x 100 psi	1,200/15	truck/trailer
*international export only. **with deep option, ***70 international/80 domestic							
Ring-O-Matic	VL150	water	31	150	3,000	600/15"	skid/truck/trailer
	VL275	water	31	250	3,000	600/15"	skid/truck/trailer
	VL550	water	31	550	3,000	600/15"	skid/truck/trailer
	VL850	water	31	800	3,000	600/15"	skid/truck/trailer
	VL1300	water	31	1,300	3,000	600/15"	skid/truck/trailer
	275 VacEx	water	42	250	4,000	600/15"	skid/truck/trailer
	550 VacEx	water	42	550	4,000	600/15"	skid/truck/trailer
	850 VacEx	water	42	800	4,000	600/15"	skid/truck/trailer
	1300 VacEx	water	42	1,300	4,000	600/15"	skid/truck/trailer
	550 HiCFM VacEx	both	49/50/81	550	70/150/4,000	1,000/15"	skid/truck/trailer
	850 HiCFM VacEx	both	49/50/81	800	70/150/4,000	1,000/15"	skid/truck/trailer
	1000 HiCFM VacEx	both	49/50/81	1,000	70/150/4,000	1,000/15"	skid/truck/trailer
	1300 HiCFM VacEx	both	49/50/81	1,300	70/150/4,000	1,000/15"	skid/truck/trailer
	1600 HiCFM VacEx	both	49/50/81	1,600	70/150/4,000	1,000/15"	skid/truck
	2000 HiCFM VacEx	both	49/50/81	2,000	70/150/4,000	1,000/15"	skid/truck
	850 Vac Extreme	both	81/100	800	70/150/4,000	1,700/14"	skid/truck/trailer
	1000 Vac Extreme	both	81/100	1,000	70/150/4,000	1,700/14"	skid/truck/trailer
	1300 Vac Extreme	both	81/100	1,300	70/150/4,000	1,700/14"	skid/truck
	1600 Vac Extreme	both	81/100	1,600	70/150/4,000	1,700/14"	skid/truck
	2000 Vac Extreme	both	81/100	2,000	70/150/4,000	1,700/14"	skid/truck
	1000 Vac Extreme II	water	100	1,000	4,000	2,500/13"	skid/truck
	1300 Vac Extreme II	water	100	1,300	4,000	2,500/13"	skid/truck
	1600 Vac Extreme II	water	100	1,600	4,000	2,500/13"	skid/truck
	2000 Vac Extreme II	water	100	2,000	4,000	2,500/13"	skid/truck
	1000 Vac Extreme III	water	139	1,000	4,000	3,000/12"	skid/truck
	1300 Vac Extreme III	water	139	1,300	4,000	3,000/12"	skid/truck
	1600 Vac Extreme III	water	139	1,600	4,000	3,000/12"	skid/truck
2000 Vac Extreme III	water	139	2,000	4,000	3,000/12"	skid/truck	
Note: HiCFM= high cfm airflow							
Super Products	Mud Dog 1000	water	410	2,000	5,500	28"	
	Mud Dog 1200	water	410	2,400	5,500	28"	
	Mud Dog 1600	water	485	3,200	5,500	28"	
	Camel 1200 (HDX)	water	370	1,500	3,500 - 6,000	18" - 27"	
Utiliscope	VE-75		80	75	850	23"	N/A
	MV-300		80	300	850	23"	N/A
	MV-560		80	560	850	23"	N/A
	MV-800		80	800	850	23"	N/A
	MV-1200		80	1,200	850	23"	N/A
Vacmasters	System 1000	both	68	300/500	100/150	780/15"	truck, trailer
	System 3000	both	100	300	165/185	1,000/15"	truck
	System 4000	both	155	450/800	300/220	1,000/15"	truck
	System 6000	both	250	950 gal	350/250	1,866/15"	
	SpoilVac	water	25 or 35	200/1,200	N/A	476 or 800/15"	truck, trailer
Vacstar	VSH500DT	water	28	500	N/A	22	trailer
	VSH800DT	water	28	800	N/A	22	trailer
	VSH500GT	water	25	500	N/A	22	trailer
	VSH800GT	water	25	800	N/A	22	trailer
Vactor	HXX-PD	both	430	1,300*/12/15 yard**	185/150	5,250/28"	chassis
	HXX QuietPak	both	500	1,300*/12/15 yard**	185/150	6,200/28"	chassis
	HXX-824	both	380	1,300*/12/15 yard**	185/150	5,000/18"	chassis
	HXX-FN	both	380	1,300*/12/15 yard**	185/150	N/A	chassis
	HXX-Prodigy	both	300	600*/6 yard**	185/150	3,200/16"	chassis
*water; **debris							
Vac-Tron	EV 150 G	water	25 gas	150	4,000	550	trailer/skid
	LPMini 303G	water	27 gas	300	4,000	580	trailer/skid
	LP533 XDT	water	24 diesel	500	4,000	550	trailer/skid
	LP533 SDT	water	49 diesel	500	4,000	1,000	trailer/skid
	LP533 SGT	water	37 gas	500	3,000	1,000	trailer/skid
	LP833 XDT	water	24 diesel	800	4,000	550	trailer/skid
	LP833 SDT	water	49 diesel	800	4,000	1,000	trailer/skid
	LP833	water	37 gas	800	3,000	1,000	trailer/skid

2016 EQUIPMENT SELECTION GUIDE

MC535 SDT	water	83 diesel	500	2,000	1,000	trailer/skid
MC835 SDT	water	83 diesel	800	2,000	1,000	trailer/skid
AIR533 SDT	both	83	500	170/4,000	1,000	trailer/skid
AIR833 SDT	both	83	800	170/4,000	1,000	trailer/skid
CS500 GT	N/A	25 gas	500	N/A	550	trailer/skid
CS800 GT	N/A	25 gas	800	N/A	550	trailer/skid
HTV 1830	water	200 diesel	1,800	2,000	2,400	truck
ATV 1830	both	200 diesel	1,800	300/2,000	2,400	truck

WHEEL LOADERS

Company	Model	HP	Operating Weight (lbs)	Standard Bucket (cu. yds.)	Tip Load (lbs)	Travel Speed (mph)	
Case	21F XT	55	10,913	0.9 - 1.05	8,164 / 7,055	12.4 / 12.4	
	21F Z	55	11,272	0.9 - 1.31	8,291 / 6,997	12.4 / 12.4	
	121F XT	60	11,023	1.05 - 1.44	8,770 / 7,586	12.4 / 12.4	
	121F Z	60	11,618	1.05 - 1.44	8,738 / 7,234	12.4 / 12.4	
	221F	70	12,547	1.2 - 1.56	9,318 / 8,014	11.4 / 11.4	
	221F HS	70	12,547	1.2 - 1.56	9,318 / 8,014	18.6 / 18.6	
	321F	70	13,303	1.3 - 1.7	9,740 / 8,192	12.4 / 12.4	
	321F HS	70	13,303	1.3 - 1.7	9,740 / 8,192	20.6 / 20.6	
	521F	131	22,856	2.1 - 4.0	18,691 / 15,993	22.3 / 14.1	
	521F XT	131	24,585	2.1 - 4.0	15,839 / 13,477	22.3 / 14.1	
	521F XR	131	23,229	2.1 - 4.0	15,862 / 13,495	22.3 / 14.1	
	621F	162	26,711	2.1 - 4.5	21,081 / 17,895	24.0 / 15.5	
	621F XT	162	27,538	2.1 - 4.5	17,615 / 14,778	24.0 / 15.5	
	621F XR	162	27,073	2.5 - 4.5	17,760 / 15,031	24.0 / 15.5	
	721F	178	31,508	2.6 - 5.5	25,058 / 21,213	24.84 / 19.3	
	721F XT	178	32,567	2.6 - 5.5	21,222 / 17,846	24.84 / 19.3	
	721F XR	178	32,064	2.6 - 5.5	21,222 / 17,917	24.84 / 19.3	
	821F	212	38,874	3.0 - 4.5	29,921 / 25,261	24.84 / 17.2	
	821F XR	212	39,716	3.0 - 4.5	23,942 / 20,066	24.84 / 17.2	
	921F	225	43,777	4.0 - 4.75	34,505 / 28,757	24.84 / 17.2	
	921F XR	225	44,090	4.0 - 4.75	27,877 / 23,120	24.84 / 17.2	
	1021F	296	53,791	4.75 - 5.5	41,989 / 35,001	23.6 / 16.5	
	1021F XR	296	56,633	4.75 - 5.5	35,086 / 29,099	23.6 / 16.5	
1121F	320	59,578	5.25 - 6.25	46,184 / 39,050	23.3 / 15.8		
1121F XR	320	61,263	5.25 - 6.25	40,386 / 34,185	23.3 / 15.8		
1221F	370	66,800	6.8 - 7.1	53,330 / 46,850	25.5 / 16.5		
1221F XR	370	68,560	6.8 - 7.1	49,160 / 42,770	25.5 / 16.5		
*tip load is straight frame/full turn							
Caterpillar	910K	92	15,714	1.6 - 3.3	11,767	25 / 25	
	914K	92	17,910	1.6 - 3.3	14,544	25 / 25	
	966M	276	51,176	3.25 - 12.0	36,711	24.9 / 24.9	
	966M XE	298	51,176	3.25 - 12.0	36,711	24.4 / 17.1	
	972M	299	54,871	3.75 - 13.0	40,779	24.9 / 24.9	
	972M XE	311	54,871	3.75 - 13.0	40,779	24.4 / 17.1	
	980M	386	66,318	5.25 - 16.0	49,897	24.9 / 24.9	
	986H	409	93,090	7.0 - 10.0	63,866	24.0 / 16.0	
	982M	392	78,382	6.0 - 15.75	54,640	23.3 / 24.9	
	988K	541	112,574	8.3 - 10.0	75,506	24.4 / 15.8	
	990K	699	178,517	11.25 - 13.0	108,644	15.2 / 16.4	
	992K	814	220,089	14 - 16.0	136,365	14.2 / 15.4	
	993K	1024	292,748	16 - 31.0	183,563	14.1 / 15.6	
	994K	1739	529,149	25 - 32.0	346,263	15.2 / 16.8	
	926M	148	28,742	2.5 - 6.5	19,383	25 / 25	
	930M	157	30,852	2.7 - 6.5	21,928	25 / 25	
	938M	182	36,156	3.2 - 6.5	26,097	25 / 25	
	950M	230	42,357	3.3 - 12.0	28,144	24.9 / 16.0	
	962M	250	44,712	3.3 - 12.0	29,877	24.9 / 16.0	
	Note: travel speed is forward/reverse.						
	Doosan	DL200-5	142	25,794	2.5 - 2.6	21,076 / 18,618	23.6 / 15.8
		DL200HL-5	142	26,566	2.5 - 4.0	17,957 / 15,851	23.6 / 15.8
		DL200TC-5	142	26,224	2.5 - 4.0	18,827 / 16,623	24.0 / 12.0
DL220-5		150	27,381	2.5	21,231 / 18,750	23.6 / 15.8	
DL220HL-5		160	28,296	3.0 - 4.5	19,412 / 17,141	23.6 / 15.8	
DL250-5		172	30,115	3.3	23,997 / 21,186	23.5 / 15.0	
DL250HL-5		172	31,129	3.3 - 5.0	21,440 / 18,927	23.5 / 15.0	
DL250TC-5		172	31,592	3.3 - 5.0	20,470 / 18,078	23.5 / 15.0	
DL300-5		271	41,645	3.9 - 4.2	33,907 / 29,939	22.4 / 16.8	
DL300HL-5		271	42,869	3.5 - 4.5	26,918 / 23,766	22.4 / 16.8	
DL350-5		271	43,541	4.8	35,561 / 31,394	22.4 / 17.1	
DL350HL-5		271	44,743	3.5 - 4.0	27,470 / 24,251	22.4 / 17.1	
DL420-5		345	50,783	5.5	40,256 / 35,550	22.4 / 11.5	
DL420HL-5		345	51,919	4.0 - 5.5	32,320 / 28,550	22.4 / 11.5	
DL450-5		345	56,868	5.9 - 6.3	45,228 / 39,937	22.4 / 16.4	
DL450HL-5		345	57,618	5.0 - 6.3	42,902 / 37,875	22.4 / 16.4	
DL550-5		380	69,887	7.1 - 7.5	53,991 / 47,675	22.4 / 16.1	
DL550HL-5		380	71,617	6.0 - 7.5	43,453 / 38,371	22.4 / 16.1	
*tip load is straight frame/full turn; max travel speed is foward/reverse; HL=high lift, TC=tool carrier							
Hyundai	HL730-9A	128	23,149	2.5	19,268	24.4 / 15.7	
	HL730-9A/TM	128	24,030	2.5	19,268	24.4 / 15.7	
	HL730-9A/XTD	128	23,589	2.5	19,268	24.4 / 15.7	
	HL740-9A	156	28,000	3	21,760	24.5 / 15.7	
	HL740-9A/TM	156	29,320	3	21,760	24.5 / 15.7	
	HL740-9A/XTD	156	28,660	3	21,760	24.5 / 15.7	
	HL757-9A	197	32,400	3.7	25,440	23.9 / 15.1	
	HL757-9A/TM	197	35,000	3.7	25,440	23.9 / 15.1	
	HL757-9A/XTD	197	35,000	3.7	25,440	23.9 / 15.1	
	HL760-9A	222	40,450	4.3	31,530	23.9 / 15.7	



WHEEL LOADERS

Company	Model	HP	Operating Weight (lbs)	Standard Bucket (cu. yds.)	Tip Load (lbs)	Travel Speed (mph)
	HL760-9A/XTD	222	42,220	4.3	31,530	23.9 / 15.7
	HL770-9A	297	51,810	5.5	39,090	26.1 / 17.1
	HL770-9A/XTD	297	53,460	5.5	39,090	26.1 / 17.1
	HL780-9A	351	66,800	7.1	52,820	22.4 / 15.4
	HL780-9A/XTD	351	68,560	7.1	52,820	22.4 / 15.4
John Deere	344K Z-Bar	97	18,408	2.0	11,596	18.6 / 18.6
	444K Z-Bar	124	24,698	2.5	17,741	22.4 / 15.7
	444K High Lift	124	25,048	2.5	15,091	22.4 / 15.7
	444K Powerlrel w/Coupler	124	27,155	2.5	13,800	22.4 / 15.7
	524K Z-Bar	141	27,445	2.75	19,652	22.4 / 15
	524K High Lift	141	27,871	2.75	16,804	22.4 / 15
	524K Waste Handler	146	33,887	4.0	20,144	22.4 / 15
	544K Z-Bar	163	28,660	3.0	20,784	22.2 / 15
	544K High Lift	163	29,009	3.0	17,881	22.2 / 15
	544K Powerlrel w/Coupler	163	31,007	3.0	16,771	22.2 / 15
	544K Waste Handler	167	35,408	5.0	24,770	22.2 / 15
	624K Z-Bar	186	34,717	3.5	23,577	24.9 / 16.3
	624K High Lift	186	35,159	3.5	19,786	24.9 / 16.3
	624K Powerlrel w/Coupler	186	37,268	3.5	20,530	24.9 / 16.3
	624K Tool Carrier	186	34,956	3.5	22,605	24.9 / 16.3
	624K Waste Handler	198	38,404	4.0	24,156	24.5 / 16
	644K Z-Bar	232	42,050	4.0	29,543	24.9 / 17.9
	644K High Lift	232	42,951	4.0	24,593	24.9 / 17.9
	644K Powerlrel w/Coupler	232	44,685	4.0	28,489	24.9 / 17.9
	644K Hybrid Z-Bar	229	40,417	4.25	28,393	24.9 / 24.9
	644K Hybrid High Lift	229	41,226	4.25	23,165	24.9 / 24.9
	644K Hybrid Powerlrel w/Coupler	229	44,017	4.0	24,364	24.9 / 24.9
	644K Waste Handler	232	46,842	5.0	29,328	22.7 / 15.5
	724K Z-Bar	264	42,812	4.25	31,451	24.9 / 17.9
	724K High Lift	264	43,311	4.25	25,278	24.9 / 17.9
	724K Waste Handler	264	48,988	5.0	32,875	22.1 / 15.1
	744K Z-Bar	304	53,674	5.25	37,360	24.9 / 20.1
744K High Lift	304	54,889	5.25	29,319	24.9 / 20.1	
744K Waste Handler	304	65,049	8.0	39,512	24.9 / 18.8	
824K Z-Bar	333	58,425	6.0	38,538	24.9 / 21.1	
824K High Lift	333	59,279	6.0	32,172	24.9 / 21.1	
844K-II Z-Bar	380	75,906	7.25	48,053	24.9 / 19.1	
NOTE: tip load is full turn; travel speed is forward/reverse.						
Kubota	R420S	39	7,450	0.50-0.75	4,585 / 3,850	12.5 / 12.5
	R520S	43.8	8,980	0.75-1.0	5,190 / 4,410	12.5 / 12.5
NOTE: tip load is straight & full turn; travel speed is forward/reverse.						
New Holland	W50BTC	51	10,173	0.92	7,377	3.1 / 12.4
	W80BTC	72	12,727	1.44	9,741	3.7 / 12.4
Volvo	L20F	54	9,945	0.9	7,055	12.5
	L30G	71.3	12,125	1.2	9,590	19
	L35G	71.3	13,779	1.3	10,913	19
	L45G	98	19,070	1.6	13,160	25
	L50G	114	20,790	1.8	14,462	25
	L60H	165	25,900	2.1	14,490	27.3
	L70H	170	29,200	2.4	15,990	27.3
	L90H	184	32,220	2.7	18,670	27.3
	L110H	258	40,920	3.2	29,430	24.9
	L120H	276	42,830	3.2	32,660	24.9
	L150H	300	55,320	3.5	45,200	23.6
	L180H	333	61,890	3.5	52,190	23.6
	L220H	371	70,440	3.5	55,710	25
	L250H	389	76,544	6.7	60,098	23.6
	L350F	528	110,530	8.1	86,750	22.2

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TECH TIPS

FROM NASSCO

TECH TIPS BY NASSCO IS A BI-MONTHLY ARTICLE ON TRENDS, BEST PRACTICES AND INDUSTRY ADVICE FROM NASSCO'S TRENCHLESS TECHNOLOGY MEMBERSHIP PROFESSIONALS.

PACP CONDITION GRADES AND THEIR PROPER APPLICATION

By NASSCO Members Marilyn Shepard, NASSCO Master Trainer, International Training & Rehab Technologies and Laurie Perkins, NASSCO Trainer, Senior Associate, Wright-Pierce

When NASSCO's Pipeline Assessment and Certification Program (PACP®) was developed with the Water Resource Centre (WRc) in Swindon, England, NASSCO added condition grades to defects to help prioritize maintenance, rehabilitation or repair of line segments. Condition grades were developed as a "one size fits all" score based mainly on the defect coded, and not on other deterioration mechanisms that are covered in the PACP class. For almost 15 years, engineers and municipalities have used PACP condition grades for prioritization, and while the use of condition grades and segment scores has been helpful to asset management programs, those using the data should clearly understand that they do not tell the complete story.



A BROKEN PIPE IS ONE IN WHICH PIECES ARE NOTICEABLY DISPLACED AND HAVE MOVED FROM THEIR ORIGINAL POSITION.

DESCRIPTORS:

BSV (Soil Visible): Soil surrounding the pipe is visible, but the soil surrounding the pipe is still in place and does not appear to be eroded

BVV (Void Visible): The outside of pipe is visible, and a void or cavity has formed outside the pipe

UNDERSTANDING DEFECT GRADES

The CCTV user should understand that the condition grade of a particular defect depends upon the correct PACP code being entered, and not each operator's opinion. Only by allowing the grades to be assigned through accurate PACP coding will the condition grades be consistent. Otherwise, we lose the benefits of standardization when the codes are based on each operator's opinion and not on what is actually observed.

Each defect observed is assigned a condition grade from 1 to 5, with 5 being the most significant defect grade and 1 being a minor defect grade. When an operator assigns a PACP defect code, the code and specific information entered with the code, such as percentages or clock positions, relate to a specific condition grade from a table in the PACP manual.

This grade is assigned by PACP (not the operator) either by looking it up in the PACP manual, or automatically through NASSCO certified software. Condition grades are then used to calculate scores for the entire segment (or manhole) to help prioritize renewal efforts. Segment scores can also be used to develop consistent "Likelihood of Failure" (LoF) values, which can be used with "Consequence of Failure" (CoF) values to develop risk assessments within an overall asset management program.

For example, a pipe exhibits structural defects such as cracks, fractures or broken sections. The defect is assigned a condition grade based on what is observed and its severity level. A single crack, defined as a break line which is not visibly open, running lengthwise down the pipe, is coded as Crack Longitudinal (CL). A CL is a grade 2. If this crack becomes visibly open, it is defined as

a Fracture Longitudinal (FL) and the condition grade increases to a 3. If the pipe pieces become displaced, it is coded as a Broken (B) and the grade increases to a 4. However, if there is soil or a void visible behind the broken pipe wall (BSV or BVV), it is a grade 5. A complete inspection of the segment might include several structural defects as well as O&M defects that could be used to calculate an overall segment score based on the number and severity of the defects observed in the line for both structural and O&M defects.

BENEFITS AND LIMITATIONS

Those professionals that use PACP data for making recommendations and decisions need to understand both the benefits and limitations of the condition grades and segment scores. The PACP Condition Grading System cannot take into account factors such as material (although we have worked toward this when redefining rigid versus flexible deformation), changes in loading, voids and other external pipe conditions.

When condition grades are used to develop the LoF values, these factors should also be considered. Further, condition grade alone is inadequate for determining if a pipe segment should be replaced or rehabilitated. **The condition grades cannot take the place of an engineer's judgement.**

It is tremendously important that the PACP technician document defects and observations consistently and accurately in accordance with the definitions included in the PACP Reference Manual so that the condition grades remain consistent. It is equally important that those professionals using this data understand the benefits and the limitations of the data.

S&N Communications

S&N Communications – a leading U.S. resource in wired and wireless infrastructure construction, electric and gas construction, professional services, site development and underground utility locating, announced the appointment of



Carrie Lynn Fazzolari

Carrie Lynn Fazzolari as zoning manager for the company.

In her new role, Fazzolari will hold responsibility for all zoning regulations, land-use reviews, public hearings, zoning and code reviews, building and construction reviews, site plans and construction drawings as it relates to work done by S&N Communications and its subsidiary partners SCE, Tower16 and Stake Center Locating.

Fazzolari will oversee a team of eight people charged with spearheading zoning projects, nationwide. She explained her team's current focus is compiling a matrix for the zoning regulations of different jurisdictions.

The new S&N Communications zoning manager has more than 17 years of diversified experience in real estate, telecommunications and business operations. Fazzolari's legal career began in 1998 when she served as an associate attorney for Baltimore law firm, Cooper & Tuerk. In 2000, she narrowed her career focus on real estate transactions for the telecommunications industry, where she advised clients on land-use regulations and site development, reviewed and resolved title issues and managed a team of site development specialists. In addition, she

acted as an adjunct professor at Anne Arundel Community College, where she taught Torts, Criminal Law and Criminal Justice. From 2011 to 2014, Fazzolari served as in-house counsel and director of contracts for a large consulting company, where she negotiated, documented and oversaw all corporate transactions. Upon the merger of that company, Ms. Fazzolari joined a law firm in Annapolis, MD, serving as a commercial transactions attorney.

Fazzolari attended State University of New York and earned her law degree from the University of Dayton. 434-591-1080, sncomm.com.

ASTM International

The ASTM International Board of Directors unanimously voted to make the Safety Equipment Institute (SEI) a subsidiary of ASTM International, thus

broadening ASTM's overall certification capabilities while also bolstering SEI, a top certification provider founded in 1981. With this decision, SEI will remain a separate entity.

"This will blend the strengths of two well-positioned organizations that share a common goal of improving public health, product safety and consumer confidence," said James Thomas, president, ASTM International.

The step will bring many benefits to SEI and its stakeholders, including end users of certified products, clients, government agencies, associations and more, said SEI President Patricia Gleason.

SEI provides third-party certification for a wide range of products such as sports and athletic equipment, safety and protective products used by firefighters and emergency responders, eye and face protection for industrial worker, and a list of other certifications.

The new ASTM subsidiary bases its programs on technical standards from a variety of standards development organizations. ASTM's existing certification activities will transfer to SEI, which holds accreditations to ISO 17065 for product certifications.

SEI employees will move under the ASTM International umbrella, July 1. Gleason will remain president of SEI while also becoming vice president of certification for ASTM International. 610-832-9603, www.astm.org.



Ditch Witch Connects With Customers Through Orange Iron Experience

Ditch Witch, a Charles Machine Works Company, welcomed more than 300 customers and dealers from locations worldwide to its Perry, OK, headquarters for the Orange Iron Experience, earlier this year.

The Orange Iron Experience allowed customers to tour the company's expansive 30-acre site, demo the newest equipment and meet the Ditch Witch team members who design, engineer and build the equipment the company's customers rely on every day.

Shan Kirtley, Ditch Witch vice president of sales and marketing, said the unique experience directly connected customers with Ditch Witch products, family and history.

"Our commitment to building the best underground construction equipment matches our dedication to exceptional product support and service on job sites across the globe," Kirtley said.

The two-day event included a ceremony introducing customers to the latest Ditch Witch equipment, welcoming notes from President Dennis Wierzbicki, a tour of the full manufacturing factory and campus, and an afternoon of hands-on equipment demonstrations.

Ditch Witch dealerships operate in more than 100 countries, on six continents and with more than 175 locations worldwide. 800-654-6481, www.ditchwitch.com.

Intermountain Drilling Supply



Intermountain Drilling Supply (IDS) announced further expansion in Utah and the regional horizontal directional drilling (HDD) industry, looking to add more experience and versatility to the HDD market with the addition of a Syracuse, UT branch to the team.

The company welcomed Brad and Mike Mills, formerly of American Eagle Drilling Supply, to the IDS team, looking to strengthen the company's impact in the HDD industry. The new additions add more than 35 years of industry experience to IDS' repertoire.



With the new Syracuse branch addition, IDS now operates with eight western locations, becoming one of the largest HDD products-centered supply chains in the region.

IDS continues its focus on becoming the source for all things HDD, and the Syracuse branch will assist in furthering the company's vision of becoming the major supplier for the HDD industry. 801-972-6455, intermountaindrillingsupply.com.

Centuri Construction Group, Southwest Gas



Southwest Gas Corporation named Paul M. Daily CEO of Centuri Construction Group, the company's construction services subsidiary.

Daily graduated from the United States Military Academy at West Point in New York, and went on to spend the first nine years of his career as a commissioned officer in the U.S. Army, managing petroleum and water logistics for the Department of Defense.

KS Energy Services Named As Top 10 Business

The Waukesha county Business Alliance, in partnership with BizTimes Media, named KS Energy Services as one of its 2016 Top 10 Businesses of the Year. The annual awards program recognizes companies headquartered in southeastern Wisconsin that have shown consistent financial growth and demonstrate a commitment to good business practices through their employee relations, customer-focused commitment and community service involvement. The number one company is set to be announced at an awards ceremony in late June.

"This outstanding group of companies contribute significantly to the economic growth of our region," said Suzanne Kelley, president, Waukesha County Business Alliance.

KS Energy Services is a leading provider of the installation of natural gas, electric, telecommunication and water services throughout the Midwestern U.S. with a vision to become the premier provider of these services while exhibiting integrity and accountability to its customers.

"We are very proud and humbled to have been selected," said Dennis Klumb, Jr., president and CEO, KS Energy Services.

The company was founded in 2005 and has since been built around the values of safety, integrity and quality. 262-574-5100, www.ksenergyservices.com.

After his esteemed career in the military, Daily held various roles of increasing responsibility at Willbros Group from 1987 to 2000, including vice president of planning and development, in which he was a member of the company's worldwide executive management team.

Daily went on to serve as senior vice president

of construction and project delivery for Earth Tech and later, went on to hold numerous executive positions within InfraSource Services, a provider of underground gas, electric and telecommunications infrastructure services. Daily was CEO of InfraSource Underground Services when it was sold to Quanta Services, after which he also took on the

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role of executive vice president of the natural gas and pipeline division for Quanta.

In 2011, Daily took on the roles of co-founder and CEO of Infrastructure and Energy Alternatives, a group of operating companies that provide infrastructure design and construction services to North American energy customers.

In 2014, after nearly three decades serving in senior level positions at engineering and infrastructure construction firms, Daily founded Paul M. Daily & Associates, prior to joining Centuri Construction Group as CEO. 702-364-3411, www.swgas.com.



PG&E
Pacific Gas and Electric Company (PG&E) was named to the 100

Best Corporate Citizens list – for the second year in a row – by Corporate Responsibility Magazine. This year, PG&E earned the number two position among utility companies and was ranked 39th overall.

PG&E Corporate Chairman and CEO Tony Earley said the company was honored to be recognized for its commitment to help create a clean energy economy through sustainable business practices.

“Earning a position on the 100 Best Corporate Citizens list for a second year in a row is a reflection of our efforts to protect the environment, promote high standards for diversity and inclusion, and build a better California for our customers and communities,” Earley said.

In addition, PG&E was named as one of the best places to work by the Human Rights Campaign; corporation of the year by the United Negro College Fund and Northern California Leadership Council, and one of the best employers for veterans by Military Times – all in 2016.

PG&E remains committed to doing even more to help achieve a low-carbon economy and encourage preservation of a healthy planet for future generations. 415-973-5930, www.pge.com.



Rich Goldsbury, president, Bobcat and Doosan North America and Oceania (middle) was recently joined by Gwinner, ND Mayor Dan McKeever (left) and members of the Gwinner City Council for a ribbon cutting ceremony at the Gwinner engineering facility. The renovation project is part of an ongoing investment to help enhance work environments, accommodate growth, drive innovation and improve operations across the organization.

Bobcat, Doosan Continue Investing in Company Culture

Bobcat Company and its parent organization, Doosan, completed \$12 million in renovations on its engineering and factory facilities in Gwinner, ND., earlier this year. Both projects are part of an ongoing investment to enhance work environments, accommodate growth, drive innovation and improve operations across the organization.

The Gwinner engineering facility underwent a slew of functional improvements in an effort to promote an increasingly collaborative work environment including the removal of individual offices to open up the floor plan and workstation areas; the addition interactive conference rooms and enclaves for group meetings both large and small, as well as more independent and private work; and the entire building is supported by advanced technology.

The new design approach taken with the engineering facility creates more chance encounters among employees who otherwise might not work together. Company officials believe chance encounters spark additional collaboration and greater innovation.

In addition, Bobcat and Doosan have added what they dub “vitality elements” aiming to promote a health-conscious and energetic atmosphere, which includes standing desks, treadmill work stations and an expanded break room for employee comfort.

At the Gwinner production facility, the north assembly and compact excavator production areas were expanded and redesigned to help improve factory flow and increase accessibility for employees. In addition, the facility now features renovated break

rooms, increased restroom facilities and dedicated lockers for each shift employee.

Mechanical improvements were also made at the production facility including the addition of a shot blast system and an orange ColorMax booth to the paint line area. The shot blast system is used to prep the major weldments prior to painting, and the ColorMax booth will assist with the even spread of a weather-resistant, orange finish on the tailgates – a part of the Bobcat signature trade dress.

Over the course of three years, Bobcat and Doosan have added and improved locations across the country, reflecting an organizational commitment to continue investing in facilities, people and products. In 2014, Bobcat and Doosan opened the new Acceleration Center – a facility focused on engineering, R&D, training and product testing – in Bismarck, ND. The West Fargo, ND, headquarters is currently undergoing a \$9.5 million expansion, slated for completion late summer 2016.

Laura Ness Owens, director of marketing, Bobcat Company and Doosan, said the companies are committed to creating environments that help attract and retain talented individuals focused on helping move the companies forward, across all types of facilities, from engineering to production.

“We believe what we are doing is cutting-edge for manufacturing companies in the U.S., and we are proud to be out in front as an industry leader,” Ness Owens said. 800-743-4340, www.bobcat.com.

Aegion Subsidiary Chosen For Shell Appomattox Project

Shell Offshore, a wholly owned subsidiary of Royal Dutch Shell, selected Aegion's subsidiary, The Bayou Companies to provide pipe coating and insulation for the upcoming Appomattox development located in the Gulf of Mexico, which is on schedule to begin in the fall of 2016.

Aegion is in collaboration with Materia to supply Materia's Proxima HTI-1400 subsea insulation system for the project. The newly developed thermosetting cross-linked hydrocarbon polymer system provides a robust thermal barrier between flowlines and seawater. The insulation system is a stable incompressible solid in deep water environments that involve depths of more than 10,000 feet. Materia completed the first phase of the required expansion of its Huntsville, TX, facility to produce the new thermal insulation material and is proceeding with the commissioning process.

Bayou's New Iberia, LA, location is currently working on the construction of a state-of-the-art

insulation coating facility designed for the Appomattox project, where Bayou will provide pipe coating and ancillary services. In partnership with Materia and Shell, Bayou Wasco – a joint venture between Aegion and Wasco Energy – has developed the proprietary ACS HT-200 pipe insulation coating application process. In April 2016, Bayou was receiving specialized equipment for the insulation application as construction on the new facility continued, set for completion summer 2016. The insulation application production is expected to begin in the fourth quarter of 2016.

The Shell Appomattox oil reserve is located approximately 80 miles off the coast of Louisiana at a depth of approximately 7,200 feet. The pipe coating and insulation project, which includes more than 200 miles of production flowlines and transmission pipelines, has an expected completion timeline of 12 to 18 months after the commencement of pipe coating and insulation application. 636-530-8000, www.aegion.com.



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Vacuworx Introduces Portable Vacuum Lifting System

The ever-innovative Vacuworx announced the introduction of a completely portable design for its new vacuum lifting system. With a rechargeable battery boasting an 8-hour runtime, rugged lightweight construction and up to 2,200-pound lift capacity, the new PS 1 Portable Vacuum Lifting System from Vacuworx is not your average cordless tool.

The PS 1 is an ideal solution for smaller lifting challenges that frequent the job site. The patent-pending portable lifter makes light work out of lifting robust pieces of concrete, marble, granite, metal, steel and iron. Powered by a 12-volt rechargeable battery, the PS 1 is ideal for applications where no power source is available or no emissions are permitted.

The PS 1 could easily be compared to a suitcase, weighing in at a mere 25 pounds. But it makes up for its

small stature with its rugged strength and can be used both indoors or outdoors as a great companion piece to small equipment including skid steers, electric skid steers, mini electric excavators, forklifts and small cranes. Three standard, interchangeable pad options are available ranging from 8-by-12 inches with a 693-pound lifting capacity, to 16-by-16 inches with a 1,654-pound lifting capacity. Additionally, Vacuworx will furnish consumers with more pad configurations upon request.

In addition to the PS 1, Vacuworx has also announced its offering of a faster, safer means for handling concrete road barriers. The company's new HL Series Hydraulic Barrier Lifters offer a smarter way to handle concrete barriers.

While the traditional method of moving concrete road barriers with slings and chains is slow and lacks control and puts workers in harm's

way, the new HL Series Hydraulic Barrier Lifters from Vacuworx offer a faster, safer way to do the job.

The HL Series was designed for use with a variety of equipment, and the lifters connect easily and work with the host's hydraulic system. Elastomer grips provide superior performance with full-surface contact without damaging materials. The series is equipped with a hydraulic lock for safety to prevent loss of load if hydraulic pressure is lost.

With 360-degree rotation, the HL Series is ideal for maneuvering in confined spaces during road, bridge and highway construction. Loading, unloading and installation is fast and easy thanks to the precision handling capabilities and wireless remote operation from the cab of the host machine. Additionally, the environmentally friendly lifting systems produce nearly no noise and air pollution, providing a solution for construction sites within city limits or

with strict emissions guidelines.

The HL B1 is designed to lift concrete road barriers up to 6,000 pounds and 12 feet long, while the HL B2 can handle barriers up to 16,000 pounds and 30 feet long. Quick-couplers are available for virtually all host machines for the ultimate in attachment versatility and improved job productivity.

Vacuworx's commitment to safety ensures all HL Series Hydraulic Barrier Lifters meet or exceed all global safety and engineering standards, including OSHA, ISO, ASME and CE.

Vacuworx engineers and manufactures innovative heavy-duty material handling equipment for the oil, gas, water, sewer, utility and road construction industries worldwide. The newest addition of a portable vacuum lifting system and hydraulic barrier lifters further expands their dedication to furthering the industries the company serves. 918-259-3050, www.vacuworx.com.



Bayco Products, Nightstick

Bayco Products announced the introduction of three new Nightstick all-LED, multi-function headlamps with Nightstick models NSP-4603B, NSP-4605B and NSP-4606B, earlier this year. Each engineered polymer headlamp features a multiple-position tilt head design and single top-mounted switch for ease of operation. All three headlamps are IP-X7 rated waterproof and drop-rated at 6.56 feet. The headlamps are available for \$20 via Bayco Products' expansive distributor network.

Each AAA headlamp model utilizes CREE LED technology with more than 50,000 hours of LED life, featuring an elastic headband with rubberized strips to keep the headlamp in place, addressing a need not found in many of the commercial bands currently on the market.

The Nightstick NSP-4603B is a dual-brightness headlamp ideal for professionals in need of long-distance site for an extended period of time. In the higher-brightness 120-lumen mode, the NSP-4603B is rated to delivery more than 470 feet of illumination for up to 5.5 hours. 469-326-9400, www.mynightstick.com.



John Deere Adds To Backhoe Portfolio

John Deere announced the addition of the 710L to its popular L-Series lineup of backhoe loaders. The latest model in the L-Series features a 17-foot, 3-inch dig depth – the largest in the John Deere portfolio – and is ideal for loading trucks, placing pipe, digging trenches, breaking up concrete or asphalt and moving materials. The 710L backhoe meets emission regulations via an EPA Final Tier 4/EU Stage IV-certified 4.5L Deere PowerTech Plus engine, providing 13 percent more net-peak horsepower than the previous K-Series model.

The 710L comes equipped with a standard John Deere PowerShift transmission which enables operators to travel up to 23 mph between jobsites. Utilizing the sealed-switch module, operators can gain an additional 10 percent craning boost through the Lift Mode feature. When selected, engine rpm is automatically set at 1,400, and the machine maximizes hydraulic pressure for increased craning capability. Pressure-compensated load-sensing hydraulics ensure superb multifunction operation. The machine boasts standard ride control, enabling front loader hydraulic cylinders to act as shock absorbers, smoothing travel over rough terrain, helping carry full load and reducing operator fatigue.

"The 710L provides a huge leg up with added lift capability and an improved rear control valve for enhance controllability as well as productivity-boosting features and unmatched reliability and uptime," said Brian Hennings, product marketing manager, backhoes and tractor loaders, John Deere Construction and Forestry.

The in-cab luxuries include extra legroom and a more comfortable seat, redesigned pilot towers with fingertip electrohydraulic controls, a multifunction lever on the steering column for control of turn signals, wipers and lights, and a state-of-the-art multi-language monitor. In addition, operators are able to program time-specific functions, such as auto shutdown and auto idle.

The 710L offers plenty more comforts including an efficient HVAC system, adjustable mechanical or air-suspension seat, a new lighting scheme with an optional LED lighting kit to enhance visibility for extending the workday, and an elevated canopy to provide better visibility for the front and rear of the backhoe. The optional premium radio with Bluetooth auxiliary input and Sirius XM satellite radio capability is also available. 844-809-1508, www.deere.com.



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HammerHead's Pipe Slitting Technology An Industry Innovation

HammerHead Same Path Gas Line Slitting Technology is a tooling system for replacing natural gas distribution pipe that cannot be replaced by traditional bursting methods. The tooling is designed for use with HammerHead's line of cable winches.

HammerHead Trenchless Equipment, a Charles Machine Works company, designed the tooling originally at the request of Ditch Witch California. Members of both the Ditch Witch and HammerHead teams identified a need for better gas line slitting technology, so in turn, HammerHead engineers worked to develop the tooling and methodology successfully used in the field by Ditch Witch California.

"We needed to help a customer frustrated by existing tooling that tended to either bunch up the pipe or high-center and get stuck," said Mike Anderson, Ditch Witch Bay Area, Central and Southern California president.

HammerHead Same Path tooling is designed to overcome such issues while concurrently splitting old pipe and installing new pipe.

HammerHead's Same Path Gas Line Slitting Technology is designed for replacing half-inch to 4-inch natural gas distribution pipe and may also be used to decommission inactive gas lines left in the ground. The slitting process follows the existing pipe path, reducing the risk of contact with other utilities.

Same Path Gas Line Slitting Technology is available from HammerHead Trenchless Equipment or from an expansive list of authorized dealers across the globe. 800-331-6653, www.hammerheadtrenchless.com.



McElroy Launches Auto Machine In TracStar Series

McElroy announced a new machine to its flagship TracStar series, offering advanced emissions reduction and automation technologies that allows users to meet today's toughest regulations in air quality and data logging.

The new TracStar 900 Series 2 Automatic boasts a Cummins US EPA Tier 4/EU Stage IIIB engine that burns ultra-low sulfur diesel making it cleaner burning, quieter running and more efficient than ever.

Fusion functions are controlled automatically with The Coach pendant which also has the ability to upload joint reports to the McElroy DataLogger Vault for safe storage, analysis and validation of pipeline integrity.

"We have equipped the Auto machine with an advanced diesel engine from an outstanding global supplier so that our customers will be ready for emissions regulations in all markets, including strict requirements in Europe, and have ready access to top-tier engine service and support,"

said Jason A. Lawrence, P.E., director of product development, McElroy.

Engineers redesigned the cowl and rearranged the components under the hood to allow for easy access to the engine for maintenance on the TracStar 900 Series 2 Automatic. The machine fuses 12-inch IPS to 36-inch OD thermoplastic pipe in accordance with many of the international fusion standards and includes all of the ongoing features of the TracStar machines.

The all-terrain vehicle features rugged, rubber crawler tracks and is self-propelled via wireless remote control. The vehicle is also self-contained with an on-board generator for powering the heating. The operator is assisted by hydraulic power with all fusion functions including the operation of the jaws, pipe lifts, heater and facer. The TracStar 900 Series 2 is available as a low-, medium- and high-force machine. 918-836-8611, www.mcelroy.com.

Century Products

The Osprey Series Fly Cutters from Century



Products is engineered for maximum performance and reliability. The new design incorporates a robust square tube design, ensuring longevity with superior strength and features the ability to pull or push ream thanks to strategically placed cutter bars with replaceable rotating carbide teeth both forward and aft. Protected recessed fluid nozzles are placed in a concentric pattern for a full sweep across the bore hole face.

The Osprey Series Fly Cutters are available in the Osprey SD standard duty and Osprey XD extreme duty with optional customization features. The Osprey SD incorporates a vertical spoke/fluid chamber design, while the Osprey XD incorporates Century's Roof Truss Design for unsurpassed structural integrity with a forward and aft angular tube design. Both designs provide a full-coverage cutting pattern with larger flow through areas to optimize cutting removal for increased penetration rates. 262-820-3600, www.centuryproducts.net.

Case Construction Equipment

Case Construction Equipment has released the 4-in-1 Systemgard Fluid Analysis Kit – a preventative maintenance tool providing a picture of fluid and internal system conditions without the need for users to disassemble the machine.

The kit monitors system cleanliness and filtration efficiency, which assists in extending the life of the machine and reducing replacements costs, as well as helping to ensure equipment reliability and uptime. The four fluid tests in the pack include engine oil analysis, coolant analysis, transmission/hydraulic oil analysis and diesel fuel analysis.

The state-of-the-art fluid analysis identifies dirt, wear particles, fuel dilution and coolant-contaminants that can cause catastrophic failure or shorten equipment life. 262-636-6011, www.casece.com.



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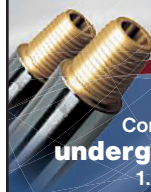
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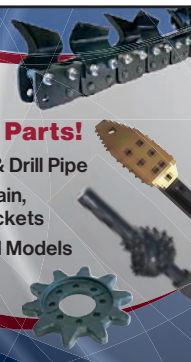
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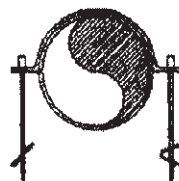


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July 27-31

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Ditch Witch:

Continuing To Meet Customer Needs

By Dennis Wierzbicki , Ditch Witch® President



Industry experts say there is already a shortage of labor in the fiber market. Putting more crews in the field means more equipment and support is needed.

There is a boom in fiber installation as carriers scramble to bring fiber optic cable connections directly to homes where internet users want the speed fiber provides for instant internet connections and the sharp, bright, high-definition images to their television screens.

A recent Fiber-to-the-Home (FTTH) Council survey reported that by late 2015, more than 12.3 million U.S. homes were connected directly to fiber, and 26 million have been “passed” by fiber.

More homes are connected every day, but the fiber expansion goes beyond the homes.

For businesses, government facilities and educational institutions, fiber connectivity is not a convenience – it’s a necessity. Corporate fiber connections are well ahead of FTTH, and fiber deployments are continuously being extended to facilities and linking multi-building complexes. In addition to communications and data, fiber is being incorporated into the structured wiring of buildings.

Industry experts say there is already a shortage of labor in the fiber market. Putting more crews in the field means more equipment and support is needed.

Ditch Witch® is the single source for every underground fiber construction need.

We are training new crew members at Ditch Witch dealerships and customer locations throughout the country, and our equipment line has everything needed to install long-haul fiber, backbone, FTTH and more. Whatever the need, Ditch Witch has it covered. “We’re In This Together” with our customers, all the way, every day.

Training

As the pace of installing fiber optic cable connections to more homes and businesses continues to accelerate, it has become clear there is a shortage of experienced labor to construct expanding fiber networks.

It also is clear that steps must be taken now to ensure there is an adequate supply of qualified workers to serve the present and future demands of a market projected to continue growing for the next several years.

The Ditch Witch® organization has taken the initiative to increase the training offered to the labor force by getting crews ready to deploy fiber with the introduction of Ditch Witch Certified Training that includes several elements:

- An industry-first online horizontal directional drilling (HDD) training program for personnel at any level of HDD experience, it covers the basics of making directional drilling installations. For those with no experience, online training provides an overall understanding and knowledge of the HDD process before stepping on an HDD job site or entering a field training session. Those completing the online training program receive a certificate of completion. Online training courses are available in English and will soon be offered in Spanish and German;
- Classroom training is available through more than 170 Ditch Witch dealership locations worldwide. The instructor-led operator training curriculum covers everything a crew needs to be safe and productive. Many dealer locations have simulated



Programs

By Greg Wolfe, Ditch Witch Director of Training

Ready HDD Crews

job sites onsite to allow a hands-on equipment experience which allows operators to put new skills into practice;

- The new Ditch Witch HDD simulator training provides an opportunity for new operators to gain familiarization and understanding of machine controls to learn proper operating procedures. Experienced operators can also benefit by refining skills to increase productivity levels. Available with many drilling scenarios, HDD simulators assist the learning process and bring a sense of confidence to new operators before they begin using equipment on the job. Practicing on an HDD simulator allows the operator to virtually learn in a controlled environment where any mistakes made in the process do not cause harm; and
- When crews are ready for exposure to real-world project conditions, Ditch Witch dealers will work with crews on the actual job site to analyze and recommend site-specific solutions aimed at improving production, lowering costs and enhancing safety. Field training is conducted by experienced dealer personnel and Ditch Witch factory product training specialists at dealerships, customer locations, job sites, or any place best suited to meet our customers' needs. A benefit of in-the-field training is that the dealer personnel are familiar with the region and can advise best practices for the soil conditions and the environment the crew is operating in.

Ditch Witch Certified Training is offered at no cost. The program is bringing a new,



younger group of workers to the industry, allowing them to complete the six basic online training courses at their own pace at home, in the office or on their mobile device. However, training isn't only for those with little or no HDD experience – we are seeing a wide range of experience among those enrolled in our training program. We are still early in the program rollout and are closely monitoring experience levels of those enrolled to gain insight into the overall composition of those seeking training assistance. We can then adjust content as necessary in the future.

Response to our training programs has been tremendous and confirms we are on the right track to address the shortage of quali-

fied workers. Each month, we continue to see an increase in the total number of individuals utilizing the online courses, and a growing number of HDD crews are contacting our dealerships for field training. We are very pleased with the overall response to these essential programs.

Many of our large customers are sending personnel to our field training programs, but we want all customers to know that Ditch Witch Certified Training is available to anyone, individually or in groups.

As the Ditch Witch Certified Training program expands and more people complete HDD training, the market will benefit from an expanding labor force.



Michael Thomas, Alltech president



Alltech drilling crew in Austin, TX.

Perfect Match

For Installing Fiber In **Austin Rock**

Austin, Texas' capital city, is one of the beneficiaries of the current fiber boom. Currently Google fiber is building an all-new fiber network, AT&T is expanding and upgrading its system, and smaller companies are also offering high-speed service via fiber.

One of the companies that is busy every day working to extend fiber in Austin is Oregon-based contractor Alltech Directional Drilling. Working as a subcontractor of Texstar Enterprises, Alltech is installing conduit for feeder lines in which fiber optic cable is placed.

"Ninety-five percent of conduit where we are working is being installed by horizontal directional drilling (HDD)," said Michael Thomas, Alltech president. "We are in subdivisions where there cannot be deviations in the accuracy of our bores. In the past year, we've done four subdivisions with complete success, and where we are now is a very upscale neighborhood."

Alltech's job is to extend the feeder lines while maintaining high production levels every day. Texstar installs fiber cable into the conduits, sets vaults and makes connections, and installs service lines to customers.

Alltech is installing high density polyethylene pipe (HDPE) conduit in diameters of 2, 2½ and 4 inches, all by directional drilling.

"HDD is what we do," said Thomas. "We are a directional drilling specialist and do not trench or plow. Clearly, directional drilling is the way to go in areas where we work. Prop-

erty owners don't want their landscaping and streets damaged or traffic disrupted."

However, soil conditions for burying conduit is not ideal.

"There's soil at the surface but down about 24 inches it is solid rock in most areas with some broken up rocky conditions," Thomas said. "The ground is so hard, Texstar has to use excavators with hydraulic hammers to set vaults and do tie ins."

Alltech is using Ditch Witch All Terrain (AT) equipment – JT3020 AT and JT30 AT models – both with 30,000 pounds of pull-back. AT equipment has a patented dual-pipe drilling system that allows relatively compact equipment to effectively drill and be steered in hard rock and other difficult conditions. Dual-pipe drilling drive design allows mid-size equipment to drill and steer in rock that would be impossible for other machines.

Right equipment

"Conventional equipment would struggle severely in these conditions," Thomas said. "AT-flush pipe is proving perfect for this ground. The value these machines gives us the confidence we will not fail on any bore. These machines work perfectly in all conditions. We have not had any failures."

Alltech drill units are equipped with Sub-site® Electronics TKD HDD guidance systems.

"They have proven to be able to hit our targets on pilot bores," said Thomas. "On many locations, there are parallel gas distribution pipes, power and communications cables and

in some cases aerial lines, but we have had no interference problems at all with our tracking signals."

Support equipment includes Ditch Witch FM25 fluid mixing systems with 1,000-gallon tanks and FX30 vacuum excavators to pothole and keep job sites free of excess drilling fluid.

"The vacuum excavators are easy to move around and fit into tight spots," Thomas said. "They are a perfect fit for our projects."

"Property owners are amazed at the low impact of HDD and are very happy with the short amount of time it takes for us to be in and out. The result has made them appreciate the benefits of HDD."

To date, Alltech has installed 50,000 feet of conduit for fiber in the Austin area. Lengths of bores range from 75 to 500 feet with the average bore approximately 200 feet.

While telecommunications work is a primary focus, Alltech also serves the water, sewer and gas markets. Until taking on the Texas fiber projects, most of the company's work was on the west coast.

Thomas credits the company's success to its dedicated employees, productivity of Ditch Witch equipment and Ditch Witch dealer support. Alltech is using two-man crews and still outperforming other contractors, he added.

"Fiber is growing and we are gearing up to be a big part of the market," Thomas concluded.



Supporting the Fiber Build-Out

The aging utility infrastructure throughout the country is creating a lot of new opportunities for underground construction professionals. One of the most significant areas of growth has been in telecommunication line installations, creating a surge in fiber connectivity in residential areas.

This is now an integral part to the development of cities across the nation. Three million homes were brought on to the fiber grid last year, according to the Fiber-to-the-Home (FTTH) Council Americas, bringing the total number of U.S. homes with access to fiber connectivity to 26 million.

But the need for quicker data delivery is going to keep the demand for these projects steady, and much work remains to be done to bring this next-generation internet and communications connectivity to all homes and commercial buildings across the country. Underground construction professionals are critical in making that happen.

Most fiber-optic cable is distributed underground in a protective conduit which must be installed with a variety of specialized equipment. Ditch Witch® offers the most complete line of equipment to install fiber from long-haul lines to customer connections.

Long-haul fiber

Long-haul routes take fiber-optic cables between cities and towns, often along highway right-of-ways through open country.

“Depending on surface and soil conditions, vibratory plowing often is the fastest, most efficient method of placing long-haul conduit



in the ground,” said Randy Rupp, vice president of product strategy for the Ditch Witch organization.

Plows in the 80- to 125-horsepower class can operate on varied terrain and place conduit into the ground through a chute in the plow blade, while leaving minimal surface disturbance. The Ditch Witch RT125Q and RT80Q trenchers are ideally suited for long-haul work. They are equipped with reel carriers to hold conduit, and use quad-track ground drive systems to traverse both level and uneven terrain.

Rocky soils and limited right-of-way access can restrict the use of plows. In these cases, both trenchers and earth saws are needed, such as the Ditch Witch RT80, RT105 and RT125 models.

“Horizontal directional drilling (HDD) plays a key role in long-haul fiber installation,” said Seth Matthesen, Ditch Witch senior product manager for drills and fluid mixing systems. “Long-haul jobs depend on directional drills to install conduit through overpass embankments, side hills, rough terrain, wooded areas and water crossings where plows and trenchers can’t operate.”



Ditch Witch HDD equipment designed for such long-haul projects include the JT25, JT30 and JT60 models. All Terrain (AT) models, an exclusive technology designed specifically for hard soil conditions, are also invaluable on many projects for their ability to drill and steer through hard rock formations. The JT30 AT and JT60 AT models in particular are workhorses in these soil conditions.

Backbone/ring

Feeders take fiber to the node, home premise (such as businesses, apartments and schools) and virtually anywhere. Equipment used

to bury conduit is directly related to site conditions. When backbone construction is in open areas and conditions permit, plowing may be the preferred method. In urban areas, HDD becomes more prevalent. Equipment for backbone construction usually is smaller than that used for long-haul. Examples include the RT80 Quad and RT80 rubber tire trenchers, along with the JT9, JT20, JT25, JT30 and JT30 AT drill units.

Soil conditions are a significant factor, Matthesen added. For example, Google Fiber and AT&T fiber deployments in the Austin, TX, area have a great deal of rock. Much of the construction requires directional drilling.

Ditch Witch All Terrain equipment is ideally suited for this work.

“We’re drilling through numerous types of different ground conditions – solid rock, limestone – but the majority of it seems to be broken up material that offers a challenge,” said Michael Thomas, president of Alltech Directional Drilling who has been working on fiber installations in the Austin area for the past year. “But with the JT30 All Terrain, it’s been no issue whatsoever. We’ve been able to move right along at a good clip. It’s proved to be great.”

Surface and soil conditions dictate the method of construction. Microtrenching

Mid-Plains Keeps Customers Current

In the Texas Panhandle town of Tulia, the Mid-Plains Rural Telephone Coop built and currently operates a fiber network that offers high-speed internet, telephone and pay television services to its 2,534 customers.

“The take rate for high-speed internet is a very high 80 percent,” said Rick Hurt, Mid-Plains chief executive officer and general manager. “People want fiber.”



Ninety-nine percent of Mid-Plains’ outside fiber plant is underground, installed by vibratory plowing, horizontal directional drilling and trenching.

“We plow almost everything that is constructed,” Hurt said. “Plowing is so much faster and requires less cleanup compared to trenching. On most projects, directional boring is required to cross roadways, driveways and other areas.”

Mid-Plains splits construction between its own crews and subcontractors.

“Subcontractors usually are used on larger projects,” Hurt explained. “We recently awarded a contract to construct 59 miles of fiber in one of our 10 exchanges.”

Three construction crews made up of employees of Mid-Plains are responsible for installing fiber to the home (FTTH), as well as mainline or backbone construction.

Mid-Plains has several pieces of Ditch

Witch equipment including: a RT120 with backhoe, vibratory plow and trenching attachments; and a RT115 with backhoe and vibratory plow attachments.

“We have two directional boring units – a Ditch Witch JT2020 and a JT5,” Hurt said. “We use Subsite® Electronics trackers with our drill units, and all of our crews are equipped with Subsite locators. We also have a SK755 mini skid-steer loader with several attachments.”

Mid-Plains has been using Ditch Witch equipment for more than 50 years.

“I personally have operated the equipment for over 15 years of my career here at Mid-Plains,” said Hurt. “Day in and day out, the Ditch Witch line of equipment performs beautifully. But I think the support after purchase from the local dealership, all the way back to the factory engineers, has been what’s most impressive.”



MR90

also may be used. The RT80 with the MT12 microtrenching system makes a narrow trench, which can be 6 to 12-inches deep, through paving with a cutting wheel.

Feeders

From the backbone or ring, feeder lines extend fiber into neighborhoods and commercial areas to fiber nodes. From nodes, service lines go to homes and other buildings. Matthesen said there is typically a mixed use of construction methods performed in developed neighborhoods and urban areas, but surface improvements, landscaping and other factors encourage greater use of HDD units and microtrenching.

“When you get into the neighborhood areas like the work we’re doing, the JT20 is perfect,” said Billy Kilmer, Jr., COO of AccuBore Directional Drilling Inc., a company experienced in fiber work throughout the California Bay Area. “You can set up without leaving a big footprint, drill down the street quickly, pull pipe back and move on.”

Ditch Witch HDD equipment for feeder work also includes the smaller JT5 and JT9 models.

Fiber to customers

“Bringing service lines to homes and structures may be done by using vibratory plowing, directional drilling or trenching. When there are no surface or underground obstructions, plowing is the fastest method,” said Rupp.

Compact Ditch Witch service plow models include the 100sx and 410sx. The Zahn R300 with plow attachment also is a popular choice for contractors.

Fiber-optic cable requires special care to



RT80 trencher

avoid excessive bends. However, Rupp added, tests have confirmed direct burial of fiber by plowing using the correct plow blades and procedures does not damage fiber-optic cable.

When plowing is impractical such as when underground irrigation systems are present, the compact, powerful JT5 directional drill is designed for service-line work.

Support equipment

Fluid mixing, recycling – separate fluid-mixing systems often are needed to support directional drilling operations. Matthesen said the development of the MR90 mud-recycling system significantly saves time and money by recycling drilling fluids on job sites, making the recycling system a key component of many fiber projects. The MR90 is used with mid-range HDD units – Ditch Witch JT20, JT25 and JT30 drills, all are used on long-haul, backbone and feeder fiber installations.

Vacuum excavators – dual-purpose vacuum excavators keep job sites clear of drilling

fluids escaping the bore hole and make potholes to uncover existing utilities with “soft” high-pressure air or water. Both trailer- and truck-mounted models are available.

“Potholing by soft excavation quickly exposes pipe and cable while minimizing the risk of damage associated with other digging methods,” said Jason Proctor, Ditch Witch senior product manager of vacuum excavation systems.

Ditch Witch offers 13 vacuum excavator models ranging from the FX20 for small projects to the powerful FXT65 for potholing and large cleanup jobs. The FXT65 is available in both hydro and air excavation models.

Subsite® Electronics – The effectiveness of directional drilling is dependent on the accuracy with which pilot holes are made, and the Subsite TK series guidance system is the most advanced on the market.

Learn more about Ditch Witch solutions for your fiber installations by visiting ditchwitch.com/fiber.

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