



# Slipping Through the Cracks

## Tennessee Pipeline Grouting Program Plugs Along After 18 Years

Sustainability, cost-effectiveness and public disruption are all major concerns when a municipality attacks a community-wide problem, especially when that problem concerns water and sewer pipelines.

As time goes on, this infrastructure will continue to spring leaks, resulting in more water intake and infiltration (I/I) to the system. That incoming water can result in contaminated water, more cost for treatment and flooded lines, among other problems. One method of fighting this ongoing battle is chemical grouting.

Just like any pipeline rehabilitation program, grouting takes experience to be truly successful. **One city that has been at the forefront of grouting for the past two decades is Chattanooga, Tenn., which began using grout to solve I/I issues back in 1988.** The city, which is nestled between the Tennessee River and the Appalachian Mountains, started its grouting program after identifying 57 points of sanitary sewer overflows (SSOs).

Among all the varying geographic areas of Chattanooga, including the mountainous regions and large water sources, was the city where the highest number of SSOs were, says City of Chattanooga I/I supervisor **Rick Toth**, who operated the grout truck when the program began under his predecessor. After 18 years, the city has eliminated all but three of those points with the help of its grouting program.

Two main varieties of grout are used for pipeline rehabilitation: acrylamide and urethane, says **Margie Meredith**, East Coast regional manager for grout manufacturer Avanti International. The process involves a CCTV truck for identifying leaks, as well as mixing the grout chemicals, a packer machine that injects the grout and a winch to pull the packer through the pipe between manholes.

The packer is remote-controlled from the truck, using a video camera to line up to the leak. Two inflatable sleeves on the machine close off the pipe when the grout is injected through a hose from the mix tanks in the truck. The grout travels through the crack in the pipe and congeals around the outside, filling any void in the soil and creating a watertight seal. The packer then scrapes away any excess grout from the inside of the pipe to ensure 100 percent flow capacity.

The ideal use for grouting is joint repair in host pipes, manhole structures and lateral transitions, Meredith says. When the grout gels and hardens, typically 22 to 28 seconds after injection, it forms a mass outside the pipe that not only seals the leak, but stabilizes the ground around the pipe, which helps reduce damage from sinkholes and to transportation infrastructure.

Though grouting cannot be used for major structural repair, it does add sturdiness by stabilizing the soil outside the pipe, she says. When gelled, grout can withstand 10 to 12 psi, but when it combines with soil that increases to approximately 80 to 100 psi. This benefit, however, is ancillary to the reduction of I/I, which Meredith says is the key purpose of grouting.



The City of Chattanooga, TN, has been a city in the forefront of grouting over the last 20 years, using it to solve I/I issues.

By eliminating additional water in a sewer system, grouting helps reduce SSOs, road flooding and treatment cost, which averages \$1 to \$3 per 1,000 gal of water. Alluding to an EPA estimate, Meredith says I/I accounts for almost half of all flow into treatment plants in the United States. “That adds up,” she says.

Grouting has additional cost benefits compared to relining and replacing pipelines, Meredith and Toth say. They estimate grouting costs from \$6 to \$9 per foot, based on 8-in. pipe, whereas relining can cost approximately \$28 to \$50 per foot and replacement costs more than \$50 per foot.

And grouting is quick, Toth says. His crews can seal a 400-ft line in just a day or two at most with virtually no disruption to the public.

However, grouting is not the end-all, be-all of pipe rehab, Toth says. Everything has its place. Chattanooga never uses grout on anything bigger than 15-in. pipe. Larger diameters become less practical because the equipment must be assembled inside the manhole. Chattanooga, he says, uses “a little bit of everything” to address problems with its infrastructure, which is more than 100 years old in some parts of the city.

### ☉ **Patience is a Virtue** //

A successful grouting program takes experience and patience, says Toth, adding that the first six months to a year is a learning process. Toth makes sure his 10-person staff is cross-trained on all areas of grouting, but time on the job is what counts the most.

“A certain amount of [training] is trial and error,” he says. “I’ve been pretty fortunate to have people above me who were confident enough and patient enough to give us the time to learn to do this right. And in the long run I think it’s very definitely paid off.”



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Grouting is not something you can perfect overnight, Toth says. The program is a work in progress and Chattanooga has taken the time to refine it. "You learn with it everyday," he says.

One thing Toth has learned after 18 years is not to try to judge the amount of grout a pipe will need by its looks.

"Lines will vary," he says. "I have had mainlines where I have put so much grout in there that I thought I was shoring up the roads because there were a lot of cavities behind the pipe."

The amount of grout required depends more on the voids outside the pipe than the size of the crack in the pipe, Toth says. Chattanooga spent \$70,000 for chemical grout in 2005. That's approximately 800 to 900 gal of chemical grout plus 8,000 gal of latex and water, which is mixed by a ratio of 8 to 1 to the grout.

That grout goes a long way, he says. The mixture of the chemical grout and the latex-water combo expands approximately five times the initial amount. Chattanooga grouts an average of seven miles of pipeline per year.

Of the two types of grout, Chattanooga uses the less popular urethane variety and has never used anything else. Toth says the reason urethane is less popular is because of its reputation for being more difficult to use, but he feels it holds up better than acrylamide. Toth reasons that acrylamide requires only soap and water to clean up after injection, whereas acetone is used with urethane.

"My personal feeling is you don't want to use something in a sewer line that is water soluble," he says. "It's going to be exposed to water all the time. So if you can clean it up with soap and water, it's not going to hold up as well. Urethane reacts against water."

Chattanooga has test pipes that were grouted 12 years ago and are still watertight, Toth says.

Urethane also has a reputation for being unforgiving with its curing time, Toth says, because it may gel too early. However, Chattanooga has had only two or three instances of grout curing too soon and that was caused in a break in the delivery hose. If the equipment is properly maintained and cleaned, those problems will not occur, he says, and the equipment can be used day in and day out.

The only problems Toth has had with urethane grout have been a result of the equipment he used. He says he has never had success with a low-void packer and suggests using a standard packer with urethane grout because it is more viscous and requires more pressure to pump. In addition, he suggests using a quick shut-off valve during application.

## Innovating Along the Line

There is no official book on what you can do with grout. But that doesn't stop Chattanooga from trying to rewrite it anyway.

Sometimes you have to do things that you're not sure will work, Toth says. Innovation helps keep grouting a viable resource to the city. Some critics may say, "You can't do that." But that doesn't mean you can't.

**Grouting is not something you can perfect overnight, Toth says. The program is a work in progress and Chattanooga has taken the time to refine it. "You learn with it everyday," he says.**

Although grouting is mainly used for mainline host pipes and some lateral pipes, Chattanooga has used grout to seal defunct service lines to eliminate laterals on a side where a parallel pipe has been installed. Another area in which the City has been successful is with ductile transition pipe that travels over ditches or through a water source, Toth says. He uses the grout to seal the transition between clay and iron pipe. The key in both instances success was altering the grout mixture, reducing it to a thicker 4-to-1 ratio.

"You do things where you try it, if it works, great, if it doesn't, what's your loss?" he says. "Most of the times we've been able to make it work. Every day is different. Every line is different."

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