

ATC-25-1

**A MODEL METHODOLOGY FOR ASSESSMENT OF
SEISMIC VULNERABILITY AND IMPACT OF
DISRUPTION OF WATER SUPPLY SYSTEMS**

by

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Preface

In September 1988 Applied Technology Council (ATC) was awarded a contract by the Federal Emergency Management Agency (FEMA) to assess the seismic vulnerability and impact of disruption of lifeline systems nationwide. FEMA's intent in awarding this contract was to develop a better understanding of the impact of disruption of lifelines from earthquakes, to assist in the identification and prioritization of hazard mitigation measures and policies, and to promote national awareness of the importance of protecting lifeline systems from earthquakes, and assuring reliability and continued serviceability of lifelines.

The project is being conducted in several phases. Phase I, reported on in the companion ATC-25 Report, *Seismic Vulnerability and Impact of Disruption of Lifelines in the Conterminous United States* (ATC, 1991), provides a national overview of lifeline seismic vulnerability and impact of disruption. Phase II, reported on herein, provides a practical model methodology for the detailed assessment of seismic vulnerability and impact of disruption of water supply systems.

The model methodology presented in this report provides the means to conduct a preliminary or "first phase" examination of the potential impacts of earthquakes on water system functionality at the local or regional level. The methodology has been designed for use by water system operators and has evolved from the review and comparison of existing available water supply system seismic evaluation methodologies.

Application of the methodology enables the user to develop estimates of direct damage to system components and the time required to restore damaged facilities to pre-earthquake usability. From this information, the user can evaluate the impact of failure of pipelines, pumping stations, reservoirs, and other water system facilities. For example, application of the methodology for specific scenario earthquakes can yield estimates of:

1. Water availability for fire fighting in different parts of the water system.
2. Reduction in water service in different parts of the system and for different users (e.g., hospitals).
3. Residual capacity of various portions of the system as a function of time.
4. Dollar losses due to direct damage to components and the system as a whole.
5. Indirect economic losses as a percentage of monthly gross product for specific sectors of the system and/or the region serviced by the system.

EQE International, a structural and earthquake engineering firm with experience in the seismic evaluation of lifeline systems, served as the project subcontractor and prepared this report. The research and engineering work was performed by Charles Scawthorn, Principal-in-Charge, Mahmoud Khater, Principal Research Engineer, and other EQE staff.

The ATC-25 Phase II Expert Technical Advisory Group (ETAG), comprised primarily of individuals representing the American Society of Civil Engineers (ASCE) Technical Council for Lifeline Earthquake Engineering (TCLEE), provided overall review and guidance for the project. Members were: Lloyd Cluff, Holly Cornell, Jeremy Isenberg, Anne S. Kiremidjian, Le Val Lund, Peter McDonough, Gerard Pardoen (ATC Board Representative), and J. Carl Stepp. The affiliations and addresses of these individuals are provided in Appendix A.

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Executive Director

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