Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 145 (2016) 483 – 490

Procedia Engineering

www.elsevier.com/locate/procedia

International Conference on Sustainable Design, Engineering and Construction

Sustainability evaluation of pipe asset management strategies

John C. Matthews[a,*], Kalyan Piratla[b], and Dan D. Koo[c]

[a]*Pure Technologies, 7231 Palmetto Dr., Baton Rouge, LA, 70808, USA*
[b]*Clemson University, 109 Lowry Hall, Clemson, SC, 29634, USA*
[c]*IUPUI, 799 W. Michigan St. ET 314J, Indianapolis, IN, 46202, USA*

Abstract

The consequences associated with pipe failures can be widespread impacting service, while potentially causing damage, affecting traffic, and contaminating water. Recently the visibility of pipe failures has increased with social media and 24-hour news coverage. In response, many utilities have adapted pipe asset management strategies to reduce failures. Also, many technologies have emerged that allow for a more proactive pipe asset management. As sustainability has become a focus for many organizations including utilities, the question becomes which pipe asset management strategy is most sustainable. The purpose of this paper is to evaluate three pipe asset management strategies for sustainability using Envision®. The strategies include: a reactive run-to-failure and then replace; a preemptive replacement prior to failure based on assumed condition; and a balanced approach of active condition assessment and action based on the known condition. Envision® will be used to evaluate each approach to determine its sustainability rating.

© 2016 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
Peer-review under responsibility of the organizing committee of ICSDEC 2016

Keywords: Sustainability Evaluation; Pipe Asset Management; Pipe Condition Assessment

1. Introduction

Water utilities provide service to their customers at a substantial discount typically as rates are not indicative of the actual cost it takes to provide water service. There are many reasons for that which are not the focus of this paper, but the impact is that maintenance and replacement rates lag and failures rates increase. This puts water

* Corresponding author. Tel.: +1-318-224-0141
E-mail address: john.matthews@puretechltd.com

1877-7058 © 2016 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
Peer-review under responsibility of the organizing committee of ICSDEC 2016
doi:10.1016/j.proeng.2016.04.025

utilities in a difficult place of having to manage larger portion of their systems with emergency repairs. While this seems inherently unsustainable, many are unaware of better options given the financial shortfalls. The purpose of this paper is to evaluate three strategies for sustainability using the Envision® pre-assessment checklist [1] to determine if there is a better way to manage pipes. The strategies are discussed more below and include: a reactive run-to-failure and then replace, which is common for under-funded utilities; a preemptive replacement prior to failure based on assumed condition, which happens when funds are available, but pipe condition is not; and a balanced approach of active condition assessment and rehabilitation action based on the known condition, which is a common strategy for proactive water pipe management.

2. Sustainability Evaluation

The sustainability evaluation was performed using the Envision® pre-assessment checklist [1] which is intended to help incorporate sustainability in the planning phase of a project. This checklist assigns credits or points to a plan based on the number of yes answers to a series of questions. These questions are broken down into five categories, namely: (1) quality of life; (2) leadership; (3) resource allocation; (4) natural world; and (5) climate and risk. There are a total of 55 credits in the checklist with each credit containing an intent, metric, and between one and seven assessment items. The intent describes the purpose of the credit and how it contributes to sustainability. The metric explains how the project team can be successful in meeting the intent of the credit. The assessment items determine if the project meets the intent for that credit.

3. Pipe Management Strategies

The three pipe management strategies evaluated with Envision® are discussed below.

3.1. Run-To-Failure

Running pipes to failure is typically only recommended when failure consequences are quite low. Unfortunately this happens more often than recommended due to financial shortfalls. In an example case, a 12-in cast iron pipe that breaks in the middle of the night would require an emergency repair without significant planning, which is costly and disruptive. For this evaluation, assumptions were made about the types of planning that go into an emergency pipe repairs, but it was clear that the main sustainable advantages the other two strategies have over the run-to-failure scenario is the inherent planning that goes into those options. It was assumed that little planning and design occur before an emergency repair.

3.2. Preemptive Replacement

Preemptive replacement based on pipe parameters is very common and can reduce the impact and likelihood of failures. The downside is that typical pipe replacement can be highly disruptive and if replacement is only based on pipe parameters such as age and material and not the actual condition, some pipes will be replaced before they should while they still have remaining life and value. For example, a cast iron main that is designed for 50 years may still have useful life at 50 years, therefore preemptive replacement may mean replacing the pipe before it needs to be. It was assumed that preemptive replacement would have a significant amount of planning and design when compared to emergency repairs, but that replacing the main would be more disruptive than rehabilitating the pipe, which is considered in scenario #3.

3.3. Balanced Approach

When proactive condition assessment is used, the actual condition of a pipe can be factored into the repair decision. This helps to prevent the replacement of pipes with significant remaining useful life. After a pipe is inspected, the actual conditions are then known, and repair decisions and timing can be made that maximize remaining life, while restoring the pipe to a proper condition. Rehabilitation methods such as liners that minimize

Download English Version:

https://daneshyari.com/en/article/853704

Download Persian Version:

https://daneshyari.com/article/853704

Daneshyari.com