

Comparison of Water Utility Earthquake Mitigation Practices

Donald Ballantyne, VP Lifeline Services, ABS Consulting, Seattle, Washington

Abstract

The U.S. and Japan lead the world in earthquake mitigation of water systems, but post earthquake performance objectives, system evaluation methods, and mitigation strategies to meet those objectives differ significantly.

Performance Objectives - In the U.S., there is no performance standard for post-earthquake system operation of water systems. Individual utilities have developed performance objectives based on their own needs. In general, these objectives address the desired level of system operation to provide water for fire suppression immediately following the event, and potable water within a prescribed number of days. The "event" is typically probabilistic/scenario based, and the desired probability of system performance is higher for earthquakes with a shorter recurrence interval. The Japan Water Works Association (JWWA) has established post-earthquake performance objectives for system restoration time to provide potable water a prescribed number of days following the event (i.e. restoration time). The restoration time, 30 days, is based on feedback from residents of Kobe following the 1995 Great Hanshin earthquake. The "event" appears to be deterministic/scenario based. Japanese performance objectives are silent on the issue of water for fire suppression.

System Evaluation Methods - In the U.S., there is no widely adopted standard or guideline for evaluation of earthquake vulnerability. Component evaluation is based on empirical data coupled with structural engineering methods. Systems are analyzed using proprietary methods developed by universities and implemented consulting firms, one of which is now incorporated into HAZUS. In Japan, the Japan Ductile Iron Pipe Association, working with the JWWA, with input from universities, has developed a system evaluation methodology that has been standardized by the JWWA. There are many similarities between the U.S. and Japan methodologies. Both are GIS-based, establish component damage states, and can perform Monte Carlo simulations of the system hydraulics. Both U.S. and Japanese evaluators have performed benefit-cost analyses.