GIS-Based Dynamic Risk Management of PCCP

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Abstract

Experience has proven that a formal, structured asset management program can help avoid re-active scenarios that can be extremely costly and place a utility in a continual defensive mode. One of the most important components of a good asset management program is an understanding as to the existing condition and life expectancy of a given asset. Based on knowing the condition of an asset, a secondary factor that is important is determining the risk of failure associated with said asset. This requires having an understanding as to the probability of failure given the asset condition and realizing what consequences may be in the event of a failure. Having a firm understanding of the asset condition and potential risk of failure allows the water utility to develop an operational strategy (repairs, cost, time-line, etc.). In the end, a value can be assigned each asset, thereby helping the water utility comply with GASB 34 accounting standards.

In analyzing the risk associated with an underground pipeline, there is a structural risk as well as an operational risk. In supporting an asset management program, all pipelines should be evaluated as to both risks. Too, not only is identifying the current structural condition of a pipeline deemed critical, but also is understanding the rate at which such an asset is continuing to deteriorate.

Two basic approaches are available to the water utility when assessing the condition of a pipeline: predictive modeling based on empirical data and non-destructive evaluation (testing) methods. Non-destructive evaluation of a pipeline provides for detailed evaluation on each segment of pipe, thereby giving a utility the ability to rehabilitate or replace damaged pipe segments only.

Although non-destructive evaluation of a pipeline identifies the current structural condition of each pipe segment that make up a pipeline – it is only one-half of the equation. Too determine the useful remaining life and accurately plan and budget for on-going maintenance and renewal, it is also necessary to know the rate at which the pipe and pipeline may continue to deteriorate.

Electromagnetic inspection combined with visual inspection and sounding can accurately identify pipe segments that are not structurally sound, and provide a baseline condition assessment. On-going, continuous monitoring of the concrete pressure pipeline can be accomplished with proven and effective acoustic monitoring. Acoustic fiber systems are now available to inobtrusively monitor the individual segments of pipe for on-going structural deterioration.

Finite element analysis of concrete pressure pipe allows the utility to predict when there is a high risk that a concrete pressure pipe segment may rupture.

Recent developments in software modeling now allow for the combining of baseline data on the structural integrity of a pipe segment with the on-going, real-time, continuous acoustic monitoring of each pipe segment to predict the useful remaining life of each pipe segment. In addition to factual data derived from non-destructive evaluation technologies (e.g., baseline data plus on-going real time rate of deterioration), the GIS-Based Pipe Risk Management System software program (developed by Advitim) also incorporates other pertinent environmental and operational factors when projecting the useful life of a pipeline. Such factors include soil conditions (chemistry, resistivity, etc.), transient pressure events and cathodic protection.