

State of California
Seismic Safety Commission

Memo

To: Commissioners

From: Richard McCarthy
Seismic Safety Commission
1755 Creekside Oaks Drive, Suite 100
Sacramento, CA 95833
(916) 263-5506

Date: 10/3/14

Subject: **Policy Lessons from the South Napa Earthquake:
Proposal from the Pacific Earthquake Engineering Research
Center**

Background

The magnitude 6.0 South Napa earthquake struck on the morning of August 24, 2014. This moderate earthquake caused significant ground shaking and damage in the epicentral region.

The Pacific Earthquake Engineering Research Center (PEER) has submitted the attached proposal to the Commission. PEER proposes to work cooperatively with a wide variety of organizations, companies and governmental entities to synthesize and analyze results they obtained regarding the effects of the South Napa Earthquake. PEER also proposes to identify policy and other lessons and issues that might be considered by the Commission as well as other governmental and private sector entities, to better mitigate the risk to California posed by earthquakes.

Recommendation

Staff recommends that commissioners review PEERs proposal, make any modifications and or recommendations needed, and approve the study. The length of time to complete the study will be approximately one year.

Policy Lessons from the South Napa Earthquake

Submitted by

Pacific Earthquake Engineering Research Center
University of California, Berkeley

BACKGROUND

At 3:20 AM, on the morning of August 24, 2014, the San Francisco Bay area was shaken by the South Napa, California, earthquake. According to the USGS, the earthquake had a magnitude (M_w) of 6, making it the largest earthquake to strike the San Francisco Bay Area since 1989, when the region was shaken by the magnitude 6.9 Loma Prieta earthquake. The epicenter was located about 8 km (5 miles) SSW of Napa, a city of about 77,000 people. Other nearby cities include American Canyon, Vallejo, and Sonoma.

While relatively modest in intensity, the South Napa earthquake caused significant ground shaking and damage in the epicentral region. For instance, in the city of Napa alone, nearly 1400 buildings have been yellow-tagged, and an additional 156-damaged buildings have been red-tagged.

The heavily shaken Napa Valley is a popular tourist destination and internationally known for its burgeoning wine industry. Preliminary reports from the USGS Prompt Assessment of Global Earthquakes for Response (PAGER) system initially estimated that economic losses directly attributable to the earthquake damage would likely be in the range of \$500,000 to over \$1 billion. Business interruption and other indirect losses are expected to contribute significantly to the total losses. The actual loss will require some time to determine, but loss estimates to date were sufficient for a Presidential Major Disaster Declaration to be issued on September 11, making damaged facilities owned by certain government and not-for-profit organizations eligible for federal assistance.

The South Napa earthquake provides one of the best recent, relevant opportunities for government officials, policy makers and others to assess the effectiveness of current policies for preparing for, responding to and recovering from earthquake emergencies. Many engineering, seismological, financial and planning organizations have and will continue to document and study the immediate effects of the earthquake and their causes, along with the longer-term consequences. These studies will provide invaluable information and guidance on possible future action. However, the typical nature of these studies is that they are focused on specific technical issues, and the findings of individual studies will be disseminated by a variety of different means and to a diversity of audiences. Thus, while the South Napa will likely provide some of the best information on earthquakes and their effects on facilities and communities, this information will likely be difficult to access in a form most useful to policy makers.

OBJECTIVES

It is proposed that the Pacific Earthquake Engineering Research Center work cooperatively with a wide variety of organizations, companies and governmental entities to synthesize and analyze results they obtained regarding the effects of the South Napa earthquake, and where appropriate

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supplement this data gathering, to identify policy and other lessons and issues that might be considered by the California Seismic Safety Commission, as well as other governmental and private sector entities, to better mitigate the risk to California posed by earthquakes.

The objectives of the investigation include identifying:

1. Success stories where current policies worked well and as intended;
2. Best practices implemented before and following the South Napa earthquake that might be considered for adoption by other jurisdictions and organizations;
3. Issues related to existing policies and mitigation practices were not as successful as desired and where further refinement may be needed;
4. Issues that were previously unanticipated and where new policies might be developed; and
5. Research and other studies that might be needed to develop, assess, and validate new policies and practices.

To the extent possible, findings will be interpreted qualitatively from the perspective of a similarly intense earthquake striking a similar city with different preparedness, financial/economic resources and opportunities for mutual aid, or subjected to an earthquake occurring at a different time of day. Similarly, issues that might not scale to a smaller or larger city, or smaller or larger earthquake will be discussed.

The work is divided into several tasks.

Task 1. Seismological and geotechnical implications, including early warning systems

Current efforts by USGS, CGS, PEER, GEER and others will be reviewed to provide a brief self-contained description of the seismic setting of this earthquake. This will help readers of the final report interpret the level of damage observed in existing and new construction. Issues of identifying and mapping of faults and other geologic hazards and policies related to zonation will be examined.

In particular, the potential benefits of newly developed early warning systems for future events like the South Napa earthquake will be summarized. PEER, in conjunction with the Berkeley Seismological Laboratory and others, is planning, with separate funding to convene a workshop to assess the technical, legal, social, economical and other implications of early warning systems, with particular focus on information that might have been available to officials, businesses and residents in the heavily shaken area of the South Napa earthquake.

Task 2. Earthquake effects on the built environment

Currently, new buildings are designed to be unlikely to collapse in a very large earthquake, but they are not expected to be damage free in moderate earthquake. Older buildings without retrofit might be expected to collapse in such earthquakes. Thus, buildings in and around the Napa area provide a good opportunity to assess current design, retrofit and assessment procedures. Various groups, including PEER, EERI, FEMA, the City of Napa and others are gathering detailed information about the performance of buildings and other structures, from the earthquake. Results of these studies will be reviewed to assess the performance of new buildings, existing buildings, and existing buildings that have been retrofit. In addition to the physical damage of the structural systems, emphasis will be placed on the economic losses and interruption of services associated with

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damage to nonstructural elements (including breakage of water pipes) and contents. In many cases retrofit measured appeared to improve seismic performance, but in other cases the retrofits used were not fully effective. Issues identified by city and other officials in inspecting and tagging of buildings will be discussed. It is increasingly recognized that in addition to the cost and time required for the physical repair of buildings, considerable interruption of use can result from time needed for inspection, safety related shoring, identification of appropriate design criteria (repair or upgrading; demolition and rebuilding), engineering and other design services, permitting, securing financing, engaging contractors. This earthquake provides an opportunity for these factors to be assessed for a moderate earthquake for commercial, residential and industrial facilities.

Task 3. Lifelines, and lifeline interdependencies

It appears that some lifelines, like gas and electric systems were fairly robust due to recent upgrading efforts, but others like water supply systems were badly damaged in some places and a million gallon water storage tank was damaged, which will reduce water supply capabilities for up to 6 months or longer. Waste water systems appear to have worked, but wine entering into the local Napa wastewater treatment plant resulted in the plant being shut down for several days. Thus, the implications of the earthquake damages to lifelines, their interdependencies, and effects on businesses and residences will be assessed. Comparisons of findings in this study will be made with recent lifeline interdependency studies by the City and County of San Francisco and ABAG and developing efforts by the City and County of Los Angeles and others.

Task 4. Fire following earthquakes

Fire poses a substantial threat to communities following major seismic events. A few fires occurred as a result of the South Napa earthquake, including a major conflagration at a mobile home park. The causes of the fire and the ability of fire fighters to effectively respond to these fires will be reviewed, with a focus on implications for urban areas following earthquakes.

Task 5. Economic impacts

Policy decisions benefit from the ability to make reasonable estimates of the social and economic impacts of earthquakes, and the costs and potential benefits of practices aimed at increasing preparedness, mitigating damage and speeding recovery. As loss information becomes available from various governmental and private sector sources, there is an important opportunity to assess our ability to predict losses, including direct losses, and longer-term losses associated with recovery, business interruption, etc. Comparisons will be made among losses suggested by immediate loss estimation models, such as USGS's PAGER system, more refined loss estimates made by financial and insurance companies and government agencies, and actual losses. Comparisons will be made considering overall losses and losses associated with individual facilities and lifelines, and categories of facilities, such as commercial and residential buildings. While the South Napa earthquake is only one event, and significant differences between a single event and probabilistic estimates are expected, such comparisons will help understand the consequences earthquakes and limitations of current loss models.

Task 6. Develop policy implications

Results will be summarized in a form useful to policy makers with specific recommendations for actions that might be considered.

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PROCESS

As noted, this work will build on and leverage technical studies being done by others, and will consider results of other recent documents suggesting policy issues, such as those resulting from the Northridge 20 Conference, Loma Prieta 25 Conference and activities by the San Francisco, Los Angeles, ABAG, SPUR and others.

It is planned to gather and review available technical, economic and other information, and to interview various experts in the areas related to the tasks listed above. In particular, a series of in-person meetings and conference calls are planned including key technical and policy experts and stakeholders. An in-person meeting will be held at the beginning of the project to discuss observations, examine commonalities and differences from expectations, and identify gaps in data. Data will then be analyzed by the project team, team meetings and conference calls held, and draft material will be prepared. A final workshop will be convened to discuss findings and draft policy and other recommendations. A final report will be submitted to CSSC for review and comment.

DELIVERABLES

To be effective, it is believed that the final report should be concise, clear and focused. Thus, the intent of this work is not to develop a compendium of all information known about the South Napa earthquake. Specific findings related to the goals and tasks identified above, and others as needed, will be offered. Details will be provided as needed in appendices and by reference to other sources of information.

MANAGEMENT AND SCHEDULE

PEER will engage a well-qualified and experienced project manager who will be responsible for day-to-day management of the project and compiling and editing of the final report. The manager will be assisted by a small team, with one or more key individuals engaged for each of the tasks identified previously. While the scope of the project is large, effort will be devoted to all of the areas identified above. However, it is believed based on current information that most work will be devoted to Tasks 2, 3, 5 and 6, and the other tasks will greatly benefit from other on-going work by PEER and others.

The project duration is expected to be no more than one year. Efforts will be initiated as soon as possible to gather perishable data. Since longer-term recovery information is desired, it is proposed to finish the project within a year of its start date. However, preliminary observations and draft recommendations will be developed based on the information available as soon as possible and relayed to the CSSC in the form of progress updates.

BUDGET (Estimated):

Salary (including Benefits):	\$34,600
Travel (including meeting participant travel as needed):	\$5,000
Overhead (25%):	\$9,900
Total:	\$49,500

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