The name Miller The Driller, Des Moines, IA, has become synonymous with some of the most difficult utility construction projects in the United States. In the world of pipe ramming Miller the Driller is considered a premier contractor. After the recent project in Altoona, IA, Miller the Driller reached a new plateau with a world pipe ramming record.

For the project in Altoona, Miller The Driller was contracted to install a 60-foot tunnel underneath a rail line in order to facilitate a new bike path. The pipe ram ranks as the largest diameter pipe ram ever completed. According to vice president of operations Brandon Young, son of Miller the Driller President Kris Young and grandson of founder Gene Miller, the installation method was key to the project’s success.

Young said, “During the early stages of this design, Snyder & Associates Engineering, Ankeny, IA contacted us regarding jacking in a square concrete tunnel underneath railroad tracks for a bike tunnel. We have completed both square and round projects in the past. After looking at the sight we determined that a square tunnel would not be a good choice for this project as the tracks were built on a levee. Our experience has been that levees are typically built on or with fill material that would hinder this type of trenchless application. We decided to pipe ram a round casing instead.”

In order to create a tunnel large enough to accommodate bicyclists, the steel casing would need to be very large. The 147-inch outside diameter casing ultimately used for the tunnel sets a new world standard for pipe ramming diameter, besting the previous record by three inches. To complete the job, Young chose a 24-inch diameter Grundoram Taurus pneumatic pipe rammer from TT Technologies, Aurora, Ill.
Ramming Basics & Benefits
Trenchless pipe installation through ramming is a basic process that can have amazing results. A pneumatic hammer is attached to the rear of the casing or pipe. The ramming tool, which is basically an encased piston, drives the pipe through the ground with repeated percussive blows.

A cutting shoe is often welded to the front of the lead casing to help reduce friction and cut through the soil. Bentonite or polymer lubrication can also be used to help reduce friction during ramming operations.

According to TT Technologies pipe ramming specialist Mike Schwager, several options are available for ramming various lengths of pipe. He said, "An entire length of pipe can be installed at once or, for longer runs, one section at a time can be installed. In that case the ramming tool is removed after each section is in place and a new section is welded on to the end of the newly installed section. The ramming tool is connected to the new section and ramming continues. Depending on the size of the installation, spoil from inside the casing can be removed with compressed air, water, an auguring system or other types of earthmoving equipment."

Some casing installation methods are impaired or even rendered inoperable by rock or boulder filled soils. Pipe ramming is different. During pipe ramming, boulders and rocks as large as the casing itself can be "swallowed up" as the casing moves through the soil and can be removed after the installation is complete.

Ramming tools, in general, are capable of installing 4- through 122-inch diameter pipe and steel casings. At 24 inches in diameter, the Grundoram Taurus is the world’s second largest pipe rammer. The Grundoram Apollo at 32 inches in diameter is the world's largest ramming tool. Until the Miller the Driller project in Altoona, diameters up to 144 inches had been successfully installed using large scale ramming equipment. Ramming requires minimal working depths and is proven effective for horizontal, vertical, and angled applications. Ramming is also ideal for installations under roads and rail lines because it displaces the soil without creating voids or slumps.
On The Job
The ram took place under rail lines (which remained active throughout the project) owned by the Iowa Interstate Railroad Ltd. A launch pit was dug on the south side of the tracks to accommodate a 50- by 16-foot concrete pad that would serve as a platform for operations. Young said, "With an existing park on the north side of the track, we didn't want to cause any more environmental impact to the area than was necessary. We built a concrete backstop and concrete launch pit on the south side of the tracks where excavation and clearing would take place anyway for the new bike trail."

After the pit construction was finished the Miller crew assembled a driving stage for the Taurus from an auger track. The crew also utilizes a hydraulic push sled to assist with ramming operations. Young said, "We used the boring machine to push against the casing during ramming. We also used it to move the rammer back after each segment of pipe was rammed into place so the next piece of casing could be brought in."

The pipe chosen for the project was made by Permalok, St Louis, MO. The casing was fabricated in 20-foot sections. Each 20-foot section had a wall thickness of 1.5 inches and weighed 2,330 pounds-per-foot or approximately 47,000 lbs per section. The Permalok casing incorporates a mechanical press fit design without an internal or external bell. According to Young, this was a real time saver. Schwager commented, "On a recent large diameter ram that incorporated a weld-in-place operation, a single joint took a week to weld and X-ray. Brandon said the time needed to make up one Permalok joint for the Altoona project was less than one hour." The crew carefully lowered a 20-ft long 147-in diameter pipe section into place and after the prep work was complete, ramming was ready to begin.

The crew used a Grundoram Taurus pneumatic pipe rammer from trenchless equipment manufacturer TT Technologies, Aurora, Ill. At 24 inches in diameter, the Taurus is the world’s second largest pipe rammer. The 32-inch Grundoram Apollo is the world’s largest.

Big Time Ramming
The connection between the 24-in diameter Grundoram Taurus and the 147-inch OD diameter casing was made using a special adapter. The 147-in inverted bell pipe adapter, rolled by Arntzen Steel, Rockford, Ill., reduced the overall diameter to 80 inches. An 80-in ram cone was then connected to the adapter and further reduced the diameter to 30 inches. A 24-in ram cone made the final connection to the tool. The entire configuration was secured with tensioning chains and the tool was connected to the air compressor.

The actual ramming went smoothly. Crews were able to install the first 20-foot section of casing without incident. The ramming tool was removed and some of the spoil was taken out of the casing. Crews then positioned the next 20-foot section of pipe in place and made the connection to the first section. The rammer was reconnected and the second section was rammed in place. The entire ram was completed on a 2.2% downhill grade. Once all of the casings were installed the Miller the Driller crew removed the remaining spoil with a skid steer loader. Almost 6,000 cubic feet of dirt was removed from the casings.
Ramming Revelry

Young attributes the success of the project to several factors. He said, "The willingness of the engineers to look beyond conventional construction techniques and allow a trenchless solution to be developed was the first part of the success. The other part was the crew. They were the success. The crew was very professional and courteous at all times. I am very proud of how our team represented Miller the Driller. Our field supervisor Bill Mendenhall took hold of a concept and made a highly difficult project highly successful. Several railroads were watching this project very closely. They couldn't believe it when we rammed the pipe through to the exit side and never disturbed the tracks.

"Plus, there's the safety factor. There were no injuries on this project. The crew even built a guardrail around the launch pit to ensure the safety of the many spectators this project had. Hard hats, safety vests, safety glasses, earplugs and steel toe boots were worn by all workers and even by spectators. All those years of pipe ramming experience paid off again. We went through 30- and 36-inch being a big size in 1993 and now we're doing 147 inches. That constant pushing the limits, understanding the technology, and working through the issues is what will help pipe ramming in the future."

On a more global scale, Young sites his grandfather, Gene Miller, for making this project possible. He said, "You know, the real credit for the expansion of pipe ramming industry I give to my grandfather and the foresight to see what that tooling can do. He doesn't put limitations on ideas." Miller said he was proud to be on the project and see how smoothly things went. With that attitude and experience behind them, another world record could easily be within Miller the Driller's reach.
During the ramming process, the pneumatic Grundoram is attached to the end of a casing through a series of ram cones. The percussive action of the tool effectively drives the casing through the soil. The ramming method is preferred in applications under roads and rails line because it is able to install casings without creating voids and slumps, leaving surface structures undisturbed.

*Underground Construction, April 2004*