Executive Summary

WERF

Manhole patching options can be effective

Structural Capabilities of No-Dig Manhole Rehabilitation (INFR1R12)

Manhole needing repair with a failed liner on and the same manhole one year after rehabilitation with calcium aluminate cement.

The Central Issue

Experience to date suggests that several million manholes in North America are suffering from serious deterioration and structural degradation. Because it is not economical or feasible to replace all of the deteriorated manholes, there is a large market in no-dig manhole rehabilitation. Yet, determining the most feasible and economical rehabilitation material and method is often a challenge for wastewater utilities and consulting engineers.

Context and Background

Gravity wastewater and stormwater collection systems are comprised of sewer pipes, manholes, and transmission components consisting of lift stations and force mains for sanitary sewers. In the U.S. alone, the number of manholes is estimated to be around 20 million. Of those, it is estimated that four million are at least 50 years old and another five million are in the 30-50-year old range.

There are numerous materials and methods available for manhole rehabilitation. To date, there have been a number of research studies on pipeline rehabilitation, but manholes are somewhat overlooked, although they can be the main source of inflow (rainwater entry into the wastewater collection systems). There are very limited studies, yet numerous options to rehabilitate manholes. Consequently, this research sought to evaluate the structural capabilities of available and emerging manhole rehabilitation materials and methods to provide a decision support tool system for manhole rehabilitation.

The researchers conducted a literature review, interviewed experts, performed mechanical tests on manhole linings, compiled case studies, conducted a computational analysis with finite element method, and developed a decision support tool. Ten participating utilities provided 11 case histories or comments regarding their manhole rehabilitation experience. These utilities were:

- Metropolitan Water Reclamation District of Greater Chicago, Illinois
- City of Rowlett, Texas
- Sewerage and Water Board of New Orleans (via MWH Global)
- Village of Palmyra, Illinois (via Benton & Associates, Inc.)
- Johnson County Wastewater, Kansas (two case histories)
- Orange County Sanitation District, California
- Anchorage Water and Wastewater Utility, Alaska
- Village of New Lenox, Illinois
- New Castle County, Delaware (via Arcadis)
- Sarasota County, Florida

Findings and Conclusions

The researchers' most significant finding was that fully structural (standalone) methods are not needed to repair the majority of manholes. Semi- or non-structural rehabilitation methods are effective for inflow and infiltration (I & I) removal at a lower cost. The researchers also found that each manhole is different; therefore use of the decision support tool developed in this research is recommended. Further, sound engineering and thorough technical specifications are crucial in implementing successful manhole rehabilitation.

Management and Policy Implications

Utility managers may realize considerable cost savings using the findings of this research. Manholes that have deteriorated and allowed I & I to breach can result in catastrophic consequences such as a sinkhole. Semi- or non-structural manhole rehabilitation can reduce costs and mitigate risk of failure.

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Structural Capabilities of No-Dig Manhole Rehabilitation

Related WERF Research

Project Title	Research Focus
Condition Assessment Strategies and Protocols for Water and Wastewater Assets (03CTS20CO)	Provides information on how to effectively use condition assessment tools and techniques to improve both long-term planning and day-to-day management of assets. The report is structured for two distinct audiences: 1) Utility planning managers who want to use cost-effective condition and performance assessment programs to support long-term planning decisions. 2) Engineering/maintenance managers that want to identify and understand the advantages and disadvantages of tools and techniques for measuring the condition and performance of utility assets to support daily maintenance and operation of assets.
Leading Practices for Strategic Asset Management (SAM1R06h)	Leading practices are presented in an easy-to-follow format that cites and explains the practice and provides examples. The research is intended to assist utility managers in the practice areas of Organization and People, Strategic Asset Planning, Business Risk, Maintenance, Secondary Data and Knowledge, and Accounting and Costing.
Assessing Utility Practices with the Strategic Asset Management Gap (SAMGAP) Analysis Tool (SAM2R06COa)	Presents an overview of the development and structure of the SAMGAP tool and summarizes 37 utility self-assessments using the tool in a benchmarking research project.
Gresham, Oregon Case Study: Measuring Progress Towards a Sustainable Asset Management Program (SAM6PR08)	Documents the lessons learned when the Gresham, OR Water Services Division and other city departments set out to implement an asset management program and began thinking about their assets in a way which allowed for increased inter-departmental cooperation.
Condition Assessment for Wastewater Pipelines (INFR9SG09caww)	Describes technologies and methodologies currently in use for condition assessment of wastewater pipelines. Provides a synthesis of condition assessment technologies contained in WATERiD.
LIFT Collection Systems Focus Area (werf.org/lift/)	Provides an effective means to identify new technologies to assess, rehabilitate, operate, and maintain collection systems assets and move them into practice more quickly through collaborative pilots, demonstrations, and data sharing.

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