

Mid-Sized Mid-Atlantic Utility

ARTIFICIAL INTELLIGENCE-BASED SOLUTION ANALYZES DATA STORED IN ESRI GIS, ENABLING A 70% CUT TO REPLACEMENT SPENDING AND A 4X REDUCTION IN FAILURES

A mid-sized Mid-Atlantic utility with a reputation for taking a proactive and focused approach to continuously improving service reliability for their 270,000 customers was facing an all too common situation – aging water infrastructure. With more than 1,000 miles of water mains across their system, and an average pipe age of about 50 years, the utility was experiencing water main breaks at an ever-increasing rate. This prompted them to seek innovative strategies that would improve service reliability while minimizing repair and replacement costs.

Challenge

With water main breaks increasing, utility customers were experiencing unpredictable service outages, costly repairs, and highly disruptive road closures. To improve its reputation and customer service, the utility wanted to be more proactive in its water infrastructure management and prioritize pipes that needed the greatest attention.

“Our goal is to leverage machine learning to identify variables that could lead to pipeline failure, and as an outcome, support our capital improvement planning.”

Project Manager Department of Public Works

Solution

In 2014, having previously worked with Xylem to manage their PCCP (prestressed concrete cylinder pipe) inventory, and being aware of both Xylem's deep expertise in identifying water main preservation strategies and their close partnership with Esri for more than 20 years, the utility engaged Xylem to develop a risk model with artificial intelligence (AI) that could be validated, updated and displayed through Esri's ArcGIS platform for their team's continuous use.

The utility and Xylem then worked together to implement a quantitative risk model combining probability of failure (when a pipe will most likely fail) with the consequence of failure (the social, financial and environmental costs of the failure). Xylem's machine learning solution forecasts the probability of



PROGRAM HIGHLIGHTS

- Developed a plan, by combining AI-based predictive modeling with desktop and Esri mobile solutions, to reduce customer outages and improve service reliability, while cutting replacement spending by over 70% compared to other prioritization methods.
- Combined Xylem's artificial intelligence prediction model and a mobile field application build within ArcGIS Online, enabling the utility to collect and evaluate data in real-time and reduce water main breaks by 4X compared to their previous prioritization approach.
- Developed a real-time, ArcGIS Online-based, mobile tracking application to improve break record accuracy, reducing labor time required to update the utility's Computerized Maintenance Management System (CMMS) and Geographic Information System (GIS), as well as improving the accuracy of the AI model.

SERVICES PROVIDED

- Pipeline failure and risk analysis
- Mobile field data collection application
- Data integration with the utility's existing systems

when each water main in the system might fail using multiple data inputs including results from prior condition assessments. As more data is collected over time and changes are made to the system, the GIS and machine learning algorithms are updated to give a continuous understanding of the overall health of the system.

This AI pipeline analysis model is one of the first artificial intelligence water main break models in North America to reliably predict future failures in the distribution system. The model uses data within the utility's ArcGIS enterprise system from Esri, such as breaks and other infrastructure data, combined with open source information in the analysis. This data-driven approach provides substantial advantages over traditional subjectively-scored models where outputs often remain static even when inputs are updated.

Xylem's risk model is able to update results as new information is collected from the system, including main breaks, pipeline condition and other operational data. Results allow clients to prioritize and stage pipeline replacement, lowering costs and reducing customer impacts by targeting the most critical and deteriorated pipes.

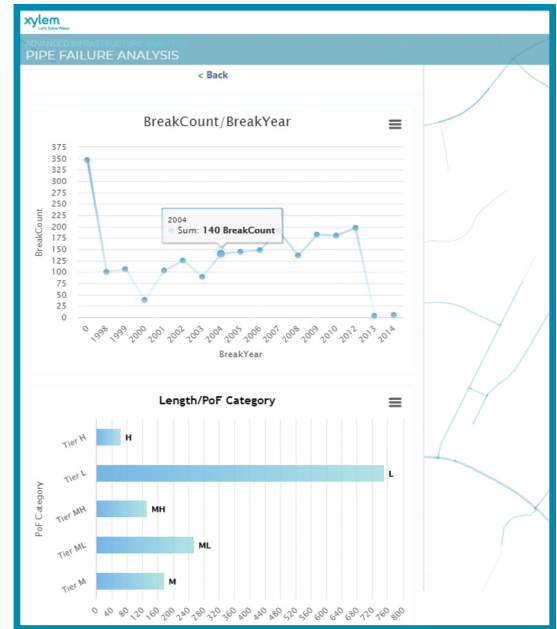
To validate this novel risk-based approach, the utility selected a forecasted "hotspot," or area with a high number of breaks, to pilot Xylem's new Decision Intelligence technology to reduce the overall probability of failure, in the area.

Additionally, Xylem provided a mobile field event tracking application (capturing information on pipe breaks) for the utility's field operators. This value-added feature not only increased the accuracy of break data records, it also reduced the overall labor time required to update their CMMS and GIS, and improved pipe failure predictions.

Outcome

The success of the pilot program has led the utility to develop additional cost-effective pipeline renewal strategies using an AI-based risk model. Once implemented across the entire distribution system, this model can help **the utility lower their annual costs related to pipeline replacement from \$90 million to just \$20 million while achieving a dramatic four-fold reduction in failures.**

That's the power of decision intelligence.



Screenshots from the Pipe Failure Analysis application. This data enables the utility to lower their annual replacement costs by \$70 million—a reduction of more than 70%.