SCIENTIFIC AND ENGINEERING INFORMATION NEEDS FOR REDUCING EARTHQUAKE HAZARDS TO WATER AND SEWER LIFELINES

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Water and sewer facilities are complex systems involving all engineering disciplines. The design, construction, and retrofitting of these systems has been under study for some years, beginning intensively in this country after the 1971 San Fernando earthquake. A reasonably current overview of the state of the art in this field was included in *Advisory Notes on Lifeline Earthquake Engineering*, published by the American Society of Civil Engineers (ASCE) in 1983.

This listing of the scientific and engineering information needs has been developed as part of a project by the Building Seismic Safety Council (BSSC) involving the development for the Federal Emergency Management Agency (FEMA) of an action plan for the abatement of seismic hazards to lifelines. As part of this project issue papers were prepared on a variety of lifeline topics and a workshop was held. The authors who prepared papers on various aspect of water and sewer lifelines were Donald H. Babbitt, Donald B. Ballantyne, Martin Jaffe,[1] LeVal Lund, James E. McCarty,[1] Michael J. O'Rourke, Lawrence D. Reaveley, Charles H. Trautmann, and Leon Wang and Eiichi Kuribayashi.

In order to simplify the discussion of needs and reduce duplication and confusion, the scientific and engineering needs are grouped here, somewhat arbitrarily, into four categories:

- Performance of existing systems during earthquakes
- Analysis and design tools
- Equipment and material development
- Design codes or standards

The suggestions or recommendations of the paper authors also are summarized below under the same categories. Where duplication occurs, the recommendations have been combined; further, some have not been included if this author believes that the information is already available or not germane.

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[1]See Volume 6 of the proceedings for papers on political, social, economic, legal, and regulatory issues affecting water and sewer lifelines by these authors and others.