By Jim Schill

Fire and Flooding in Los Alamos:

Pipe Ramming Provides a Solution

The Cerro Grande fire ravaged the Los Alamos, N.M., landscape in May of 2000. In addition to threatening the world famous Los Alamos National Laboratory, the firestorm consumed more than 47,650 acres of forest and left more than 400 families homeless. However, almost as soon as the fire was contained a new threat arose: flooding.

The massive fire left the mountainous region vulnerable to excessive water run-off. The threat of extreme summer flooding prompted the Los Alamos National Laboratory and local communities to take steps to help mitigate the potential disaster. New drainage pipes had to be installed to help route the expected run-off.

The first project called for the installation of a 250 feet of 36″ steel drainage casing under a roadway near the lab. The area's sediment rich soil was not going to make the job easy. Boring contractor DH Underground, Albuquerque, N.M., was contracted for the project. DH Underground partners John Theiler and Mark DeVaney ultimately chose the Grundoram Pipe Ramming System from trenchless equipment manufacturer TT Technologies, Aurora, Ill., to perform the work.

"We anticipated a simple trenchless auger boring project, but plans changed dramatically once we encountered the soil conditions," Theiler said. "We decided on pneumatic pipe ramming instead, another trenchless casing installation method that would allow us to place the drainage pipe without open cutting the road." The road was one of only two roads that traveled to the National Laboratory.

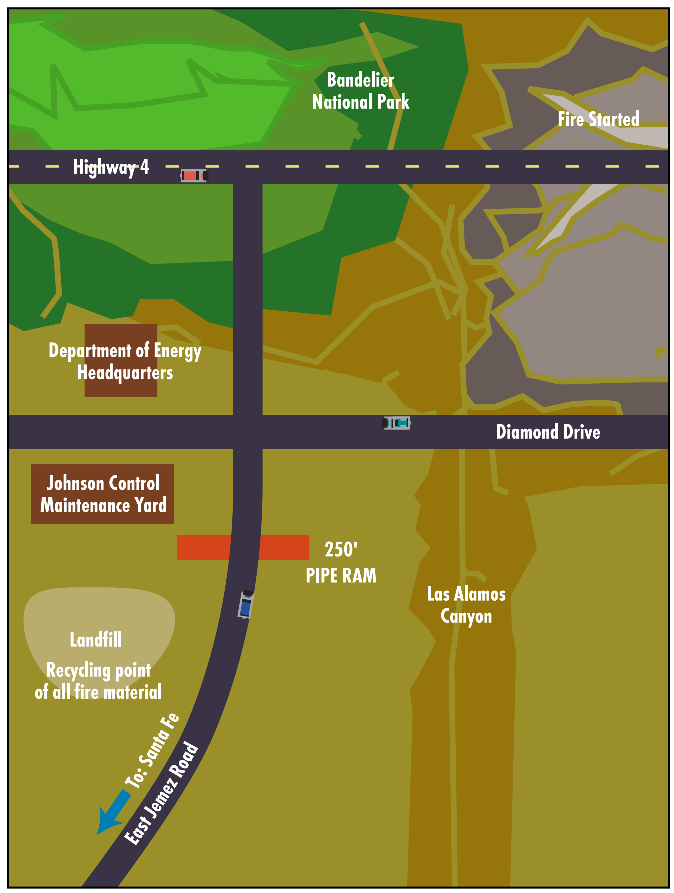
Fire and Water

Ironically, the Cerro Grande fire was a result of a controlled burn designed to help prevent just such an incident. While the Laboratory basically escaped unharmed, the area's watershed and natural erosion controls were not as lucky. The firestorm destroyed thousands of acres of forest. The underbrush in that forest is what slowed water run-off.

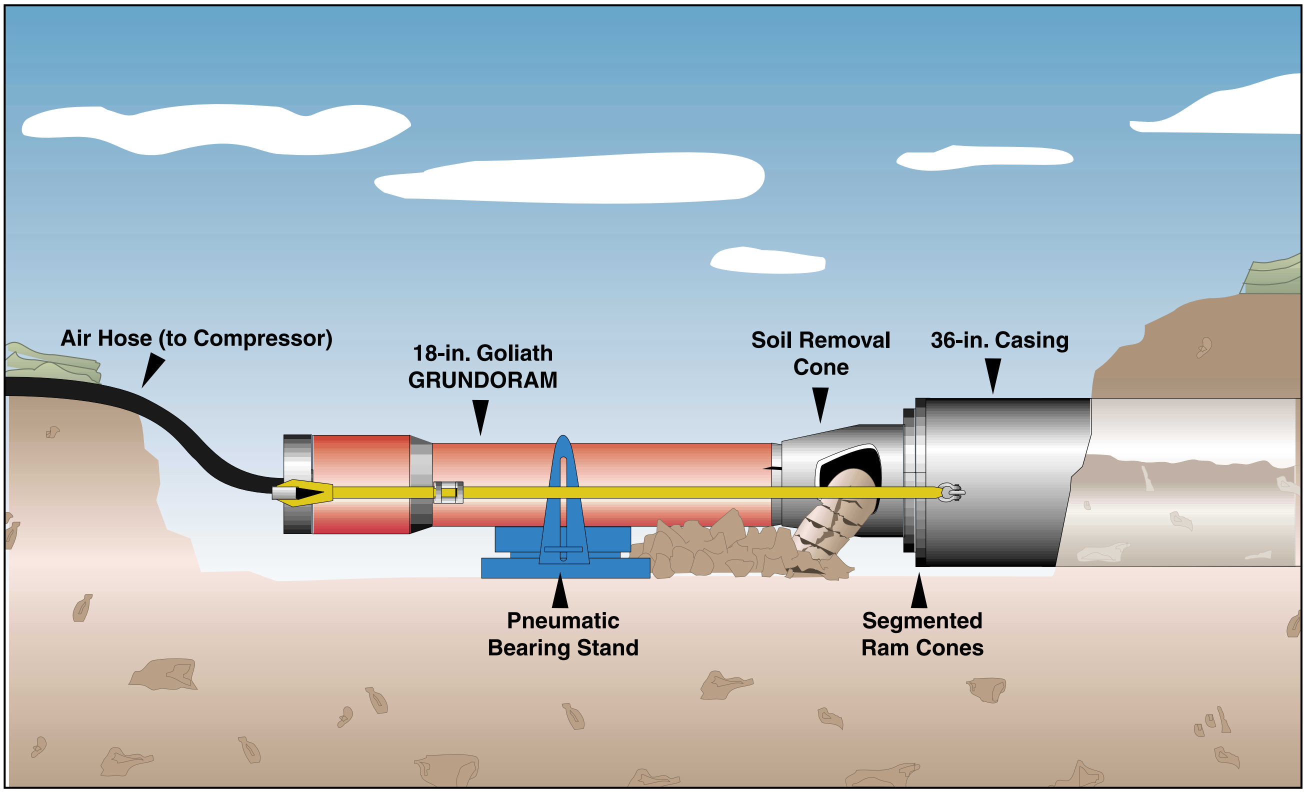
In addition, the intense heat of the fire transformed the soil. The charred soil became unable to readily absorb water. For an area that averages more than 8½″ of rain from July through September, these conditions signaled a potential disaster.

Efforts to reduce the effect of potential flooding began almost immediately. U.S. Forest service workers cut down charred trees to help divert run-off. Prison inmates were used to till the scorched soil and volunteers planted rye, barley and other vegetation to help soak up rainwater and begin the restoration process.

The National Laboratory took steps as well, identifying drainage routes and con-



▲ The 250′-casing installation took place under one of only two roads leading to the Los Alamos National Laboratory. Traffic disruption was avoided through the use of trenchless pipe ramming.



This is a typical pipe ram setup. For the Los Alamos job, the crew was able to install 250 feet of 36″ casing through extremely challenging soil conditions using an 18″-diameter pneumatic pipe ramming tool.

tracting to have drainage casings installed and replaced. "After the fire, local representatives sought out roadways that experienced excessive water run-off and designated them for drainage casings. Our particular job took place under a roadway just a few blocks from National Laboratory and about a mile and a half from the fire itself. When installed, the new casing would channel the water under the road and on its way down the mountain," Theiler said.

Change of Plans

According to Theiler the 250′ installation was intended to be an easy auger bore through drillable volcanic ash type soil. After digging a test hole it became apparent that auger boring was not going to work.

"We could barely dig through the ground with a 90,000-lb. track-hoe," Theiler said. "The soil was a densely compacted cobble conglomerate with large boulders, some as large as 24″ in diameter. We found that out later."

The original project specification called for 250 feet of 36″ pipe with .375″ wall casing. When it became apparent that augering was not going to work, Theiler and DeVaney decided to try pipe ramming instead. He turned to TT Technologies Pipe Ramming Specialist Rick Melvin for technical support and put in a change order for a thicker walled casing to accommodate pipe ramming.

Ramming Basics and Benefits

Trenchless pipe installation through ramming is simple; a pneumatic hammer is attached to the rear of the casing or pipe. The ramming tool, which basically is an encased piston, drives the pipe through the ground with repeated percussive blows.

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

According to Melvin, several options are available for ramming various lengths of pipe. "An entire length of pipe can be installed at once or, for longer runs, one section at a time can be installed."

If the pipe is sectioned, the ramming tool is removed after each section is in place and a new section is welded on to the end of the previous 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 augering system or a mini backhoe.

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 are capable of installing 4″-through 80″-diameter pipe and steel casings. Diameters up to 148″ have been installed successfully using large scale ramming equipment. Ramming requires minimal working depths and is proven effective for horizontal, vertical and angled applications. Ramming also is ideal for installations under roads and rail lines because it displaces the soil without creating voids or slumps.

The conditions at Los Alamos would put the pipe ramming method to the ultimate test.

Prep Work

Over the 250′ run, the DH Underground crew needed to maintain a 0.01/10 lf grade and line. The crew dug a 60′-long launch pit to accommodate the ramming equipment and the 40′-long sections of casing.

"After the pit was dug, we moved the first casing section into position. We checked line and grade using surveyor's equipment and water levels," Theiler said.

Once the casing was in position, the DH crew began assembling the ramming gear to connect the 18″-diameter pipe ramming tool with the 36″-diameter casing.

The "Goliath" weighs approximately 5,400 lbs. and operates at 1,236 cfm. At full force, the rammer's piston moves at 180 strokes per minute. A pneumatically powered adjustable bearing stand was used to raise the tool to the required height for ramming.

In order to connect the ramming tool with the casing, a series of tapered and segmented cones is used. The configuration for the Los Alamos lab included a segmented ram cone as well as a soil removal cone.

"When assembled, the segmented ram cone reduces the overall diameter from 36″ to approximately 24″. The soil removal cone is then added and further reduces the diameter to approximately 18″. At this point, the tool is connected, friction fit, to the soil removal cone completing the assembly," Melvin said.

Ramming the Way

Once the connection between tool and casing was complete, the crew was ready to begin ramming. However, some giant boulders were encountered about 60 feet into the run. These had to be removed before going on. Once the boulders were removed, the first sections of casing went in at an incredible rate. All the remaining boulders in the path were demolished by the rammer.

The DH crew pumped approximately 100 gallons of bentonite and water per 40′ casing section. Once a section was installed, welds between casings took anywhere from 3½ to 4 hours to complete. Ramming times averaged 1 foot every seven minutes in the beginning of the run and slowed to 1 foot every 20 minutes at the end of the run.

Once the 250-foot casing was in place, the DH crew began removing the spoil with its auger system. A lead auger of 24″ was initially used, followed by a 30″ and finally a 36″ auger.

Overall, Theiler was impressed by the equipment in such harsh conditions. "It was unreal. We could barely dig through the ground with our trackhoe. These were some incredibly difficult soil conditions. We were extremely pleased when the last section of pipe was in the ground."

Theiler anticipates more pipe ramming work in the Los Alamos area. He also is making plans for a 72″ ram later this spring.

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Casings from 4″ through 80″ are installed regularly through pipe ramming. Casings as large as 148″ have been installed through pneumatic pipe ramming.