Proceedings of the Annual General Donald R. Keith Memorial Conference
West Point, New York, USA
May 4, 2017
A Regional Conference of the Society for Industrial and Systems Engineering

Design of a Workflow Optimization System for Urban Water Utility Maintenance

Adnan Khan, Rebekah Orozco, Mohammad Khattab, and Fahad Alqahtani

George Mason University

Corresponding author's Email: akhan33@gmu.edu

Author Note: The authors of this work are senior undergraduates enrolled in the systems engineering program at George Mason University. This capstone project has been sponsored by DC Water's Distribution and Maintenance Branch (DMB) and completed under the guidance of Professor Lance Sherry.

Abstract: The Water Distribution System (WDS) in the District of Columbia is one of the most complex in the world, with pipes spanning 1,440 dense urban miles. Built in the 1800s, much of the District's infrastructure has reached a critical age. Breaks in water main pipes carrying over 200 psi of pressure can buckle roadways, flood streets and cause widespread service outages. The local water utility prioritizes incidents with public safety, customer interest, and environmental impact taken into account. Analysis of operational data indicates that the average response time for lower priority incidents is nearly five times higher than high priority incidents. A stochastic queueing model of the workflow was developed to derive optimum crew schedules, process sequences and dispatch methods for each incident type. Additionally, an Artificial Neural Network (ANN) model was coupled to the workflow to predict failure surges and further enhance operational efficiency.

Keywords: Water Distribution System; Failure Prediction; Workflow Optimization; Main Breaks; Water Utility; Priority System; Artificial Neural Network.