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Aging Water Infrastructure Research Program

Addressing the Challenge Through Innovation

Rehabilitation of Wastewater Collection Systems

"Our nation's extensive water infrastructure has the capacity to treat, store, and transport trillions of gallons of water and wastewater per day through millions of miles of pipelines. However, as our infrastructure deteriorates, there are increasing concerns about the ability of this infrastructure to keep up with our future needs."

George Gray, Ph.D.
Assistant Administrator for
Research and Development
United States Environmental
Protection Agency

EPA has begun a new research program intended to generate the science and engineering that will address our aging water infrastructure. The program, entitled "Innovation and Research for Water Infrastructure for the 21st Century," calls for research relating to condition assessment, advanced concepts, and system rehabilitation.

System rehabilitation is the application of infrastructure repair, renewal, and replacement technologies in order to reinstate functionality of a wastewater system or subsystem. The proper balance of the repair, renewal, and replacement depends on the condition assessment, the life-cycle costs of various rehabilitation options, and the related risk reductions.

Current Issues

Rehabilitation includes a range of approaches that return the system to near-original condition and performance. For example, repair techniques are used when the existing sewer is structurally sound. But when the existing sewer is severely deteriorated or collapsed, or when its flow capacity should be increased, the system is usually replaced. Current rehabilitation methods address unsound structural conditions. There are many causes for wastewater collection system deterioration and failure:

- Poor design and installation
- Inadequate or improper bedding material
- Chemical attack
- Traffic loadings
- Soil movements
- Root intrusion
- Compromised joint integrity
- Subsequent construction damage
- Ground water fluctuation
- Inadequate maintenance

Deposition of material and sewer blockages that occur because of flat grades along with high ambient temperatures and poor ventilation can lead to the development of sulfuric acid and resulting crown corrosion. This reduces the structural integrity of concrete and its reinforcing steel.

In addition, inadequate inspections and quality assurance, and poor workmanship during sewer installation, can result in long-term problems. Other issues include:

- Pipe defects can cause blockages that lead to dry-weather sewer overflow and backups into buildings.
- Water that flows into sewer pipes through defects (e.g., holes, cracks, and failed pipe joints) can weaken the critical soil-pipe structure.
- Fine soil particles carried into the sewer can eventually reduce soil support and cause pipe deformation or subsidence.
- Exfiltration of water from the sewer into the surrounding soil can weaken support provided by the soil.
- Soil movement due to traffic can exceed design assumptions and result in soil support problems.

State of the Technology

Collection system rehabilitation includes many repair and replacement options, each of which could return the system to acceptable levels of performance. Options include repairing the pipeline using common methods, such as chemical and cement grouting, to address ground water movement, washouts, soil settlements, collapses, and soil voids.

Trenchless technologies have moved to the forefront of sewer system rehabilitation. These techniques enable workers to install new pipe in the location of the old pipe without total surface digging and its accompanying traffic and business disruptions.

Selection of rehabilitation materials is an important factor. New materials are emerging; the application of plastic pipe (as opposed to more traditional sewer pipes made of concrete, clay, or ductile iron) is becoming standard practice. The most commonly used for wastewater applications are glass-reinforced plastic, polyvinyl chloride, and polyethylene. Innovations using plastic include structured wall pipe and composite pipe that use different materials to address both structural and corrosion issues. However, long-term performance testing is needed to understand the capabilities of new materials under field conditions and to determine life-cycle cost. In addition, raw materials and formulations can vary widely, resulting in different quality pipe from the same plastic.

Studies have shown that sewer rehabilitation at the street alone does not completely solve the infiltration problem for various reasons, including those involving private ownership of service laterals. It is at these service laterals (the pipe that conveys wastewater from the property line or easement to the public sanitary sewer) where entry can occur when successive rainfalls elevate the ground water table. Rehabilitation of service laterals is generally done by point repair or replacement; cured-in-place lining, sliplining, and pipe bursting are also used. However, these approaches do not resolve the private ownership problem or the problems associated with the location and configuration of the line (e.g., sharp bends and transitions) or the line condition (e.g., nearby massive roots that can cause line damage).

New Research

Beginning in fiscal year 2007, EPA's new research program will initiate projects that address rehabilitation of wastewater collection systems in the following areas:

- Assess State of the Technology
  - Convene technology forum
  - Evaluate rehabilitation of:
    - Service laterals
    - Sewer liners
    - Manholes
    - Force mains
    - Siphons
    - Combined sewer overflow regulators
    - Pumping stations and wet wells
  - Evaluate decision support — rehabilitation vs. replacement
- Conduct Technology Demonstration Studies
  - Develop protocols and metrics for field demonstrations
  - Determine site selection criteria for field demonstrations
  - Initiate field demonstrations

The Door Is Open for Collaboration

EPA, whose primary role is that of advocate for a sustainable water infrastructure, is only one partner in this effort. The Aging Water Infrastructure research program presents opportunities for utilities, vendors, researchers, academics, water associations (trade and professional), and other agencies and organizations to collaborate. In fact, the success of the program depends on stakeholder involvement, sharing information and tools, and working together toward the long-term stewardship of our water infrastructure

CONTACT

Daniel J. Murray, Jr., P.E.,
Senior Environmental Engineer
Office of Research and Development
U.S. Environmental Protection Agency
National Risk Management Research Laboratory
(513) 569-7522
murray.dan@epa.gov

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