Replacing An Old Pipe **With 'New' Clay**

As with most cities in the United States, Springfield, IL, has an old infrastructure that is in need of replacement. There are approximately 540 miles of existing sanitary sewer in the city with some sections combining storm and sanitary. The oldest pipe sections are brick. Springfield has sewer lines that have been in service since the days when Abraham Lincoln walked through its streets.

The city recently decided to replace approximately 390 linear feet of an existing 8-inch concrete pipe in an alley between residential and commercial property. As with other cities across the country, city personnel looked at many different ways to maintain their underground infrastructure. When starting the process, it had to be determined which technology and material would be right for this situation.

Repair options considered by Springfield included:

- Cured-in-place liners;
- Fold and form liners;
- Open cut and replace;
- Pipebursting using flexible pipe; and
- Line replacement with a rigid pipe trenchless insertion method.

Several factors had to be taken into consideration. The liner options both required point repairs where the existing line was badly deteriorated. In this case, the existing line had misaligned joints and a partially collapsed section (the CCTV camera could not navigate through the pipe). Because the line in question serviced commercial as well as residential properties, the idea of giving up diameter was unacceptable.

The sewer line to be replaced ran through an alley behind commercial properties that were directly across the street from the front entrance to the Illinois State Fair Grounds. After considering the time, inconvenience, and both the financial and social cost of open-cut construction, it was determined a trenchless method was necessary.

When the scope of the existing system is recognized, the importance of design life considerations become apparent. With a total system size of 540 miles, a 50-year design life would require that the replaced lines be attended to at the rate of 10.8 miles per year instead of 5.4 miles per year for a 100 year life. The city had done a small pipebursting job using a flexible plastic pipe in the past and decided to use a rigid pipe for this job. The vitrified clay jacking pipe chosen carries a 100-year guarantee from the manufacturer.

Pipe considerations

When the subject of using clay jacking pipe was discussed, there were lots of questions:

- How can you put that much jacking load on clay pipe?
- Are the clay pipe joints better than in the past?
- How can a tap be made on a pipe of that thickness?
- Are there couplings made that would allow connections in the pit or outside of a manhole? and
- What about the "swags" or bellies in the line – how would a rigid pipe be pushed through a line that was not 'dead straight?'

The jacking pipe that was used is of the same configuration as the pipe designed for microtunneling applications (i.e., a high jacking load capacity). Vitrified clay is a ceramic material. Ceramics are one of the few materials that do not return to the original shape or deteriorate. Ceramics also have very high compressive strength characteristics. The eight-inch jacking pipe that was specified on this job had a jacking load capacity of 200 tons.

The joints consisted of a factory-installed gasket material on each end of the pipe. The pipe is actually a barrel section with a spigot on each end. The spigot ends are then connected using a specially designed stainless steel band that is installed on one end of the pipe at the factory. This is a newer joint design that minimizes leak problems.

It is recognized today that taps must be made with a cutting process by using a hole-saw or shell cutter similar to those used for water mains. Taps for connections can be made with an array of different saddles and available adapters.

With regard to coupling the pipe to another pipe and repairing couplings damaged by other utility construction – couplings are available by diameter dimension from most utility supply houses.

Rigid pipe requires a path that is relatively straight. Very seldom is the existing line 'dead straight.' The Tenbusch Insertion Method (TIM) is a trenchless method used to install rigid pipe in place of old piping. The system has proven itself to dramatically straighten the existing line.

Methodology

A local contractor, Petersburg Plumbing and Heating, replaced the old line using the Tenbusch system.

A small insertion pit was excavated and the new pipe was pushed in both directions from the insertion pit. Once the push is started, the pipe is normally inserted at a rate of about one foot per minute (that rate was surpassed at times on this job).

First, the old pipe is fractured and then forced radially outward to form a "burrow" for the new pipe. This work is done by what is referred to as the 'lead train.' The lead train consists of the lead, the cracker, the expander cone and the front jack (a special hydraulic cylinder) and finally, an adapter that connects the lead train pieces to the new pipe.

As each pipe segment is installed, the jacks are retracted and a new pipe segment is lowered onto the jacking frame. Each pipe segment has two flexible hoses, which are connected to those in the previous pipe segment. One hose supplies hydraulic fluid to the front hydraulic cylinder. The second hose supplies lubricant, which is ejected at the pipe adapter into the annular space.

The system provides lubricant at the leading end of the new pipe column to reduce friction and fill annular voids. When high resistance develops, the cracking and expanding force from the main jacking frame is enhanced by activating the front jack and advancing the lead train assembly forward without moving the new pipe column. This allows for the full application of the force to the lead train without loss due to friction along the pipe string.

The entire operation (other than the pit itself) can be staged off of the back of a truck or trailer, i.e., the pipe can arrive at the last minute on a trailer and not be unloaded unless it is immediately used. Thus, the TIM System reduces the required footprint for trenchless pipe installation.

The Tenbusch System allows for the trenchless replacement of existing pipe, both size on size and upsizing. Tenbusch Inc. licenses its patented technology and manufactures the equipment for use by local contractors like Petersburg Plumbing & Heating.

The new line has been televised and inspected. And the decision has been made to use this technology in the very near future on another existing line in poor condition and in a place that will not tolerate anything other than trenchless replacement.

Because of the pipe that was used, along with the methodology of installation, the city of Springfield can now concern itself with other lines in town. Even if they are able to replace existing infrastructure at the rate of 5.4 miles per year, odds are they won't need to attend to this line for another 100 years.

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