WHITE PAPER

Criteria for Choosing Appropriate Large-Diameter Sewer Rehabilitation Solutions

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The 2013 ASCE Report Card on American Infrastructure says:

"There are between 700,000 and 800,000 miles of public sewer mains in the United States. Many of these pipes were installed after World War II, meaning they are now approaching the end of their useful life. Capital investments in those pipes account for between 80% and 85% of all wastewater system investment requirements in the United States."

The report also states that addressing the nation's sewage collection infrastructure needs may require an **investment of more than $300 billion** over 20 years. Similarly dire assessments apply to the underground pipes and culverts that divert stormwater. As DPWs and other municipal officials well know, aging sewers made of CMP, brick, clay, and other materials are beginning to fail at extraordinary rates and have essentially become ticking financial time bombs for many cities. And in the years since they were installed, many old pipes have been covered over by increasing dense urban growth and other development. Basically, replacing and rehabilitating America's underground pipes is going to be an expensive and inconvenient mess for the next several decades.

But we live in a golden age of infrastructure, and new sewer rehabilitation technologies have emerged and matured, presenting contractors and sewer network managers with multiple options when planning new projects. This paper compares three commonly-deployed techniques for large-diameter sewers—dig-and-replace, cured-in-place pipe (CIPP), and HDPE sliplining—with a relatively new trenchless solution known as centrifugally cast concrete pipe (CCCP). Several criteria are suggested for evaluating large-diameter sewer rehabilitation projects and choosing appropriate solutions.

A Quick Look at Four Sewer Rehabilitation Solutions

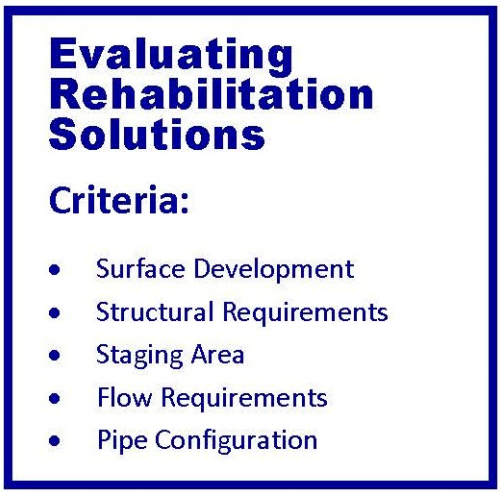
Dig-and-replace is, of course, the oldest and best known of the sewer rehabilitation methods. And in many cases it's still a good choice; replacement can be fast and cost-effective, and if larger pipe is needed to increase flow capacity, new trenching may be the *only* option. But there is one serious disadvantage; trenching inevitably disrupts surface activity and the economic costs to business owners and other stakeholders can be prohibitive. Stopping traffic, environmental disruption, and disturbing other underground assets such as power lines, can also be costly. Except in undeveloped areas, most cities will go to great lengths to avoid digging new trenches.

CIPP is a well-understood solution that has been around since the 1970s. In this method flexible, resin-saturated tubes are pulled into existing sewers, expanded with water or air pressure, and cured with heat or UV light so that the new tube stiffens. CIPP is an excellent choice for the rehabilitation of smaller diameter pipe, and it does not require new trenching. But, collapse and failure during installation is fairly common when CIPP is applied to very large diameter pipe, and fabricating custom liners for long runs of large diameter pipe can be prohibitively expensive. Also, CIPP doesn't adhere to old pipe (allowing water flow in the annular space), isn't in itself a structural repair, can't usually negotiate bends in pipe, and installation can be inhibited by weather and soil conditions.

HDPE sliplining is one of the oldest trenchless sewer rehabilitation methods and is simple in concept: new HDPE pipe is pulled through the old, failing sewer. HDPE is a structural solution, but otherwise the pros and cons are similar to CIPP. Also, HDPE sliplining requires relatively large staging areas and nearly always causes significant reductions in flow capacity due to the smaller diameter of the HDPE replacement pipe.

CCCP is a solution pioneered by AP/M Permaform. With successful large projects in place for more than ten years, the basic centrifugal spray casting technology has been used for decades in manhole repair. AP/M Permaform's CentriPipe technology, a complete CCCP equipment and material system, has been evaluated and approved by numerous large agencies, including the Minnesota and New Jersey Departments of Transportation. Basically, CCCP uses a spincaster to apply thin coats of cementitious material to the inside of failing sewers, creating a new, structurally sound and waterproof pipe that adheres tightly to the original pipe. The fiber-reinforced materials developed by AP/M Permaform have high tensile strengths, cure quickly, and stick to a variety of materials including CMP, cast iron, steel plating, brick, and clay. Currently, CCCP can only be used in pipes ranging from 30-inches to 120-inches in diameter, but can be applied to elliptical and other odd-shaped pipe. Staging areas are modest, bends are no problem, work can be interrupted and resumed without leaving seams, and flow reduction is minimal.

Project Criteria to Consider



Given the above strengths and limitations of modern sewer repair methods, sewer network managers should consider the following criteria when evaluating rehabilitation solutions for failing large-diameter pipe:

• **Surface Development.** If the failing sewer runs underneath roadways and buildings, is co-trenched with sensitive utilities, or if it is in an environmentally sensitive area, dig-and-replace is usually ruled out and trenchless methods must be used.

• **Structural Requirements.** If the project pipe runs underneath roadways, in areas of high groundwater, or is in heavy clay soils, structural strength of the new pipe may be important. When this is the case, CIPP may not be suitable.

• **Staging Area.** Even in trenchless projects, very tight road right-of-ways and other factors may limit staging area. This can rule out sliplining and some other methods.

• **Flow Requirements.** If the failing sewer is near capacity, or if future loads are expected to increase, sewer managers can't risk the use of sliplining or other methods that reduce sewer capacity.

• **Pipe Configuration.** If the project sewer features angular bends to accommodate irregular right-of-ways or other obstructions, and if dig-and-replace or re-routing are unfeasible, CIPP and sliplining must usually be ruled out.

Given the above criteria, CCCP emerges as an extremely flexible and effective solution for most trenchless large-diameter sewer rehabilitations, especially where the rehabilitation must be structurally sound and cannot reduce flow capacities. Since CCCP is also extremely cost-effective, especially compared to CIPP, it should be on the 'short list' of desirable options for large-diameter sewer rehabilitation projects.

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