ATC-102

Development of Earthquake-Resilient Lifelines: NEHRP Research and Implementation Roadmap, Phase I

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Project Technical Committee

Project Goal

- 10-year Research, Development, and Implementation Program for NEHRP Activities to Improve the Seismic Resilience of Lifelines
  - ✓ Electric Power
  - ✓ Gas & Liquid Fuels
  - ✓ Telecommunications
  - ✓ Transportation Networks
  - ✓ Water and Wastewater

ATC-102 Project Tasks

- ✓ Identify & analyze available resources & information
- ✓ Prioritize critical research, development, & implementation needs
- Plan & conduct review workshop (late April/early May 2014)
- Prepare final research/implementation roadmap (Summer 2014)
- In-person NIST program briefing (Summer 2014)

Technical Committee Members

- Craig Davis, Los Angeles Department of Water and Power, Los Angeles, California
- Leonardo Duenas-Osorio, Rice University, Houston, Texas
- Laurie Johnson, Laurie Johnson Consulting and Research, San Francisco, California
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- Tom O'Rourke (Chair), Cornell University, Ithaca, NY
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- Chris Poland, Degenkolb Engineers, San Francisco, California
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Review Panel Members

- Don Ballantyne, Degenkolb Engineers, San Francisco, California
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- C.B. Crouse, URS Corp., Los Angeles, California
- Andre Filiatrault, State University of New York at Buffalo
- Doug Honegger, D.G. Honegger Consulting, Arroyo Grande, California
- Stephen Mahin, University of California, Berkeley
- Michael O'Rourke, Rensselaer Polytechnic Institute, Troy, New York
- Charles Scawthorn, SPA Risk, LLC., San Francisco, California
- Kathleen Tierney, Natural Hazards Center, University of Colorado
- Yumei Wang, Oregon Department of Geology and Mineral Industries, Portland

Background Resources (Collected to Date)

U.S. Perspective

- Creation of EERCs, TCLEE, and ALA (Honneger and Nishenko)
- TCLEE Overview and Historical Perspective (Davis and Tang)
- Lifeline Interdependencies Resources from National Labs and DHS (Duenas-Osorio and Poland)
- PEER Lifelines Programs and Transportation Systems Research (Borzorgnia)
- MCEER Lifelines Research (Filiatrault and T. O'Rourke)
- Notes on 2005 ALA Design Guidelines for Water Pipelines (M. O'Rourke)
- ATC Reports (Rojahn)
- Telecom standards (Tang)

International Perspective

- Japanese Codes and Guidelines re Lifelines (Scawthorn and Ballantyne)
- Japan Water Works Association Seismic Design Guidelines (English v. 1997; Notes by M. O'Rourke)
- New Zealand Lifelines Committee – Learning from Canterbury Earthquake; Group Projects and Activities 2012 (Fenwick Email)
- Regional Lifelines Vulnerability Assessment Methodologies and Outputs (Fenwick 2012)
- A Decade of Lifelines Engineering in New Zealand (Brunsdon 2000)

Consideration of Critical Research, Development and Implementation Needs at Two Levels

- Performance of individual lifeline systems
- Integrated performance within a national framework with attention to interdependencies and socioeconomic & institutional issues

Lifeline Interdependencies

- 2001 WTC Disaster collapse of Twin Towers triggered water main breaks that flooded the PATH Tunnels, Exchange Place Station, and Verizon telecom vault, causing multi-day loss of fiber optic circuits for block trades at NYSE
- Hurricane Katrina caused electric power loss to liquid fuel pump stations interrupting major supply routes
- Hurricane Sandy caused electric power losses that led to the failure of credit card purchases, leaving motorists without fuel

Resilience

- Degree of preparedness and ability to respond to and recover from shocks
- Capacity of a region to respond effectively to a major hazard, recover quickly from it, and adapt to changing conditions, while also taking measures to reduce the risk of significant damage in the future (Hurricane Sandy Rebuilding Task Force, 2013)

Vision

- The roadmap is an integrated plan that identifies the key overarching issues and national needs for lifelines, and establishes a framework for addressing improvements in their collective and individual performance.
- The vision is to help local communities secure the “last mile” of distributed resources and services through resilient lifeline systems. Improved lifeline resilience is accomplished by focusing on national lifelines performance goals with a coherent and well-coordinated plan that addresses key socioeconomic and institutional issues, lifeline interdependencies, and the need to advance research, development, and implementation for both individual and collective lifeline systems.

Proposed Roadmap Program Elements

- Element 1: Establish a national framework for lifelines systems performance and restoration goals
- Element 2: Develop lifeline system specific performance manuals, guidelines, standards, and codes
- Element 3: Conduct problem focused research for various lifeline systems
- Element 4: Enable the adoption and implementation of lifeline system performance goals and standards and sustain lifeline system reliability and seismic resilience over time

National Framework for Lifelines Performance

- Current guidelines, standards, and codes vary widely with little consideration of interdependencies and little consistency in performance objectives
- Need to transition from current utility-specific crisis management to building integrated performance and community resilience
- Performance and recovery goals with respect to timelines and phased geographical restoration
- Improved resilience of new and existing lifelines has long-term benefits for economic efficiencies, national security, and quality of life

National Framework for Lifelines Performance

- Responsive to evolving nature of communities, technology, business, and government
- Stakeholder engagement is important from both community and owner/operator perspectives
- Coordination among NEHRP agencies and DOT, DOE, and DOD.

Performance Goals Example

The San Francisco Public Utilities Commission [SFPUC] (SFPUC, 2009) has developed performance standards for system level service after earthquakes. There are short term (24 hrs) and long term (30 days) levels of service that SFPUC plans and designs for. The basic level service criteria are based on delivering winter day demand (low demand for the year) of 215 million gallons per day (MGD) within 42 hrs after a major earthquake. A 90% confidence level is to be achieved in meeting this goal, which includes delivering at least 70% of the winter demand water to SFPUC wholesale customers. It is assumed that no significant repairs are performed in the first 24 hrs after a major earthquake. The long term performance criteria are based on making temporary repairs to restore average daily demand of 300 MGD to wholesale customers. It is the intent that all water be disinfected as a minimum, but this objective may be waived for emergency purposes.

Working Draft Outline
Earthquake Resilient Lifelines:
NEHRP Research, Development, and Implementation Roadmap

1. Introduction – Background, Roadmap Scope and Purpose, Roadmap Organization
2. Vision for Earthquake Resilient Lifelines – Lifelines, Resilience, and Vision
3. Framework for Roadmap and Recommended Topics
   - 4 Program Elements and Prioritized Topics
   - Management Plan (Organizational Leadership, Personnel Requirements, Budgetary Requirements
4. Proposed Lifelines Research and Implementation Roadmap

Appendices

A. American Lifelines Alliance

B. ASCE Technical Council on Lifelines Earthquake Engineering

C. U.S. and International Research and Implementation Efforts (1996 NIST Standards Workshop, NSF/NRC Programs (NCEER/MCEER, PEER, and MAE), Telecom New Equipment Building Systems (NEBS), and International Workk (Japan and New Zealand)

Glossary

References

Final Project Workshop
(San Francisco Bay Area, Late April/Early May 2014)

- Confirming Location/ Dates
- Who to invite? / What organizations?
- Number of participants: 35 to 50

- American Water Works Association
- Electric Power Research Institute
- Federal Energy Regulatory Commission, FERC
- North American Electric Reliability Corp
- Pipeline and Hazardous Materials Safety Administration,
- Western Electricity Coordinating Council
- California Dept. of Water Resources

Comments/Suggestions

- Thank you!
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