Risk-Based Asset Management

Winnipeg's Water and Waste Department is implementing a prioritized assessment program and plan for critical mains in the city.

By Geoffrey Patton & Ross Homeniuk

Winnipeg, Manitoba, is Canada's seventh-largest city. Servicing the water needs of the city's 675,000 residents involves maintaining a network of more than 1,700 miles of cast iron, asbestos cement, PVC and prestressed concrete cylinder pipe water mains. As with many North American utilities, aging infrastructure, regulatory changes and growing public expectations have left the city struggling to address these issues with limited financial and human capital—while coping with potential risk and liability issues.

Canadian city takes a criticality approach to water main management

Historically, the city focused attention on its cast iron mains, which make up roughly one-third of the overall inventory. Installed in the early 20th century, these pipes were placed in highly corrosive soils that fostered extreme deterioration, resulting in some 2,200 breaks a year by the early 1990s. While aggressive replacement and cathodic protection had dropped yearly failure counts to fewer than 600 in less than two decades, very little was known about the condition of the remaining system and any associated risk and liability it might pose.

Seeking a Strategy

The Water and Waste Department hired a consultant, AECOM, to undertake a criticality assessment of its water mains. The city wanted to gain a better understanding of the system's risk exposure, develop a strategy for more efficiently investing its resources and improve the collection, management and use of information to support informed, defensible investment decisions.

The project produced sound technical solutions that drew on internationally recognized innovations in water system analysis and decision support, and then adapted them to Winnipeg's specific needs and resources. Work began by thoroughly reviewing and consolidating the department's water main asset data and gathering information on its maintenance and rehabilitation practices. The consultant then studied the international state-of-the-art practices in four key areas and refined the techniques to meet local conditions, producing the following:

- ***A criticality model.*** Assessing the consequences of failure for each water main asset and quantifying the relative economic, operational, social and environmental impacts, its findings coalesced into a method for rationally applying the information to plan and prioritize water main inspection, maintenance and rehabilitation activities.
- ***Condition tracking.*** This produced a toolbox of preferred condition assessment and life-cycle modeling techniques for identifying and tracking water main conditions over time. This resulted in a strategy for leveraging the strengths of current and emerging condition assessment technologies, and it recommended methods for predicting and forecasting water main condition based on available information.
- ***Rehabilitation technology.*** Assessing the costs, benefits and constraints of traditional and emerging water main renewal and

rehabilitation technologies resulted in the development of a toolbox of preferred rehabilitation options, along with guidance for the selection of appropriate tools based on an asset's physical condition, defects and environmental characteristics.

- ***Support tools.*** These tools identified requirements for collecting, managing and electronically processing information to improve the department's ability to efficiently manage its physical and financial assets.

The study resulted in 36 specific recommendations to improve the department's ability to manage risk and target its investments. The recommendations were prioritized, with a suggested implementation schedule ranging over a period of five years or more. Since the completion of the study in 2009, the department has been working to implement several of the recommendations.

Implementation

Work on the study included the pilot application of several monitoring and condition-rating techniques to help rationalize their applicability and usefulness to the city in managing its assets. This involved a two-year opportunistic sampling and condition-rating program for asbestos cement mains and a pilot assessment of emerging leak-noise identification and analysis tools. Protocols and data collection tools developed to support this work have been adopted by city forces and incorporated into normal operations.

The department has adopted the criticality model to plan and prioritize water main inspection, maintenance and rehabilitation activities. This tool equips the department to make objective decisions based on defined criteria, and the rationale for those decisions can be demonstrated and defended. The department's management strategy varies depending on a project's criticality. Sections of water main with a high consequence of failure are treated proactively, while problems in areas with a low consequence of failure are repaired reactively.

The department is now implementing a feeder main assessment program. Work will establish a prioritized multiyear assessment plan for critical mains within the city. Using the risk matrix analysis as a base, mains will be prioritized and grouped into reasonable assessment packages that will serve as the basis for an initial baseline assessment of appurtenances and mains. Lessons learned in the initial round of assessments will be used to refine protocols and improve planning and delivery in future years.

For the short term, the department is planning to improve its water main information management practices and expand the application and use of predictive models to support mid- and long-range planning and forecasting. The department also is considering the development and introduction of standard protocols to improve the capture of opportunistic information during water main renewals and break repairs.

Rules of Thumb

Risk-based asset management provides a sound basis for life-cycle planning and decision making. With a thorough understanding of existing conditions, risk probabilities, potential consequences and various repair and replacement options, an agency can manage its risk, optimize its expenditures and sustain service to its customers.

Taking advantage of the new tools that are available, however, requires organizational change, and changing an organization's approach to decision making is a major undertaking that must be planned and implemented carefully. The integration of new standards, practices and tools must take into account both the technical issues and stakeholder concerns. Technical enhancements must be tailored meticulously to suit local conditions—and incorporated into day-to-day work practices—to yield their full benefit. But for agencies that are confronting an aging infrastructure, tightening budgets and a growing customer base, those benefits are tangible and worthwhile. WWD

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