A Decision Support Tool for Managing the Pipe Network of the Honolulu Board of Water Supply (Year 2)
**Problem and Research Objectives**

The Honolulu Board of Water Supply (BWS) manages the drinking water supply and distribution system for the island of Oahu, Hawaii, serving approximately one million customers with 54 billion gallons of freshwater every year (Chung et al. 2008). In FY 2008–2009 the BWS had a total field operations budget of $19 million per year. The BWS maintains over 2,000 miles of pipes, and installs approximately 30 miles of pipe annually at an average cost of about $1.6 million per mile. Over the last 22 years the BWS Oahu water-distribution system has averaged 366 breaks per year. Given the scale of its operations the BWS needs to develop the best management practices (BMPs) for pipe-utility management. Doing so will aid the BWS in deciding which pipes to replace and when, in a more scientific manner.

The following study objectives have been established:

1. Develop a framework of BMPs for pipe-utility management at the BWS to aid in quality control and in prioritizing specific pipelines for replacement. The goal is to improve policy-making at the BWS so that decisions may be made in a more informed and scientific manner.

2. Develop a warning system using indicators; including the cause(s) of current/past pipe breaks, pipe age, pipe diameter, pipe type, and soil type to determine when and where pipes should be replaced.

3. Develop operating-characteristic curves for various pipes showing the number of breaks, the average cost per break per length in ground, and the average age of various pipes.

4. Calculate the reliability of the water-distribution system identifying various pipe ages, various pipe diameters, and various pipe types.

5. Undertake availability analysis, apply process-capability analysis to availability.

6. Undertake Bayesian analysis for the probability of failure of a given pipe age, pipe diameter, pipe type, and soil type.

7. Develop a pipe-replacement prioritization.

8. Develop a facility condition index.

**Methodology**

Study data will be analyzed using statistical models and quality-control models to aid in decision making for replacing aging water-distribution pipes. As, in some cases, only limited data is available, proportional analysis will be used on the limited data sample. Availability, economic feasibility, and pipe efficiency of various alternative pipings will be studied and reliability/probability of failure of current piping will be examined using historical data maintained by the BWS regarding past water-main breaks.
**Principal Findings and Significance**

1. Concrete cylinder pipes, when compared to composite pipe systems, were relatively inefficient in performance.
2. Concrete cylinder pipes, when compared to other pipes, were expensive and uneconomical to maintain.
3. Though ductile iron pipes produce the maximum defectives from a repair perspective, overall they were still more efficient and economic than concrete cylinder pipes.
4. Concrete cylinder pipes should no longer be installed for new or replacement use in the Honolulu BWS water-distribution system.
5. The Honolulu BWS would benefit from professional asset management and quality control.

**Publications Cited in Synopsis**