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AHEAD OF THE CURVE

Despite superstition, Friday, October 13 turned out to be a lucky day indeed for Midwest microtunneling contractor Super Excavators, Inc. and Superior Stones Canal CSO Improvement Project owner, Northeast Ohio Regional Sewer District (NEORS). The date marked the successful completion of Super Excavators, Inc. (SEI)/CRS Tunneling, Inc.'s (CRS) third curved microtunnel, the second that they've completed in Cleveland, OH on the Project Clean Lake initiative.

SEI has earned a reputation as a leading North American microtunneling contractor by their fearless ambition to tackle the most complex microtunneling projects, and in 2013 began a flourishing curved microtunneling service category.

The Superior Stones Canal CSO Improvement Project involves the construction of two force mains and a gravity sewer, a new wet weather pump station and upgrade to an existing pump station to increase capacity and reduce an annual estimate of 13-million gallons of raw sewage discharge into the Cuyahoga River.

Of particular sensitivity within the project region is the eight-floor wedge-shaped Western Reserve Building, constructed in 1891 and listed on the U.S. National Register of Historic Places.

While the original project design called for a straight tunnel just under the Western Reserve Building and several large diameter water mains, Super Excavators saw an opportunity to reduce some long-term risk for the NEORS. SEI modified the design to move from a straight to a curved alignment and retained S. J. Ludlow Consulting Engineers, Inc. to propose a Value Engineering Change Proposal to move the alignment 34-ft. away from the historic building. The proposed modifications were informed and presented based on past success on the curved microtunnel project from 2013.

The revised 765-ft. tunnel design was broken down into a 60-ft. straight to 336-ft. curve culminating with a 368-ft. straight section for effective mitigation of ground settlement above the project's most sensitive surface structures. The completed microtunnel would house two 12-in. force mains and an 18-in. gravity sewer carrier.

NEORS agreed that the proposal presented the best available option to mitigate risk exposure in the event of structure settlement and approved the change proposal to proceed with construction.

The ground in the project region was characterized as glaciolacustrine and glacial till deposits consisting of sandy silt with loose to medium density with medium to hard stiff clay. (continued...)



SEI's SL60 MTBM cutterhead emerges after completing a 765-ft. curved microtunneling for the NEORS. Pictured from left to right are SEI crew members Justin Okruhlica, Glen Riley and Jim Strane.

CURVE CONTINUED...

SEI embarked on shaft construction in September 2017 along West Superior Avenue in downtown Cleveland within a tight corridor of bus and automobile routes, surrounded by many buildings including several high rises. The 43-ft. deep, 24-ft. diameter launch shaft was constructed with liner plates and ring wales on four-foot centers. The shaft was designed to withstand the jacking forces required to advance the pipe through the ground and accommodate the 15-ft. wide by 8.6-ft. high, 36-in. thick thrust block.

Forty-eight inch ID RCP with C-wall thickness in eight-foot segments was ordered from the Columbus, OH plant of Forterra Building Products. Unlike a straight alignment, pipe segments on a curved alignment are customized with varying amounts of reinforcement, banding, gaskets, and joints to withstand jacking, and load tolerances. The pipe for this project was manufactured with 6,000 psi concrete to tolerate 800-tons of jacking force. European in style, the pipe features a profiled gasket to ensure sealed joints for a successful curved tunnel that was able to house the two 12-in. force mains and 18-in. gravity sewer carrier pipes with specially designed casing spacers.

SEI employed the use of their Akkerman SL60 MTBM system equipped with a mixed-face disc cutter head, increased to excavate 62-in. diameter. The MTBM and pipe were advanced with an 800-ton capacity jacking frame. All microtunneling functions were remotely operated from the control container.

The 335-ft. curve featured a 1,500-ft. radius and was installed at a 5.5% downhill grade.

To maintain line and grade tolerances, SEI used Akkerman's AZ100 TGS for tunneling navigation. The AZ100 TGS is comprised of individual, self-leveling station units that maintain a surveyed connection along the alignment without having to conduct multiple surveying efforts throughout tunnel construction. For operation, the shaft station is positioned in the launch shaft on a self-leveling tribrach, and subsequent pipe stations are inserted within the tunnel as required for the lasers to maintain a line of sight between the stations, monitor the alignment and slope, and read the angle of incidence around the radius of the curve.

KS Associates, Inc. (KS), a civil engineering and surveying firm located in Elyria, OH, performed the initial survey for setup of the AZ100 TGS. KS surveyed tunnel alignment control points at the ground surface and transferred the information 40-ft. down

to the launch shaft level. KS then established the coordinates for line and grade and Akkerman staff and SEI crew initiated the AZ100 TGS system. During mining operations, KS periodically surveyed the station units to ensure that everything was working accurately. Thanks to the competency of KS and effectiveness of the AZ100 TGS system, the tunnel was completed with minimal downtime for surveying and the pipe emerged in the launch shaft within an eighth of an inch on line and at exact elevation.

The 48-in., 765-ft. microtunnel was completed in just 14 days of mining while abiding by a 12-hour a day construction ordinance.

Nathan Weidmeyer, superintendent with SEI, remarked, "With a 1,500-ft. radius and 5.5% downward slope, I couldn't ask for a better guidance system. The AZ100 TGS was always on the mark, and there was minimal downtime for surveying."

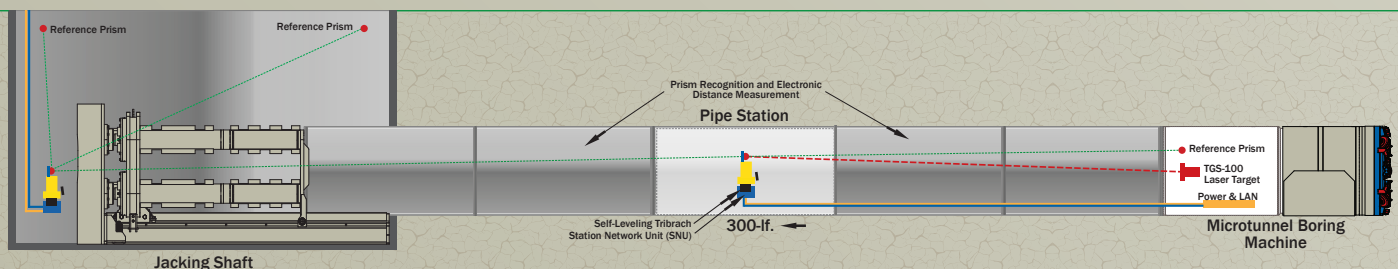
Weidmeyer furthered, "SEI and I thank all who participated to efficiently complete this project." He credits the achievement to "the expertise of MTBM operator Jim Strane and crew, and top notch collaboration with Forterra Building Products, KS Associates, Independence Excavating, and Akkerman."

Going forward, it is certain that the industry will see SEI/CRS navigate future microtunnel curves with the same level of success.

SEI'S PREVIOUS CURVED MICROTUNNELS

The Superior Stones Canal CSO Improvement Project represents SEI's and sister company CRS's third successful curved microtunnel in four years. It is their second curved microtunnel in Cleveland, OH. The first curved microtunnel in Cleveland, the Dugway West Interceptor Relief Sewer, was completed in October 2013 by Walsh/Super Excavators, JV. To reduce combined sewer overflows, they completed 4,000-ft. of 48-in. RCP micro-tunneled sewers in up to 32-ft. depths. The highlight of this project was a 700-ft. drive of 72-in. RCP, representing the first curved microtunnel in the Midwest, completed with an Akkerman SL74 MTBM system.

Just in September 2017, CRS completed a 323m (1,060-ft.) curved microtunnel of like diameter with their SL60 MTBM microtunneling system on the Airport Road Storm Sewer from International Centre to Derry Road Project in Mississauga, ON for the Region of Peel. The storm sewer, near the Lester B. Pearson International Airport, featured a 175m (574-ft.) curve with a 1,050m (3,773-ft.) curved radius. Using the AZ100 TGS, CRS achieved accurate tunnel alignment.



Akkerman's AZ100 TGS is comprised of individual, self-leveling station units that maintain a surveyed connection along the alignment without having to conduct multiple surveying efforts throughout tunnel construction.

RAMMING ONWARD

Contractor pilot tube ingenuity has been consistent since we first introduced our guided boring systems in 2001. Occasionally an innovative pilot tube approach creates demand for a specialized service all its own. Such is the case with the guided pipe ramming method for The Tunneling Company (TTC), formerly Kamloops Augering & Boring, Ltd., who first incorporated this method into their standard service portfolio eight years ago.

Recently the Ministry of Transportation required the installation of two new culverts in the McDowell Creek for passage under Highway 16, two kilometers (1.2 mi) east of the village of Telkwa in the providence of British Columbia, Canada.

Belvedere Place Contracting Ltd. was the successful prime contractor on the Highway 16 Tyhee Passing Lane project. The full scope includes the construction of a 2.3 km (1.4 mi) eastbound passing lane added to Highway 16 near Tyhee Lake and a two kilometer (1.2 mi) extension of the existing pass lane. The project is part of a \$37.7 million effort allocated for five new passing lanes on Highway 16 and 37 and 10-year transportation plan to improve travel safety and growth.

Belvedere subcontracted TTC to install a 2440mm (96-in.), 45m (147-ft.) main culvert and 1200mm (48-in.), 43m (141-ft.) overflow culvert for McDowell Creek flow under Highway 16. The two new culverts are approximately 2.4m (8-ft.) apart at a 4.5% grade. The overflow culvert was positioned slightly higher at 0.5m (1.6-ft.) at the invert.

Harry Dickinson, project coordinator and estimator at TTC described, "We originally planned on just open-ended pipe ramming but due to the culverts' grade tolerances we could not risk any deviation so opted to guide the pipe string with pilot tubes."

Guided pipe ramming utilizes the Akkerman guided auger boring method of accurately installing pilot tubes to establish line and grade. To upsize, the pilot tubes are followed by a pneumatic pipe hammer attached to the final diameter steel casing. The hammer transfers force to the open-ended pipe to advance it with powerful and repetitive percussive blows. The use of the pneumatic hammer ensures ground control at the face of the excavation, and since advancement happens quickly, the potential for settlement is minimal. The method is also conducive to a wide variety of soil types. To date, TTC's longest and largest guided pipe ramming project was 84m (276-ft.) using 3m (120-in.) steel casing.

The pilot tubes on the 2440mm (96-in.), 45m (147-ft.) main culvert were installed from the direction of the culvert's outlet side of Highway 16, approximately 5m (16-ft.) below the roadway surface. The GBM jacking frame was mounted to the auger boring machine track at the entry point on the center of the alignment in preparation for pilot tube installation.

Dickinson explained "After the pilot tubes were across, we opted to pipe ram a 760mm (30-in.) casing with our Hydrohammer and auger boring machine along the entire crossing, to



TTC was subcontracted to install a 2440mm, 45m main culvert and 1200mm overflow culvert under Highway 16 in British Columbia.

effectively act as pilot pipe for the 2440mm (96-in.) culvert." TTC fabricated the 760 to 2440mm (30-96-in.) adapter to join the two diameters and provide rigidity. The soil in the interior of the tunnel was cleaned out using a Bobcat® skid-steer loader.

The 1200mm (48-in.) overflow culvert was tackled just 2.4m (8-ft.) to the left of the main culvert. After the pilot tubes were in place, a 600 to 1200mm (24-48-in.) weld-on reaming head followed to increase the diameter to the final steel casing size and augers cleaned out the soil. The pneumatic hammer was attached to the back of the product pipe, and advanced the steel casing the along the full 43m (141-ft.) length.

The two culverts were completed on line and grade in early August without incident and in three weeks' time.

Using the past several years demand as gauge, Dickinson anticipates that this sector of TTC's market will continue to strengthen and steadily grow.



Pilot tubes initiated the 2440mm, 45m main culvert installation followed by a 760 to 2440mm adapter.

PIPED CANOPIES IN SYDNEY

Tunnelling Solutions (TS) of Melbourne is known throughout Australia as a full-service, specialized tunneling contractor with a team representing decades of technical tunneling experience.

One of TS's ambitions of late was to expand their range of services to take on piped canopy projects. By combining guided boring pilot tube technology with an adjustable support and tension frame, they've developed an approach for consistent and repetitive success. In the past six months, they've packaged this service offering for use on three projects.

GUIDED PIPED CANOPY METHOD

The method of guided piped canopy installations, also called guided pipe roofing, is used for short tunnels, culverts or crossings for extra reinforcement in heavily traversed regions for stress distribution and to mitigate ground settlement. Connected lengths of steel casing, called canopy tubes, are installed to provide an arch or crown above a support structure, culvert or tunnel.

First, pilot tubes are successively installed on line and grade. To do this, the Guided Boring Machine (GBM) jacking frame is positioned on an adjustable platform to relocate the point of entry for each pilot tube pass. Next, the GBM jacking frame installs the steel casing canopy tubes into the precise position, using 6m (20-ft.) versus 1m (3.3-ft.) segment lengths to expedite installation. The casing is filled with concrete, void filling is inserted around the outside of the casing, and the support structure is fitted and finished below the arch.

THE RIGHT EQUIPMENT

Nick Lewis, project manager with TS, was confident that the Akkerman GBM system was the ideal match for their adjustable support and tension frame concept because of "its reputation for accuracy and its ability to probe the alignment before committing to the ground." TS contacted Akkerman representative Lovsuns about equipment acquisition.

As the next course of action, Lewis teamed up with Akkerman to engage in discussions about how the adjustable tension frame could best accommodate the Akkerman GBM 240A jacking frame.

TS then collaborated with a local manufacturer to fabricate the adjustable tension frame. The design includes shaft rails, a tension frame with support beams, a working platform to hold the GBM jacking frame with an integrated backstop and crawler inserts, and a belt conveyor system for soil removal.

THE PROCESS

On a typical guided boring project, pilot tubes are used to establish an accurate bore path, and they are followed by a full pass of temporary casings and augers. The installation is complete when the product pipe is jacked into place, resulting in three full passes. The standard three-pass method works when the alignments are designed with a definite

point A to point B. However, with TS's piped canopy projects there were no reception shafts so all points of entry and tooling pull-back had to happen from the launch shaft.

To overcome this challenge, Akkerman developed a lead integral cutter head featuring retractable wing cutters and a heavy-duty auger to guide the 350mm (12.75-in.), 6m (20-ft.) length canopy tubes along the bore path. With this solution, the steps progress as follows:

Step 1: Install pilot tubes on line and grade.

Step 2: Retract pilot tubes and steering head from the pilot tube bore hole and remove them from the launch shaft.

Step 3: Launch 350mm (12.75-in.) diameter canopy tubes with lead integral cutter head and enclosed augers. The cutter head excavates to the canopy tube diameter with a slight overcut for reduced jacking forces. When the lead auger reaches the final point of installation, the integral cutter head dirt wings are retracted, the GBM jacking frame operator engages pull-back mode, and the augers and cutter head travel back to the launch shaft for removal and the canopy tube remains in place.



The contractor's GBM system and adjustable support and tension frame is used to install successive installations of 350mm steel casing canopy tubes.

CONSTRUCTION

In early 2017, TS took delivery of a GBM system to install 13 repetitions of 40m canopy tubes for their first project in Sydney. To address a broad range of geology, TS elected to include the Rock Drill Adapter (RDA) and several TriHawk® drill bits in their system package for use in combination with the standard pilot tube steering heads for multiple choices for each canopy tube installation in up to 12,000 psi UCS ground.

TS also acquired a Butor TEM74E tunnel excavator to remove the soil from the concrete tunnel below the pipe canopies.

TS has since completed two successful pipe canopy projects and is currently on site on a third project. The first project was the Castle Hill Pedestrian Underpass for the Northwest Rapid Transit Infrastructure Joint Venture (NRTIJV), the second was the Norwest Pedestrian Underpass for NRTIJV, and they

are currently on the Darebin Rail Underpass for the North Eastern Program Alliance. The three projects represent a total of 45 pilot tube to canopy pipe bores in up to 50 mPa and sticky clay ground conditions.

LESSONS LEARNED

TS's piped canopy service has allowed them to overcome challenges for clients and provide a complete and inclusive project solution.

Lewis states that their machinery investment has benefited their company through project savings in "reduced machinery costs by offering clients an all-inclusive approach, and production savings from fewer individual set-ups on each project."

The method is valuable in Lewis's view because it "provides the opportunity for further geotechnical information before installing the main tunnel, reveals a complete set of soil samples for the length of the tunnel which aids in the permit to tunnel process, and presents less risk in certain ground conditions."

Lewis concludes, "The pilot tube going first proves the alignment and ensures an accurate installation of the canopy tube for a precisely installed pipe canopy that sets the tunnel off to a good start and with a neat excavation profile."



Step three in TS's process launched the 350mm diameter canopy tubes with lead integral cutter head and enclosed augers along each pilot tube bore path.



A completed pipe canopy before the installation of the of the support structure to be inserted below.



WELCOME WESTON



Earlier this year, we welcomed Weston Alberts to our engineering team as Senior Project Engineer. Alberts' primary focus is electrical design and control systems for all Akkerman equipment.

Alberts' interest in electrical design and control systems stems from an early interest in farm machinery while growing up on his family's dairy farm in southeast Minnesota.

He received his formal education from Michigan Technological University in Houghton, MI with a bachelor's degree in electrical engineering.

Alberts' professional career spans the past decade, across many varieties of electrical systems. His first position was as design engineer for truck chassis electrical systems with Oshkosh Truck in Oshkosh, WI. A few years later he returned close to home to design multiplexed electrical and software control systems for controlling truck hydraulics at McNeilus Truck in Dodge Center, MN. Most recently, he was a staff application engineer, designing electrical and software control systems for products ranging from mobile cranes to ambulances at Hydro Electronic Devices, Inc. in Hartford, WI.

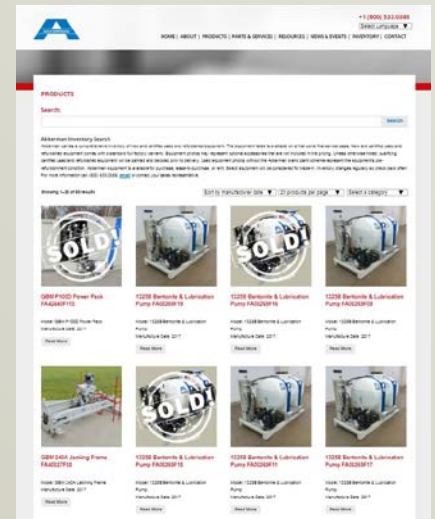
Right after he joined our team, Alberts hit the ground running to complete his first project, the Akkerman Bentonite Injection System (ABIS) for automated bentonite injection using a touch screen monitor for pipe jacking and microtunneling operations. In the near future he will begin work on a two-way communication system for MTBM systems, then the next generation GBM guidance system.



The International Construction and Utility Equipment Exposition held October 3-5, 2017 was a big success, attracting many visitors to our outdoor displays. We will return to Louisville, KY for ICUEE 2019.

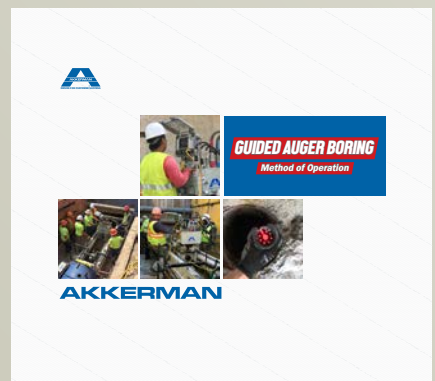
ONLINE INVENTORY

Customers enjoy the availability of our online finished goods inventory. Each listing contains several photos and important information about equipment availability, specifications, package offerings and much more. Select equipment is marked for special web and clearance pricing. It's easier than ever to inquire about specific units since your inquiry form gets sent directly to the sales team member in your region. Check out what's available today and check back often!



GUIDED AUGER BORING METHOD OF OPERATION GUIDE

The Guided Auger Boring Method has become the most common application for our guided boring systems in the US, and with ever evolving tooling innovations, its utilization has positively impacted the auger boring market and furthered industry expectations on what can be achieved. We recently made available a handy method of operation guide, available for download at www.akkerman.com/gbm_documentation.php.



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AKKERMAN BENTONITE INJECTION SYSTEM (ABIS)

Our newest lubrication solution for pipe jacking and microtunneling operations, the Akkerman Bentonite Injection System (ABIS) delivers automated bentonite injection at optimal tunnel intervals to reduce jacking forces and facilitate efficient and extended length pipe jacking. The ABIS package delivers totalized flow control at each valve location using touch screen functionality from the main system monitor.

This ABIS system is comprised of a Control Skid housing the flow meter and Monitor Touch Screen. It connects up to 10 Remote Station Control Boxes, each with three linked Automated Injection Ball Valve Assemblies for point flow distribution onto the pipe annulus. The Remote Station Control Boxes are also capable of controlling and monitoring Intermediate Jacking Stations (IJSs) functions. The standard ABIS configuration equips microtunneling and pipe jacking contractors with components for a 2,000-linear foot tunnel, and the flexibility to suit a variety of project conditions. The distance between Remote Station Control Boxes and Automated Injection Ball Valve Assemblies is determined by the contractor and individual project requirements.

The ABIS system's hub is its innovative yet simple 10.4-inch (264mm) Monitor Touch Screen interface. The user's interaction from the menu screen on is intuitive and straightforward. With totalized injection control, everything from valve injection volume, current valve flow volume, pressure and injection sequence to IJS extend and retract, and tunneling lighting are all commanded from the above ground Monitor Touch Screen. The monitor's resistive touch screen feature makes it possible for operators to initiate commands without removing safety gloves. The ABIS system logs cumulative data on dates and times, station valve injection totalized volume and pressures, as well as IJS data including pressure and displacement. If bentonite injection control is preferred from the microtunneling control console, the Monitor Touch Screen interface can be transferred via Ethernet cable to the control console for MTBM operator command. The Monitor Touch Screen is powered by single-phase 120VAC power.

Like all Akkerman equipment, the Control Skid is designed with conveniences for a project environment in mind. The Monitor Touch Screen and bentonite control plumbing mount to the Control Skid for ease in transport and site set-up. The flow meter, pressure transducer, in and out manifold, and un-loader and relief valves are easily accessible to connect to the bentonite supply lines. Affixed hose and cord hooks on either side of the skid promote project tidiness. The skid is easily transportable using the fork pockets and a lift eye.

The ABIS system safely removes operators from the interior of the tunnel; however, its safety features do not end there. If the operator must enter the tunnel, each Remote Station Control Box contains an integrated, flush-mounted 24 volt LED light as well as a detachable, magnetic light with a 30-foot (9.1m) cord to illuminate the tunnel and the Automated Injection Ball Valve Assembly sites. Lighting is managed from the Monitor Touch Screen.

The ABIS system pairs with all Akkerman lubrication solutions as well as other manufacturer's bentonite and lubrication pumps.



Come visit us at the following 2018 Tradeshows and Conferences:

January 30 - February 1, 2018

UCT 2018

Booth #703

New Orleans, LA

Ernest N. Morial Convention Center

Presenter

February 5-8, 2018

25th Annual Pilot Tube

Microtunneling/Microtunneling

Short Course

Boulder, CO

University of Colorado at Boulder

Main Event Sponsor & Presenter

March 6-9, 2018

NUCA 2018 Annual

Convention and Exhibit

Booth #TBD

San Antonio, TX

Wyndham San Antonio Riverwalk

March 25-29, 2018

No-Dig 2018

Booth #309

Palm Springs, CA

Palm Springs Convention Center

Gold Sponsor & Presenter

May 15-17, 2018

CATT Trenchless Technology Road

Show 2018

Booth #112

London, ON

London Convention Centre

Presenter

June 24-27, 2018

2018 North American Tunneling Conference

Booth #633

Washington, D.C.

Marriott Wardman Park

July 15-18, 2018

UESI Pipelines 2018 Conference

Booth TBD

Toronto, Canada

Sheraton Centre Toronto Hotel

Presenter

September 18-20, 2018

Equipment Training School &

Akktoberfest 45th Anniversary

Celebration

More details coming soon!



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EQUIPMENT TRAINING SCHOOL & AKKTOBERFEST 45TH ANNIVERSARY CELEBRATION

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We have exciting news! Many of you recall Akktoberfest, when we celebrated our 35th year anniversary. The year 2018 marks our 45th anniversary, and we're raising the bar to not only commemorate all our years of providing the industry's best guided boring, microtunneling, pipe jacking and tunneling equipment—we're also adding two days of in-house operator training! You'll send your crew to our factory to learn all the best practices, techniques and tips for successful operation from our team of experts for free!

We could not celebrate this occasion without the support of our long-time equipment owners—and the dual purpose of this event is to also express our gratitude! The one day Akktoberfest will include equipment displays of our newest and greatest products, factory tours, networking with our team, and great food and entertainment!

More information will be available as planning unfolds, but for now, mark your calendar for **September 18-20, 2018!**