

Inspection Guidelines for Wastewater Force Mains

Force mains represent approximately 7.5% of the U.S. wastewater network with an approximate length of 60,000 miles. In percentage terms, gravity sewers are a much greater length. In terms of failure, a wastewater force main failure can create much greater operational and environmental problems than a failure in a gravity line. It is very unusual to find dual force mains or alternative routing. If a key force main is out of commission, the entire wastewater system comes to a stop. In addition, extensive pollution can be created by raw sewage being pumped onto the surface and finding its way into watercourses.

Most utilities work reactively and accept that they will have to manage failures when they occur. They have limited means of developing a proactive investigation and assessment policy as is now regularly done for gravity sewers. The goal of this project was to provide operators of force mains in the wastewater industry with a workable set of guidelines which allows them to undertake effective condition assessment of their force mains using practical and economic investigation approaches.

The team identified the characteristics of the force main network, the pipe types, and the modes of failure together with the indicators for inspection technology. This report provides information on the characteristics of the wastewater force main network and the most common defects encountered. It includes a comprehensive review of the current state-of-the-art in inspection technology for pressure pipelines. The technologies and methods utilities use to inspect the force mains to identify and locate these defects are listed together with what are the perceived unmet inspection needs. The report reviews data management and processing and considers the application, effectiveness, and suitability of the technologies reviewed for use in force mains and includes a risk-based failure evaluation. Innovative inspection technologies and methods for force main inspection are reviewed under five categories:

- External inspection of ferrous force mains
- Internal inspection of ferrous force mains
- Inspection of asbestos cement force mains
- Inspection of prestressed concrete cylinder pipe force mains
- Inspection of plastic force mains

The study included 10 case studies of actual inspections undertaken on pressure mains. The researchers proposed a structured approach to force main investigation driven by information need and cost-effectiveness within a condition assessment and asset management program. The team provided guidelines for developing and implementing force main inspection programs.



The researchers reviewed inspection technology tools for pressure pipelines that could be used for visual investigation, structural integrity, and leak detection. Shown here: The Teletest remote detection tool.

BENEFITS

- Provides a detailed review of the characteristics of the wastewater force main network.
- Includes case studies that discuss the most common force network defects faced by wastewater utilities.
- Includes a review of currently available inspection technologies related to force main inspection.
- Provides guidelines for development and implementation of force main inspection within condition assessment and asset management programs.

RELATED PRODUCTS

An Examination of Innovative Methods Used in the Inspection of Wastewater Systems (01CTS7)

Sustainable Infrastructure Management Program Learning Environment – SIMPLE (03CTS14)

Inspection Guidelines for Ferrous Force Mains (04CTS6UR)

Sustainable Stormwater Management: Infiltration vs. Surface-Water Treatment Strategies (04SW3)

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The inspection guidelines provide:

- Information on the force main network developed from utility surveys which identified pipe materials, diameters, age, and causes of failure.
- Background information on the mechanical properties and basic theory behind the defects and failure mechanisms in ferrous and non-ferrous pipes.
- Guidance on the defects and problems experienced in ferrous and non-ferrous mains.
- Guidance on the information required to undertake a condition assessment program.
- Guidance on relevant inspection technologies, relating them to specific types of defects and problems.
- Site inspection and off-site testing procedures.
- Guidance on the evaluation of investigation data and interpretation of results.

The research team based their approach on the principle that “If you don’t know what you are looking for you are unlikely to find it.” In determining what they were looking for, the team identified the characteristics of the force main network, the pipe types, and the modes of failure together with the indicators that need to be identified by inspection technology.

The aim was to provide operators of force mains in the wastewater industry with a workable set of guidelines to allow them to undertake effective condition assessment of their force mains using practical and economic investigation approaches. A soundly based condition assessment, of which condition inspection is a key part, will, together with risk-based assessment, enable owners to make decisions on replacement and rehabilitation programs.

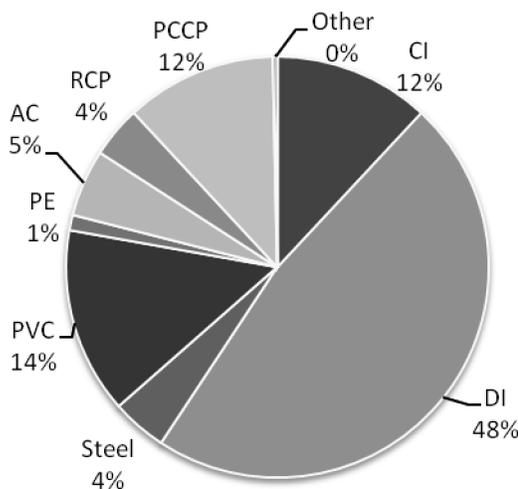


Figure 1. Percentage of Breakdown by Pipe Material for Force Mains.

Types include: Ductile Iron, Cast Iron, Steel, PVC, Polyethylene, Pre-stressed Concrete Cylinder Pipe, Fiber Reinforced Plastic, Asbestos Cement

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