

Findings and Recommendations

from the

San Simeon Earthquake of December 22, 2003



CALIFORNIA SEISMIC SAFETY COMMISSION
CSSC No. 04-02

May 5, 2004

California Seismic Safety Commission

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EXECUTIVE SUMMARY

The Magnitude 6.5 San Simeon earthquake occurred on December 22, 2003 and was located approximately 7 miles northeast of San Simeon, California. Two lives were lost, 47 people were injured and approximately 290 homes and 190 commercial structures were damaged in San Luis Obispo and Santa Barbara Counties. These counties were declared Federal Disaster Areas on January 13, 2004.

The Seismic Safety Commission held hearings in Paso Robles in March 2004. Public testimony presented during these hearings identified 26 issues based on lessons learned from this earthquake (Appendix A). Although the Commission considered all of the issues raised are important, the Commission judged the following factors as the most cost effective and highest priority actions for consideration by the Governor and the Legislature:

Finding No. 1: During earthquakes unreinforced masonry buildings that have not been retrofitted continue to be the most dangerous buildings in California. Previous efforts to reduce the potential risk posed by unreinforced masonry buildings have been effective in a limited number of local jurisdictions.

Recommendation No. 1: Local Governments in Seismic Zone 4 if not already done so, should adopt effective retrofit programs to be completed within the next five years. New retrofits should at a minimum comply with the 2003 International Existing Building Code Appendix Chapter 1.

Recommendation No. 2: The state's existing URM placarding law is ineffective and should be improved by:

- **Imposing fines for non-compliance;**
- **Requiring warning signs to clearly describe where occupants can find more information about their building's risks and recommendations for appropriate actions to building occupants when earthquakes occur; and**
- **Allowing URM building owners to remove placards after completing retrofits that comply with the state's minimum standard. Alternatively, owners should also be allowed to post substitute signage indicating that the building has been retrofitted.**

Recommendation No. 3: Accelerate the retrofitting of URM buildings by minimizing the conditions imposed by local government on proposed URM retrofit projects.

Finding No. 2: Public reactions during the earthquake illustrate that there is confusion about what building occupants/public should do to avoid injury during earthquakes.

Recommendation No. 4: The Department of Education, in cooperation with the Governor's Office of Emergency Services and the Seismic Safety Commission, should develop curricula for public and private schools on earthquake and building safety to better prepare our citizens to live safely with earthquakes.

Recommendation No. 5: The Governor's Office of Emergency Services should reinvigorate efforts to provide clear, concise, comprehensive, and frequent earthquake safety information to the general public.

Seismic Safety Commission Findings and Recommendations from the San Simeon Earthquake

Introduction

On December 22, 2003 a magnitude 6.5 earthquake occurred with an epicenter approximately 7 miles northeast of San Simeon, California. This was the largest historic earthquake in the area since the 1927 Lompoc earthquake and the most damaging in California since the 1994 Northridge Earthquake.

Although strong shaking at ground level lasted only four seconds, two lives were lost and 47 people were injured. Within San Luis Obispo and Santa Barbara Counties, approximately 290 homes and 190 commercial structures were damaged. Unreinforced masonry buildings were the principal cause of human casualties and economic disruption to older downtown areas in Paso Robles, Atascadero, Guadalupe and Templeton. Damage also occurred to a number of water tanks, roads, bridges, and wineries in the region. (See Table 1 for a comparison with past earthquakes.)



Figure 1. Paso Robles' Landmark, the Acorn Clock Tower Building before and after the earthquake. (Photo: www.PanJewelers.com and EERI, Josh Marrow)

On January 13, 2004, the Counties of San Luis Obispo and Santa Barbara were declared Federal Disaster Areas. The Federal Emergency Management Agency (FEMA) and the Governor's Office of Emergency Services (OES) established five Disaster Field Offices within the two counties. FEMA, state and local officials estimate there were over \$239 million in direct losses.

As of May 5, FEMA and OES reported¹:

- \$44 million in damage to public entities, with \$2.5 million in Public Assistance Grants to local governments and public school districts;
- 4,736 individuals and households applying to FEMA and OES for assistance, with 3,742 receiving grants or unemployment assistance totaling \$7.9 million;
- 644 loans for families, small businesses and economic injuries, with \$16.6 million granted from the Federal Small Business Administration; and
- 76 preliminary applications to the post-disaster Hazard Mitigation Grant Program.

¹ Numbers subject to change.

Earthquake	Year	Magnitude	Lives Lost	Injuries	Buildings Damaged or Destroyed	Direct Losses in \$ Millions
San Simeon	2003	6.5	2	47	480	\$250
Napa	2000	5.2	0	72	?	\$65
Hector Mine	1999	7.1	0	0	<10	<\$0.2
Northridge	1994	6.7	57	9,000	14,000	\$40,000
Landers/Big Bear	1992	7.3/6.5	1	402	?	91.1
Loma Prieta	1989	6.9	63	350	27,640	\$10,000
Whittier	1987	5.9	8	200+	10,500	\$358
Coalinga	1983	6.5	0	94	1,000+	\$31
San Fernando	1971	6.7	65	2,000+	2,600+	\$505
Long Beach	1933	6.4	115	100's	?	\$40
Santa Barbara	1925	6.3	13	?	?	\$8

Table 1. Recent, Significant California Earthquakes (www.seismic.ca.gov). Earthquake losses depend not only on the magnitude of an earthquake but also the proximity to structures and the quality of the construction.

On March 11 and 12, 2004 the Seismic Safety Commission conducted hearings in Paso Robles, California. The purpose of the hearings was to receive written and oral testimony from federal, state and local government representatives, as well as business owners, engineers, scientists, and the public, on lessons learned from this earthquake. This information was compared with lessons learned from other damaging earthquakes and used to help develop this Report's Findings and Recommendations.

To develop the most practical Findings and Recommendations, the Commission requested that witnesses at the hearings draw upon their personal experiences and focus their comments on the following statewide seismic safety issues:

- Performance of retrofitted and unretrofitted buildings;
- Performance of water, sewer, electric, and gas delivery systems;
- Effectiveness of emergency response procedures;
- Effectiveness of building codes and their enforcement;
- Seismic hazard mapping;
- Urban search and rescue;
- Performance of school and hospital buildings;
- Effectiveness of "Drop, Cover, and Hold On" responses by building occupants;
- Effectiveness of "ShakeMap" on emergency response;
- Recovery, business interruption, economic impact, and housing;
- Other issues that may have statewide impact.

This document is intended for use by the Governor and the Legislature. These Findings and Recommendations can serve as the basis for policy development to promote earthquake risk reduction and rapid post-event recovery.

Findings and Recommendations

A list of issues presented to the Commission by witnesses at the public hearings is presented in Appendix A. After considering the facts independently gathered by the Commission and public testimony, the Commission adopted the following two Findings and five Recommendations as the most cost effective actions to be presented as priorities for consideration by the Governor and the Legislature:

Finding No. 1: During earthquakes unreinforced masonry buildings that have not been retrofitted continue to be the most dangerous buildings in California. Previous efforts to reduce the potential risk posed by unreinforced masonry buildings have been effective in a limited number of local jurisdictions.

Some types of buildings pose a significant risk of collapse in strong earthquakes. Periodic changes to California's building codes have reduced seismic vulnerabilities to new construction. However, since building codes are not retroactive, certain types of pre-existing buildings continue to pose a significant risk to our citizens. Of these dangerous building types, unreinforced masonry buildings stand out because they can kill occupants through collapse at relatively mild levels of shaking. The level of shaking experienced in Paso Robles, that caused URM buildings to collapse and kill two people, occurs somewhere in California every few years.

The San Simeon earthquake demonstrated the effectiveness of retrofitting URM buildings. Downtown Paso Robles has 53 URM buildings of which 9 have been retrofitted. None of the retrofitted buildings suffered major damage while many of the unretrofitted buildings sustained enough damage to require them to be demolished.

“Our tenant said, ‘Thanks for saving our lives.’” *Mr. Gary Smith, Owner of a Retrofitted URM Building*

“We [the Lutheran congregation] got a letter saying in essence ‘Tear it down.’ We were very angry but in retrospect, we would like to thank whoever sent that letter. There is no question in our minds that we saved our historic church.” *Mr. Roy McKee, Bethel Lutheran Church member*

“I’m confident the building would have come down in the quake if we hadn’t done the retrofitting. There were times when we were bleeding so badly in paying for it, we wondered what in the heck we were doing. Now we know.” *Mr. Jim Saunders, an owner of the retrofitted McLintock Building*

Two women died in the collapse of an unretrofitted URM building.

Efforts to reduce the URM risk have not produced satisfactory results. In 1986, the State enacted legislation requiring local jurisdictions to catalog their URM buildings and develop a retrofitting program. In some communities, all the URM buildings have been strengthened or demolished, but an estimated 8,700 URM buildings remain unstrengthened in the most seismically active parts of the State. Since the 1986 law, 10 Californians have been killed under collapsing URM buildings.

State legislation in 1992 required owners to post placards at entrances to URM buildings. This law has also proven ineffective because it lacks an enforcement mechanism. It is also unfair to owners who have already retrofitted because they can’t remove the placards, and it fails to ensure that occupants know how to protect themselves in buildings during earthquakes.



Figure 2. Retrofitted unreinforced masonry buildings such as this one in Atascadero generally performed better than nearby unretrofitted or partially retrofitted buildings. (Photo: CSSC)

Recommendation No. 1: Local Governments in Seismic Zone 4 should adopt effective retrofit programs to be completed within the next 5 years. Retrofits should at a minimum comply with the 2003 International Existing Building Code Appendix Chapter 1.

Recommendation No. 2: The state’s existing URM placarding law is ineffective and should be improved by:

- **Imposing fines for non-compliance;**
- **Requiring warning signs to clearly describe where occupants can find more information about their building’s risks and recommendations for appropriate actions to building occupants when earthquakes occur; and**
- **Allowing URM building owners to remove placards after completing retrofits that comply with the state’s minimum standard. Alternatively, owners should also be allowed to post substitute signage indicating that the building has been retrofitted.**

Recommendation No. 3: Accelerate the retrofitting of URM buildings by minimizing the conditions imposed by local government on proposed URM retrofit projects.



Figure 3. The Printery Building in Atascadero is one of the few buildings in the region with a placard. The building was damaged and closed following the San Simeon earthquake. (Photo: EERI, Abe Lynn)

Finding No. 2: Public reactions during the shaking illustrate that there is confusion about what building occupants/public should do to avoid injury during earthquakes.

Two people died attempting to exit a collapsing URM building. Other occupants remained in the same building until the shaking stopped and were subsequently rescued. In the aftermath, the media conveyed mixed and sometimes incorrect messages to the public about the safest ways to respond during earthquakes.

A century of experience has shown that taking shelter under sturdy furniture during earthquakes is much more effective at protecting lives than running outside. The outsides of buildings pose many additional hazards (such as brick walls, balconies and cornices) that are likely to fall on people trying to run outside. The San Simeon Earthquake reconfirmed that people are more likely to survive by seeking shelter under sturdy furniture, covering their heads and grasping the legs of the furniture.

The action of “Drop, Cover and Hold On” is counterintuitive to many people during strong shaking and needs to be taught and periodically reinforced. People panic and the instinctive reaction is to vacate a collapsing building. It is clear that many people in the San Simeon earthquake did not comprehend the dangers of running outside. No program exists to teach this outside of schools. Even within schools, “Drop, Cover, and Hold On” is practiced as part of annual drills but school curricula do not include earthquake preparedness. Teachers do not explain to students why “Drop, Cover and Hold On” is critical when in buildings outside the classroom situation.

The public’s safety in earthquakes is not ensured with California’s current practice of infrequently issuing simplistic, poorly understood messages that are limited to Drop, Cover, and Hold On. A comprehensive public education effort is needed that explains why certain actions are recommended during earthquakes.

Recommendation No. 4: The Department of Education, in cooperation with the Governor’s Office of Emergency Services and the Seismic Safety Commission, should develop curricula for public and private schools on earthquake and building safety to better prepare our citizens to live safely with earthquakes.

Recommendation No. 5: The Governor’s Office of Emergency Services should reinvigorate efforts to provide clear, concise, comprehensive, and frequent earthquake safety information to the general public.



Figure 4. This response could save your life. (www.redcross.org)

Appendix A

Issues Raised by Individuals at Commission Hearings

Emergency and Recovery Management

1. Reemphasize Drop, Cover and Hold On.
2. Enhance communication and warning system reliability after disasters.
3. Address local government recovery phase difficulties with training and mutual aid.
4. Require Safety Assessment Placards on damaged mobile homes after future earthquakes.
5. Establish a natural gas relighting certification program for volunteers.

Regulations

6. Recommend adoption of effective programs for URM building retrofitting.
7. Strengthen URM building placard law, requiring fines and education.
8. Require alterations to existing buildings to trigger seismic evaluations and retrofits.
9. Develop new regulations for anchoring building contents.
10. Require heavy and high building contents to be braced to avoid collapse.
11. Modify FEMA construction code triggers following disasters to be consistent with California codes.
12. Ensure that restoration of historical buildings is not at a disadvantage compared to non-historic buildings.
13. Expand inventories of early Field Act public schools to identify those built before 1933.

Incentives and Financing

14. Decouple retrofit requirements from other requirements imposed on proposed URM seismic retrofit projects.
15. Establish more incentives for retrofitting similar in concept to the Williamson Act or Mills Act.
16. Use Community Development Block Grants and Redevelopment Funds to pay for the cost of retrofits.
17. Suspend prevailing wage requirements for the government-funded recovery work.

Education and Outreach

18. Disseminate information about FEMA and OES training opportunities.
19. Clarify liabilities of URM Building Owners and local governments.
20. Emphasize quality in design, construction, and code enforcement to reduce future losses.

Planning and Land Use

21. Expand use of business pre-disaster safety, response and occupancy resumption plans.
22. Develop Multi-hazard Mitigation Plans.
23. Check water wells for damage and changes in water levels, quality and flow rates.
24. Avoid misconstruing minor troughs of seismicity on probabilistic shaking maps as low hazards.

Research and Intelligence

25. Reduce ShakeMap limitations in sparsely instrumented regions.
26. Establish systematic cataloguing of earthquake observations to enable future research.

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