

Methods to Eliminate/Control Infiltration and Inflow in Sanitary Sewer Systems

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ABSTRACT

Sanitary sewer systems will be considered to include sewer mains, manholes, and service lines, and to exclude, for purposes of this paper, treatment works, pump stations, and force mains. Remove and replace is the traditional alternative chosen to repair leaky sewer components, but that decision does not necessarily eliminate or even reduce infiltration/inflow (I/I). Effective trenchless rehabilitation methods include both structural repairs and non-structural repairs. Structural repairs include coating and liners, primarily used for corrosion protection in manholes, since liners typically do not stop I/I in the main line sewers. Point repairs which fit tight up against the main, and liners with a T-shape, or Top Hat-shape, designed for lateral reinstatement, are structural repairs which may be effective in I/I control. Non-structural repairs include the use of chemical grouting for mains, manholes, service lines, and lateral reinstatements after a liner has been installed. Also, the use of wax for sealing service lines is a new technique being tested now.

OUTLINE

- I Remove and Replace
- II Trenchless Structural Repairs
 - A. Coatings and Liners
 - B. Point Repairs
 - C. Lateral Liners
 - D. "Top Hat" Inserts
- III Trenchless Non-Structural Repairs
 - A. Chemical Grouting
 - B. Wax Process

I. Remove and Replace The traditional way to solve leaky sewer problems was to dig up the offending unit and replace it with new materials. This applies to pipe manholes, and service lines, which are the main focus of this paper. We are excluding treatment works, pump station and force mains, but obviously some of the techniques discussed herein would apply there as well.

The problems with remove and replace are:

- A. No guarantee of improvement,
- B. Expensive, and
- C. Not trenchless, i.e., this option is disruptive to the sewer system and the neighborhood.

II. Trenchless Structural Repairs

A. Coatings and Liners. Primarily for manholes, the use of coatings and/or liners could be effective means of eliminating I/I; but, most of the leaks have to be stopped first, especially in the case of

coatings. Building a new manhole inside an old one may not require that leaks be stopped, but that process is really a replacement instead of rehabilitation. Also, the use of polymers and layers of composite materials (liners for manholes) could stop I/I without first stopping the water leaks. But most coatings of epoxies, urethanes, and cement formulations need a clean and fairly dry surface for good adhesion. Running water leaks must be stopped before the coating can be successfully applied.

Liners in mainlines and service lines cannot be expected to stop I/I unless they tightly fit against the host pipe, thus eliminating the annular space around the liner. Both cured-in-place-pipe (CIPP) and fold-and-formed (FNF) liners do have an annular space, so I/I control is not really possible. The use of non-shrinking epoxy resins could eliminate the usual annular spaces but a rising water table and the continued leaks into the mains at service connections will lead to the conclusion that infiltration/inflow has not been eliminated even if the main has been lined.

B. Point Repairs. Mainline and service line point repairs that fit tightly against the pipe could eliminate I/I for the distance of the repair, but groundwater could simply be diverted to a defect in the pipe at another location. A tight-fitting mechanical repair with chemical grout included is offered by Link Pipe Inc., which also offers the possibility of multiple, over-lapping sleeves. Other tight-fitting point repairs are offered by LMK Enterprises, Formadrain, and others.

C. Lateral Liners. Lining systems with a "T" or "Top Hats" connection to the main sewer could provide a permanent solution to the I/I that occurs in the service line and at the junction of the service line with the main. Two such systems are offered by LMK enterprises and Insituform.

D. "Top Hat!" Insert. AMerik Supplies offers a "Top Hat" insert made of fiberglass, which can be inserted into the service line from the main. It extends 8" up into the service line, so its usefulness would be mainly for I/I at the connection of the pipes, and for the annular space between the liner and the host pipe if the main has been lined. This is a fairly new process which may not have a lot of field experience yet.

III. Trenchless Non-Structural Repairs

A. Chemical Grouting. Chemical grouts have been used since the 1950's to stop water leaks into manholes, pipelines, and other underground structures. These repairs are considered to be permanent because (1) the grouts are only affected by extremely dry conditions, which never occur in the vicinity of leaky sewers below grade, and (2) history has proven the efficacy of chemical grouts in all areas of the country.

Chemical grouts are used in mainlines to stop water leaks at joints where the pipeline is structurally sound. The test-and-seal procedure allows the operator to first test, then seal the joint if it field the test, and then to test it again. Regrouting could then be done if the joint failed the second test. The technique forms a barrier of soil and grout outside the pipe which blocks groundwater from entering the defective pipe joints.

The use of chemical grouts in service lines was greatly facilitated 5-6 years ago when American Logiball and Cues, Inc. came out with lateral packers which worked from the mainline sewer. As bladder materials have improved, and as the market has developed for sealing laterals, the industry now can claim to stop I/I at the connection to the main and up to 30 feet into the service line. Some

owners and engineers specify lateral grouting after liners have been installed to stop the above-mentioned leaks and the leaks in the annular space as well. Lateral sealing can be done whether or not a liner has been placed in the mainline.

B. Wax Process. Herman Pipeline Systems is developing a process of sealing laterals using molten wax. This process has been patented, but field experiments are still progressing to develop the process into a fully commercial enterprise. The appeal of the system is that the non-toxic and inexpensive wax would cool and harden outside the cracks and breaks in the pipe, providing a permanent seal affected only by very high temperatures.

If you have any questions, please contact [Dr. C.Vipulanandan](#)

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