Urban Water Innovation Network

Transitioning toward sustainable urban water systems

National Science Foundation
WHERE DISCOVERIES BEGIN

Project B1-1 (Texas A&M)

Urban Water Infrastructure Resilience

PROJECT OUTPUTS

This project will analyze the resilience of water infrastructure system to climate change impacts.

The strategies identified in B1-1 will be modeled in order to simulate the long-term resilience performance (e.g., system reliability, pipe break frequency, and leakage) of water infrastructure under different scenarios.

The results will be integrated with B1-2 to compare the life cycle impacts and resilience of infrastructure under different strategies and analyze trade-offs.

The outputs of the model will consider various measures such as:

- Network Costs
- Reliability
- Performance Condition
- Energy Use

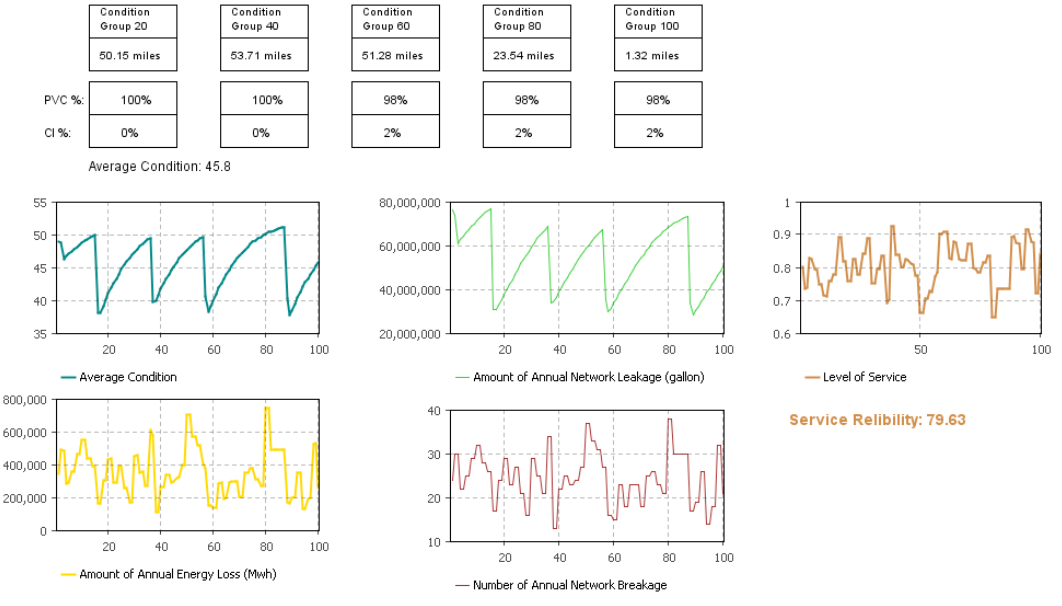
In addition, the analysis will capture the impacts of abrupt disruptions (e.g., hurricane or earthquake) in order to simulate the impacts of these extreme event scenarios on water infrastructure.

In order to evaluate innovative water strategies before investments are made, analysis of long-term resilience of urban water infrastructure is needed.

The objective of this study is to analyze the long-term resilience of urban water infrastructure systems under different stressors (e.g., climate change impacts, population growth, and aging infrastructure).

The approach is to create a dynamic simulation model capable of capturing the attributes of physical infrastructure (e.g., pipe age, material, length) as well as decision-making processes of utility agencies in order to simulate the effectiveness of different strategies in improving the resiliency of water infrastructure.

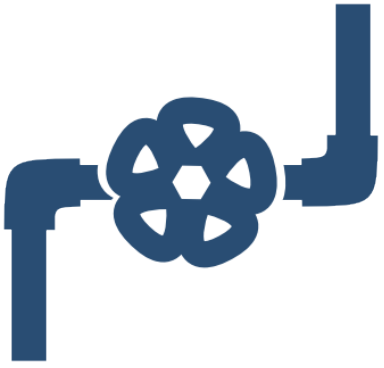
Water Infrastructure Model Output



The model examines several measures to generate a service reliability score including average condition, annual network leakage, annual energy use, annual network breakage and level of service.

THE MODEL

The dynamic simulation model combines the attributes of physical infrastructure with the decision-making processes to simulate the effectiveness of different strategies in improving the resiliency of water infrastructure.



Modeling of physical infrastructure will consider different factors such as:

- Decay of pipeline networks
- Likelihood of breaks
- Amount of leakage in the network

The decision-making process component will examine:

- Renewal Strategies
- Revenue Allocation Mechanisms
- Capital & Operational expenditures
- Risk Tolerances

The physical and decision elements will be modeled using the following methods:

- Mathematical
- Stochastic
- Decision-theoretic

Different strategies, such as dual water supply and distributed treatment systems, will be modeled and the resilience performance of each strategy will be analyzed.

DATA REQUESTS

A detailed list of specific data needs will be provided to case study utilities.

- Aggregated urban water infrastructure inventory (pipe, pumps, tanks, etc.)
- Location of treatment plants and pump stations
- Topology of water distribution network (GIS Layer)

DATA USE

Data will be used as inputs to water infrastructure model to simulate the long-term performance and resilience of infrastructure networks.

PROJECT KEYWORDS

- Physical Infrastructure
- Decision-Making Strategy
- Sustainability
- Urban Planning
- Resilience Performance
- Network Costs
- Energy Use

PROJECT CONTACT

Ali Mostafavi
Texas A&M University
Department of Civil Engineering
979-845-4856
amostafavi@civil.tamu.edu
https://erams.com/UWIN/b1-1-tamu/

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