

Can we develop a robust performance index for wastewater pipeline asset management?

Predicting the Remaining Economic Life of Wastewater Pipes:

Phase I: Development of Standard Data Structure to Support Wastewater Pipe Condition and Performance Prediction (SAM3R06)

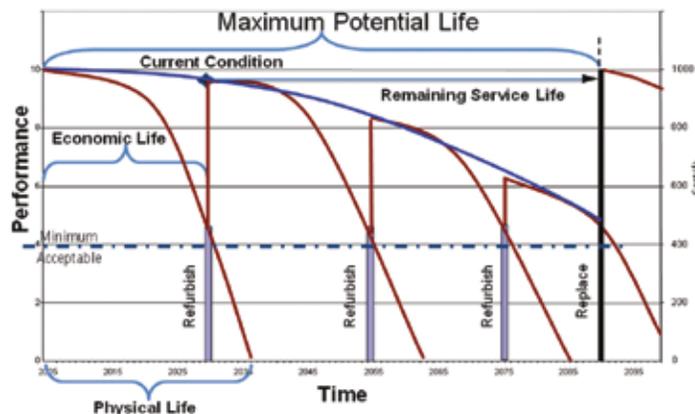
Phase II: Development of a Robust Wastewater Pipe Performance Index (SAM3R06a)

The Central Issue

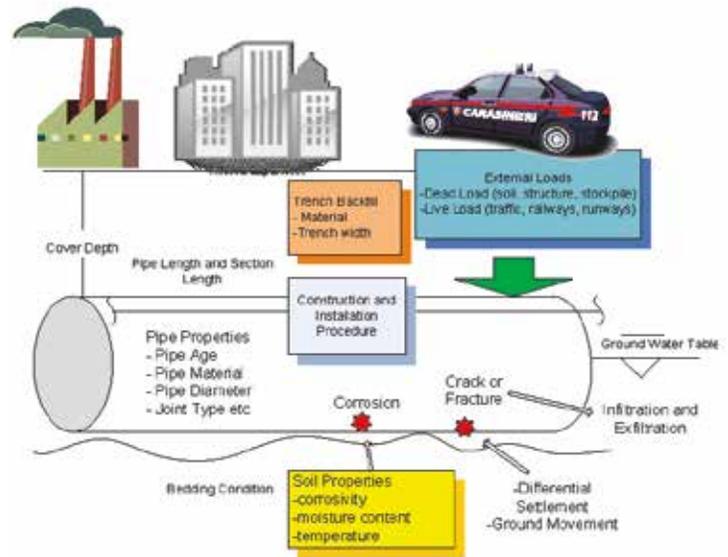
Accurate prediction of wastewater pipe structural and functional deterioration plays an essential role in asset management and capital improvement planning. The key to implementing an asset management strategy is a comprehensive understanding of asset condition, performance, and risk profile. This research sought to develop protocols and methods for predicting the remaining economic life of wastewater pipes.

Context and Background

At present, utilities rely mostly on CCTV (closed-circuit television) in evaluating pipes and making rehabilitation decisions. The CCTV inspection is rated using in-house or National Association of Sewer Service Companies' (NASSCO) rating systems. However, the CCTV rating doesn't capture all data needed to predict wastewater pipe performance. This research proposed methods to evaluate the



Graphical Representation of Asset Performance, Deterioration, and Life Prioritization Programs.



Factors Affecting the Condition and Performance of Buried Pipes.

pipe condition by using not only CCTV data, but also structural, environmental, operational, and other data. Based on these data, a better condition index and prediction model can be developed.

The research team developed a robust performance index for wastewater pipes. All parameters for wastewater pipe systems identified were considered. Essential parameters were selected for performance index development. Analysis of participating utilities' data was conducted to determine the statistical significance of each parameter. The performance model was validated through a pilot study on 12 utilities' data across the nation.

Findings and Conclusions

The research team identified the causes of pipe failure in different phases of the life cycle including design, manufacture, construction, operation, and maintenance and repair, rehabilitation, and replacement. In addition to the failure modes and mechanisms, the researchers identified environmental and societal consequences of the failure. The performance model can be linked to the remaining life of a wastewater pipe infrastructure system for benchmarking pipe conditions and performance, comparing pipe segments within the system, and with other systems. Five case studies were developed that describe the overview of each city's wastewater system, utility data collection, and utilities' GIS capabilities. The participating utilities were:

- Seattle Public Utilities, Seattle, WA
- Western Virginia Water Authority, Roanoke, VA
- Orange County Sanitation District, Orange County, CA
- Pittsburgh Water and Sewer Authority, Pittsburgh, PA

Predicting the Remaining Economic Life of Wastewater Pipes

- Massachusetts Water Resources Authority, Boston, MA
- Blacksburg VPI Sanitation Authority and Town of Blacksburg, VA
- Atlanta Public Utilities, Atlanta, GA
- Cobb County Water System, Cobb County, Cobb County, GA
- Anchorage Water Waste and Water Utility, Anchorage, AK
- Washington Suburban Sanitary Commission, MD

Management and Policy Implications

This web-based risk management tool has important practical value and can be cooperatively expanded. It provides a standard data structure and data collection methods that enable effective and systematic data collection and storage.

Related WERF Research

Project Title	Research Focus
Condition Assessment Strategies and Protocols for Water and Wastewater Utility 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: <ol style="list-style-type: none"> 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.
Strategic Asset Management and Communication: Decision Analysis/ Implementation Guidance (SAM1R06c)	Catalogs available strategic asset management (SAM) tools, identifies and prioritizes a core set of needed tools, explores factors for successful asset management, refines pathways for implementing SAM, and develops information to support SAM implementation.
Remaining Asset Life: A State of the Art Review (SAM1R06d)	Synthesizes the broad range of factors that influence remaining asset life. Covers the state of knowledge with respect to the estimation and prediction of remaining asset life, and if there is the capacity to translate between condition and performance data (e.g., the presence of significant defects) and the residual life of an asset.

Principal Investigator:

Sunil K. Sinha, Ph.D.
Virginia Tech

Steve Krai
Los Angeles County Sanitation District

Steve Krai
Los Angeles County Sanitation District

Research Team:

Thiti Angkasuwansiri
Virginia Tech

Terry Martin
Seattle Public Utilities

Terry Martin
Seattle Public Utilities

Richard O. Thomasson
Malcolm Pirnie

Manju Sharma
Metropolitan Water Reclamation District of Greater Chicago

Ted Regan
Massachusetts Water Resources Authority

Technical Reviewers for SAM3R06:

Wayne Green
York Region

Kendall Jacob, P.E.
Cobb County Water System

Greg Kane
Sydney Water Corporation

Technical Reviewers for SAM3R06a:

Nancy Campbell
City of Henderson, NV

Wayne Green
York Region

Kendall Jacob, P.E.
Cobb County Water System

Greg Kane
Sydney Water Corporation

James Thomson
Consultant



To Order

Contact WERF at 571-384-2100 or visit www.werf.org and click on Search Research Publications & Tools. WERF Subscribers: Download unlimited free PDFs. Non-Subscribers: Charges apply to some products.

Refer to Stock No. **SAM3R06/SAM3R06a**
For more information, contact Walter Graf at wgraf@werf.org