

ABSTRACT

Majed, Alinizzi. M.S.C.E., Purdue University, December 2013. A framework for coordinating water distribution system and pavement infrastructure M&R based on LCCA. Major Professor: Amr Kandil

The amount of disruptions which public are facing daily around the world due to urban infrastructure Maintenance and Rehabilitation (M&R) activities leads to significant social, economic and environment impacts on the community. With respect to water distribution systems, there have been millions of water main breaks in the U.S. since January 2000, with an average of nearly 700 water main breaks every day. The majority of the water utilities lie under the paved roads and Open Cut method is the most widely technology for repairing water main breakages. Subsequently, continuous increase in pipe breakages requires the breaking of pavements that may be in good condition resulting untimely inconvenience to stakeholders and large cost implications. Hence, in order to reduce the impact of pipe breakage on pavements in good condition and minimizing disruption to the users, it is essential to coordinate M&R activities for both infrastructure systems. Therefore, this thesis presents a framework for coordinating pavement infrastructure and water distribution system M&R activities based on life cycle cost analysis. The proposed framework considers the costs and benefits associated with each treatment in a candidate scenario. The costs of each scenario constitutes of agency costs (construction and subsequent maintenance) and user costs incurred due to work zone activities. The benefits of each scenario are measured using monetized (saving in annual maintenance cost and vehicle operation cost due to pavement treatment and pipe valuation) and non-monetized (treatment service life) approaches. To demonstrate the framework, three scenarios (only maintenance, only rehabilitation, and combination of both for pavement treatments, while only replacement is considered for water pipelines) were evaluated using the EZStrobe discrete event simulation system. Highway agencies and water utilities can use the methodology to evaluate different scenarios and enhance the robustness of their decision making processes.