Sliplining – It Looks Easy

Just Push One Pipe into Another – How Hard Can It Be?

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This article discusses the challenges that are faced when sliplining medium- to large-diameter sewers and the solutions created by the specialized equipment and a well-trained and well-managed crew.

Most large urban areas depend on larger interceptor sewers to convey the sewage from subdivisions and suburbs to the treatment facilities. Whether the large sewer drains city neighborhoods or neighboring towns' collection systems, the pipe is always large and usually deep. In an area like Los Angeles, interceptor sewers have been in use for a very long time.

The La Cienega Interceptor Sewer was installed in Beverly Hills and Culver City almost 100 years ago. The pipe consisted of a profile (non-round) brick tunnel. It was common practice to tile the inside surface of the tunnel with clay tiles made and installed specifically for the profile of the interceptor/collector pipe.

Over the years, the tiles have not been damaged by hydrogen sulfide gas; however, the mortar that held them in place has all but disappeared. The hydrogen sulfide gas has damaged the ceiling of the tunnel in many places, and for that reason, the decision was made to sliplining the tunnels with a pipe product that will be unaffected by the gas. The La Cienega Interceptor Sewer Rehab Project consisted of 11,500 feet of nominal diameters 39, 42 and 63 inches.

A temporary frame was used to support the cable sheave and pulling cable.

Kiewit Infrastructure West was the contractor that performed the work. The trade name of the new pipe is Amiren, a fiberglass reinforced polymer mortar pipe supplied by Thompson Pipe Group and manufactured by Amiantit in Poland. The pipe joints had a laying length of nine feet.

The profile of the new pipe closely matched the profile of the existing tunnel. The sliplining equipment, including the main sliplining machine, a 12DD-150, as well as the prover mandrels and hydraulic power unit, was manufactured by Tenbusch Inc. in Lewisville, Texas.

As sliplining challenges go, the La Cienega Interceptor Sewer was relatively standard. At first glance, sliplining an existing pipe with a new pipe looks like it ought to be easy. The following are just some of the existing conditions that were addressed as the work was performed.

Many challenges

Because of the normally large size of the interceptor tunnels, it is always preferred to work wet, also referred to as "live," since the line is not taken out of service. Bypass pumping the flow would require locating hoses on the surface. It is not typically acceptable to locate hoses on the sidewalk in front of a local business or on the grass in front of a residence. The volume of sewage that is conveyed by these kinds of conduits is almost always too much for bypass pumping.

When hydraulic equipment is working in a live sewage flow, it is imperative that standard hydraulic oil not be allowed to enter the flow. Tenbusch equipment is commonly shipped with environmentally safe hydraulic oil. For this work in Los Angeles, the contractor required it.

When working wet, the operator of the machine and any other employees in the pit, must be tethered to prevent them from falling into the live stream of sewage. The velocities are sometimes substantial and therefore dangerous. In order to allow maximum mobility while operating the machine, a wireless control panel was attached to the operator's belt.

The existing pipe usually has a substantial amount of debris laying in the bottom of the pipe. The new pipe cannot be inserted through the old pipe without thoroughly cleaning the existing line. In some pipes/tunnels that have deteriorated, the amount of debris can be problematic.

As is often the case where the existing tunnel/pipe has been repaired in the past, the inside surface sometimes loses its continuity. This can occur when the city crew places a round pipe as a patch in the repair of a non-round tunnel. In this situation, the new pipe might not pass through the repair section.

Therefore, it is always necessary to drag a prover mandrel through the line in preparation for the insertion of the new pipe. Prover mandrels are always constructed of steel and must with-

stand the stresses of begin pulled in either direction as the line is proven acceptable for the new pipe. Mandrels must be configured to the shape and diameter of the new pipe, allowing the flow of sewage through its structure as it is pulled and pushed.

Sewer gas

Sewer gas escaping from the collection system during the work must be fully controlled. Creating work pits and lateral connection excavations allow the escape of sewer gas. Because of this and the cost of controlling the escaping gas, it is extremely important that the pipe be sliplined with as few pits as possible. The limited number of pits, along with the machine's ability to simultaneously push both ways, dramatically reduced the cost of the sewer gas control.

Existing interceptor lines are always deep and are located below the elevations of other utilities servicing the area. It takes a great deal of planning to locate the insertion pits. It might seem obvious that the length of the pit is critical. However, because of the presence of parallel utilities, the width of the pit is also critical.

The Tenbusch DD12-150 requires a pit of only 17 feet in length and only 9 feet wide. The jacking unit pushes the new pipe in both directions from the same pit without any extra setup.

Before the new pipe can be pushed, the joint must be "made up." This refers to the important detail of pushing the new pipe spigot into the previously set pipe's bell. Because the joint uses a gasket, it can take a fair amount of thrust to push the spigot into the bell. The Tenbusch jacking unit features a set of clamps on each end of the machine to hold down the bell while the spigot is inserted. This allows the crew to quickly and efficiently join the pipes and continue the sliplining process.

The owner of the line required that the jacking equipment have a thrust maximum capacity of 150 tons. Another requirement was a digital chart record of the jacking forces applied to each pipe as it was inserted into the tunnel. The DD12-150 jacking unit fed data, via a wireless connection, to the laptop computer in the project manager's truck, giving real-time data for review by the inspector and for use later in reports to the owner.

Due to underground utilities, right of way issues, and existing structures, the 11,500 linear feet could only be installed using 12 pits throughout the length of the sewer line. Also, at every pit location there were existing utilities that couldn't be relocated, so the area available wouldn't allow for a large pit. As a result, some of the pipe runs had to be up to 1,700 feet long.

Transport

The contractor required that the jacking unit used on this job have a thrust capacity of 150 tons, but still had to be built so that it could meet the weight requirements and size requirements to be transported on city streets without extensive disassembly and reassembly. The hydraulic power unit also had to meet CA-AQMD Tier 4 Final clean air requirements

The first phase of the job included approximately 3,000 feet installed from a single pit. With the ability of the machine to push in both directions at the same time, it was finished in just four days. During this phase, the crew set a record of 100 pieces of pipe pushed in a normal workday. During later phases of the work, as the crew became skilled in the use of the equipment, even pushing in a single direction, the crew was still able to push 90-100 sticks a day.

The Tenbusch jacking unit could be demobilized from one access pit and reinstalled in the next access pit in the same eight-hour shift using the same crane. The short joint length of the new pipe and the small footprint of the Tenbusch 12DD-150 made it possible to install all new pipe with only eight moves of the machine.

The well-trained crew's attention to detail ensured that the new pipe was correctly installed.

- In the 11,500 feet, there were 40 laterals ranging in size from 24 inches down to 8 inches. Two of them were too large to reconnect under flow conditions, so they were performed by cutting in a factory tee (from Amiantit) and then concrete encasing the connection.
- The annular space between the new pipe and the tunnel wall was grouted using grout ports installed 300 feet apart in the existing tunnel wall.

And like so many tasks in life, the devil is in the details. The specialized equipment, along with the effectively trained and well managed crew, made a great combination and the job was completed on time. •

FOR MORE INFORMATION:
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The DD12-150 sliplining jacking unit is shown, ready for the installation of the new pipe.

The operator uses a wireless remote-control panel. The photograph also shows the hold-down clamps (in red) used to restrain the previously set pipe while the joint is made up.