

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: 1/2/13

Background

Over the last 6 months, the Commission has provided Dr. Guna Selvaduray from San Jose State University, direction on completing a "Post-Earthquake Economic Recovery" report as part of the "California Earthquake Loss Reduction Plan." Dr. Selvaduray has developed a final draft plan based on commissioner input and is now ready for action by the full Commission. This will complete Phase I of the study.

The Commission requested Dr. Selvaduray to return with a Phase II proposal that would develop a "California Post-Earthquake Economic Recovery Plan, based on the needs of the business community, and on research of policies and initiatives that have proven to be effective, or not effective after previous earthquakes and other disasters." This would specifically cover economic lessons learned from other earthquakes/disasters in California, other U.S. states, and other countries.

Recommendation

Staff requests that Commissioners review the attached materials, listen to Dr. Selvaduray's presentation, provide direction, and approve the completion of the Phase I study and approve funding to begin Phase II. Commission staff will continue to work with the Governor's Office of Economic Development during Phase II.

California Earthquake Loss Reduction Plan

Post-Earthquake Economic Recovery

Alfred E. Alquist

Seismic Safety Commission

1755 Creekside Oaks Dr., Suite 100

Sacramento, CA 95833

916-263-5506

CSSC 2013-xx



Publishing Information

The *California Earthquake Loss Reduction Plan* was developed by the Alfred E. Alquist Seismic Safety Commission in fulfillment of a mandate enacted by the Legislature in the California Earthquake Hazards Reduction Act of 1986 (*Government Code* Section 8870 et seq.). **The document was prepared for production by the staff of the Publications Division, California Department of Education. (See Acknowledgments, pp. 2 and 3, for a full list of contributors.) It was edited for publication by the Alfred E. Alquist Seismic Safety Commission. The original cover design and interior layout were prepared by Paul Lee. Vincent S. Vibat completed the formatting.** The *California Earthquake Loss Reduction Plan* was distributed under the provisions of the Library Distribution Act and *Government Code* Section 11096.

In addition to this document, the Alfred E. Alquist Seismic Safety Commission publishes a variety of documents related to earthquakes and earthquake safety. To obtain a publications list with prices and ordering information, contact the Commission's office or visit its Web site (see below).

Alfred E. Alquist Seismic Safety Commission
1755 Creekside Oaks Dr., Suite 100
Sacramento, CA 95833
(916) 263-5506; FAX (916) 263-0594
Web site: www.seismic.ca.gov

Contents

Acknowledgements	iii
Executive Summary	1
Earthquakes and California	2
Loss Reduction Legislation in California	5
Economic Effects of Earthquakes	6
Post-Earthquake Economic Recovery	11
Factors Affecting Post-Earthquake Economic Recovery	13
Research Element	14
Education and Information Element	15
Economics and Finance Element	16
Recovery Element	18
Utilities and Transportation Element	19
Preparedness and Emergency Response Element	20

Progress on the initiatives presented in this Plan will be presented periodically in the Alfred E. Alquist Seismic Safety Commission’s “Progress Report for the California Earthquake Loss Reduction Plan.” Copies of this document may be obtained by contacting the Alfred E. Alquist Seismic Safety Commission.

Acknowledgments

Alfred E. Alquist Seismic Safety Commission

Mark Ghilarducci,
Secretary
CalEMA

Dr. Margaret Hellweg
Seismologist

Helen Knudson
Social Services

Jim McGowan
Building Standards
Commission

Dr. Emir José Macari
Geotechnical

Honorable Michael
Gardner
Chairman
Local Government

Dr. Kit Miyamoto
Structural Engineer

William Monning
Assemblyman

Sheriff Mark Pazin
Emergency Services

Timothy Strack
Fire Protection

Chester Windom
State Architect

Alfred E. Alquist Seismic Safety Commission Staff

Richard J. McCarthy
Executive Director

Robert Anderson
Karen Cogan
Sue Celli

David King
Henry Reyes
Fred Turner

Consultants

Guna Selvaduray, Ph.D.
Executive Director
Collaborative for Disaster
Mitigation
San Jose State University

Laura Luong
Collaborative for Disaster
Mitigation
San Jose State University

Gretta Wilson
Collaborative for Disaster
Mitigation
San Jose State University

Contributors

Executive Summary

The Alfred E. Alquist Seismic Safety Commission was established by legislation in January 1975 to set the State's goals and priorities for earthquake safety.

Formal earthquake policy planning began in 1974 with the publication of the *Final Report* by the Joint Legislative Committee on Seismic Safety. That report identified the basic need for continuing efforts to mitigate earthquake risks and spawned the establishment of the Commission. Since then, periodic loss reduction plans, formerly published under the title *California at Risk*, and numerous issue-specific reports have been published in concert with the Commission's mandate.

The *California Earthquake Loss Reduction Plan 2013* is devoted to developing a comprehensive post-earthquake economic recovery plan that will enable California to continue maintaining its economic vibrancy and leadership, and provide employment and services for its residents.

The following were taken into account in developing this *Plan*:

- California is the most productive state in the Union and is the 8th largest economy in the world
- 88% of the State's economy is derived from the private sector
- Agriculture is as important as industries are for California's economy
- Small businesses are a very important part of the State's economy
- The current global economy makes it possible for overseas companies to compete with California companies for markets

- Previous loss reduction plans have focused on the built environment and the public sector, with insufficient attention paid to the needs of the private sector, including small businesses.

Examination of the effects of earthquakes in California and other countries indicates that:

- Any part of California can experience the effects of earthquakes
- The **last major** earthquake in California was in 1906
- Earthquake damage in one location can have repercussions in several other countries
- Loss of production capability as a result of a natural disaster can result in the permanent loss of market share
- Damage due to earthquakes can result in businesses rebuilding in other regions
- Agriculture is as prone to earthquake damage as are industries and urban localities.

A more comprehensive study of past earthquakes worldwide will be undertaken next to examine economic recovery measures taken by various local and national governments to determine their efficacies. This information will be used to develop a comprehensive strategic plan for California's rapid recovery after an earthquake.

While much still remains to be achieved, California has made great strides towards improving seismic safety. It is perhaps one of the safest regions in the world in this aspect.

Earthquakes and California

More than 80 destructive earthquakes of magnitude 5.0 or higher have been recorded in California since the early 1800s. Since 1980 there have been more than ten damaging earthquakes ranging in magnitude from 5.8 to 7.3. These earthquakes were considered to be of “moderate” size, and fortunately, they generally occurred during nonworking hours and in locations with relatively low population density. Even with such good fortune, the resulting devastation clearly demonstrated the need for continued efforts to reduce both human and economic losses and accelerate recovery.

Some of the better-known damaging earthquakes that have occurred in California are shown in Figure 1. As can be seen earthquakes have occurred in most parts of California - not just along the San Andreas fault. While some of the regions prone to earthquakes are urban and industrialized, other regions are rural and largely agricultural.

Natural hazards exist everywhere, and California is no exception. Throughout its history, the State has experienced floods, tsunamis, wildfires, droughts, landslides, volcanic eruptions, windstorms, and earthquakes. But of all these natural disasters, earthquakes pose the greatest threat to the lives, property, and economy of California. The California Geological Survey estimated, in 2000, that California’s annual amortized losses to structures, contents, and income will average \$4.7 billion per year.¹ This is equivalent to \$6.25 billion in 2012 dollars.

Some other important facts to consider are:

- California's 2011 GDP of \$1.96 trillion placed it as the 8th largest economy in the world. It has the highest GDP among all 50 states in the USA and contributes towards 13.08% of the USA's national GDP.² The GDP generated by private industries was \$1.73 trillion, or 88%.
- As of July 2012 the total nonfarm, employment was 14.3 million individuals³ and those employed in the agricultural sector was approximately 2.5 million.⁴
- Key among California's industrial sectors are information technology, microelectronics, and biomedical technology. Recognizing California's global leadership in these areas, several multinational companies have located their research and development facilities in California.
- One important reason for California's leadership in the high-tech area is its intellectual capital as evidenced by the 400 odd public and private universities and colleges that produce more than 200,000 college graduates annually.⁵
- According to the United States Geological Survey, “*California has more than a 99% chance of having a magnitude 6.7 or larger earthquake within the next 30 years.*”⁶ The likelihood of an earthquake greater than magnitude 7.5 occurring is 46 % over the next 30 years. The

¹ *An Evaluation of Future Earthquake Loss in California*, Division of Mines and Geology, 2000

² US Bureau of Economic Analysis; accessed August 19, 2012

³ California Labor Market Review, July 2012

⁴ California Community Colleges Research Brief 2011

⁵ California Investment Guide, Governor's Office of Business and Economic Development, July 2012

⁶ http://www.usgs.gov/newsroom/article.asp?ID=1914#.UC_1UN2PXig, Accessed August 18, 2012.

1989 Loma Prieta Earthquake and the 1994 Northridge Earthquake had magnitudes of 6.9 and 6.7, respectively, considerably lower than 7.5. The reported economic losses (in constant 2012 dollars) were about \$11 billion for the Loma Prieta Earthquake and between \$20-30 billion for the Northridge Earthquake.

- The last truly major earthquake that California experienced was the San Francisco Earthquake of 1906, with a magnitude of 8.3 and approximately 3,000 casualties. Since then California has not experienced a truly "major" earthquake. If such a major earthquake were to occur today or in the future, the private sector which accounts for 88 % of California's GDP can be expected to be suffer serious losses. This in turn can result in California losing its dominant leadership role in several industrial and commercial sectors.
- Any damage to the California economy will affect not just the state but also the entire nation and the world.

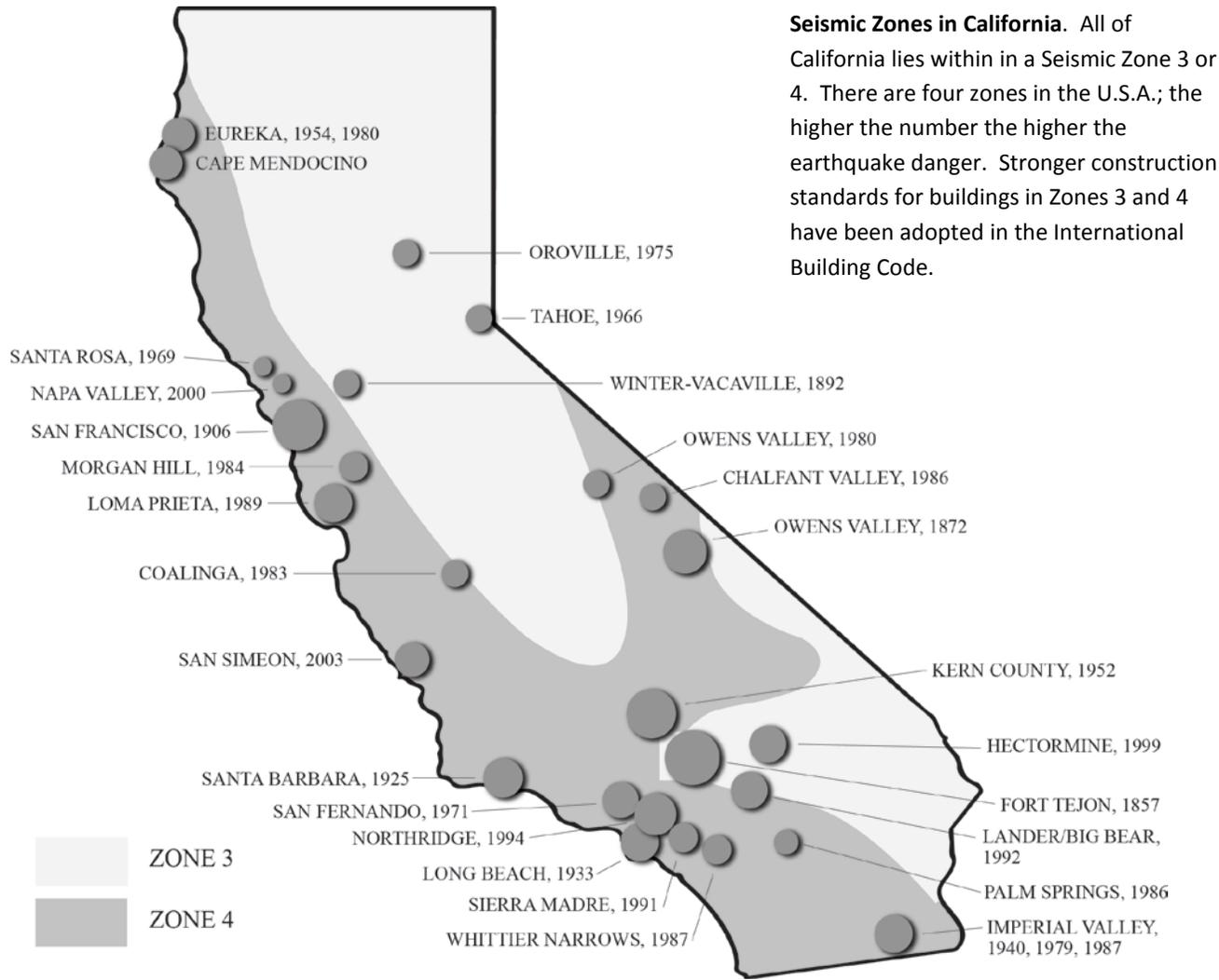
Thus far, the State of California has passed many laws/regulations that have contributed greatly towards reduction of earthquake risks and losses. These are briefly reviewed in the next section, and listed in Appendix A.

- **Notably absent are laws and/or policies that are aimed at reducing damage to the private sector and accelerating post-earthquake economic recovery.**

It is imperative that appropriate policies be adopted and implemented so that California's businesses and industries, including the agricultural sector, can recover rapidly from any damage they may incur as a result of the next major earthquake.

The failure to do so can result in California's economy taking a severe blow, both due to small businesses not being able to recover and reestablish themselves and by larger companies relocating to other states or even countries which are constantly attempting to lure them away.

Figure 1—Earthquake history. California has experienced many damaging earthquakes in the past two centuries. The sizes of the dots on this map indicate the relative magnitude of earthquakes that occurred at these locations.



Sources: California Geological Survey, 1986; Earthquake History of the U.S., U.S. Department of Commerce and Interior, 1982; Records of California Office of Emergency Services; compiled and revised by California Seismic Safety Commission, 2004; International Code Council, Uniform Building Code 1997 Edition.

Loss Reduction Legislation in California

California has had a relatively long history of enacting legislation aimed at reducing earthquake-caused damage to its social systems and building stock.

The damage caused by the 1933 Long Beach Earthquake, and the potential consequences it could have had had it occurred at a different time, spurred the enactment of the Field Act, within 30 days! As a direct result of this Act schools throughout California have not only experienced significantly less damage compared to the rest of the building stock, but have also been able to serve as centers of mass care.

The 1971 San Fernando Earthquake highlighted weaknesses in California's earthquake risk management policies. To address these weaknesses, in 1975 the state legislature created the independent California Seismic Safety Commission (CSSC) to provide a consistent earthquake policy framework for the state with the mission of providing "*decision makers and the general public with cost-effective recommendations to reduce earthquake losses and expedite recovery from damaging earthquakes.*"

Senate Bill 1279 in 1978 laid the foundation for California's strategic planning process for seismic safety. This legislation followed two significant earthquakes in China, a damaging earthquake in Haicheng in 1975 that had been "predicted," and a devastating earthquake in Tangshan in 1976 that had not. SB 1279 directed the Commission to assess the policy and program implications of earthquake prediction and to develop a strategic seismic safety program and financing plan for California.

The series of studies in pursuit of this objective have resulted in several reports and policy recommendations, beginning with *Earthquake Hazards Management: An Action Plan for California*, published in 1982.

Among the many achievements of the Commission is the sponsoring of, and successful passage of, the California Earthquake Hazards Reduction Act of 1986, shortly after the 1985 Mexico City Earthquake.

Subsequently the Commission was also charged with being responsible for implementing the California Earthquake Hazards Reduction Act, which requires the CSSC to "*prepare and administer a program setting forth priorities, funding sources, amounts, schedules, and other resources needed to reduce statewide earthquake hazards.*"

In keeping with the spirit of hazards management and loss reduction, the Commission has continued to study the issues related to improving seismic safety. The *California Earthquake Loss Reduction Plan 2007-2011*, published in 2007, is one such study that views seismic safety in a truly multidisciplinary manner and has identified the vast array of actions that still need to be taken.

Several major pieces of legislation have been passed immediately after major earthquakes occurred in California and other countries. Legislation that have a direct bearing on earthquake safety and loss reduction are summarized in Appendix A.

In the next section some of the major earthquakes that have occurred worldwide, and some of their consequences, are briefly described.

Economic Effects of Earthquakes

Major earthquakes have occurred, and continue to occur, worldwide, with damaging economic consequences and loss of life. Some have triggered tsunamis, with devastating consequences. In other instances, landslides have led to loss of life. Major conflagrations and technological and environmental hazards have also been triggered by earthquakes. In some cases, damaging aftershocks have followed the main shock. A selection of these earthquakes are listed in Table 1

Today, the economies of the major industrialized nations are intricately interconnected. It is practically impossible to purchase any product which contains components that are all manufactured in one country. Components that are incorporated into major assembled units such as computers, automobiles, farm equipment, and others are most frequently manufactured in several countries. As a direct result of this interconnectedness, a disaster in one country or region can have ripple effects in other countries and regions.

After the 1995 Kobe Earthquake, several automobile manufacturers in Japan had to cease production for different periods of time.

- Toyota Motors lost their supplier of brake parts and radios, resulting in the loss of production of 20,000 vehicles.
- The Malaysian automobile manufacturer, Proton, had to cease operations for some time because the parts they were receiving from Mitsubishi Motors could not be shipped due to the damage to Kobe Port.
- In the US, Chrysler Motors came very close to having to suspend operations.

Recovery of the greater Kobe region, after the January 1995 earthquake, has not been rapid.

- Non-leather shoe production, a major industrial sector in Hyogo Prefecture, in October 2007 was still at 78.8% of what it was in October 1994 - three months prior to the 1995 earthquake.
- Sake shipping figures in October 2008 were 40.4% of what they were in the same month in 1994.
- Damage to the port facilities resulted in shipping traffic being diverted to other ports in the region. While goods destined for Japan were diverted to other Japanese ports, goods for transshipment, a major activity in the port of Kobe, were diverted to Pusan in Korea.

The 1999 Chi-Chi Earthquake in Taiwan, a major producer of DRAM chips for the semiconductor industry, resulted in prices spiking to six to eight times, affecting computer prices worldwide. Similarly, the 2011 floods in Thailand, producer of 25% of world consumption of computer hard drives, also resulted in severe shortages.

Manufacturers today source their supplies globally. The loss of productive capability in one country or region generally results in the manufacturers obtaining their parts, components, and raw materials from a different supplier who is located in a different region of the same country or a different country.

While major emphasis has always tended to be placed on losses sustained by the manufacturing sector, losses sustained by the agricultural sector have also been significant. This is particularly relevant to California where agriculture is not only

a major contributor to the economy but is also a major employer. Table 2 is a summary of some of the type(s) of agricultural damage caused by some earthquakes.

In the current competitive global economy, many international companies are competing to supply the same goods or services to their customers. Once a customer is "lost", the effort to win them back can be enormous. The experience of some of the industrial sectors in Kobe drives home the fact that this loss can persist even after 10 or more years have passed.

If California companies are incapacitated after a major earthquake, the competitors seeking these markets are located all over the world.

- The wine industry, for example, faces competition from Chile, South Africa, New Zealand and Australia, just to name a few
- The semiconductor industry continues to face stiff competition not only from China, but also other states in the US ; these states are constantly trying to attract California's high technology industry with a variety of incentives including less rigorous environmental standards.

Table I: Twenty Major Damaging Earthquakes Since 1960

No.	Event	Date	Magnitude	Loss of Life
1	<i>Northern Italy</i>	May 2012	6.1, 5.8	27
2	<i>Japan</i>	March 11, 2011	9.0	>20,000
3	<i>New Zealand</i>	Sept 2010 - June 2011	7.1, 6.3, 6.3	181
4	<i>Mexico</i>	April 4, 2010	7.2	2
5	<i>Maule, Chile</i>	February 27, 2010	8.8	523
6	<i>Haiti</i>	January 12, 2010	7.0	316,000
7	<i>Central Italy</i>	April 6, 2009	6.3	300
8	<i>Sichuan, China</i>	May 12, 2008	7.9	>87,000
9	<i>Northern Sumatra, Indonesia</i>	December 26, 2004	9.1	>250,000
10	<i>Chi-Chi, Taiwan</i>	September 20, 1999	7.6	>2,400
11	<i>Izmit, Turkey</i>	August 17, 1999	7.6	>17,000
12	<i>Kobe, Japan</i>	January 16, 1995	6.9	>6,000
13	<i>Northridge, California</i>	January 15, 1994	6.7	60
14	<i>Loma Prieta, California</i>	October 18, 1989	6.9	63
15	<i>Mexico City, Mexico</i>	September 19, 1985	8.0	>9,500
16	<i>Tanghsan, China</i>	July 27, 1976	7.5	>250,000
17	<i>San Fernando, California</i>	February 9, 1971	6.6	65
18	<i>Peru</i>	May 31, 1970	7.9	70,000
19	<i>Prince William Sound, Alaska</i>	March 27, 1964	9.2	128
20	<i>Chile</i>	May 22, 1960	9.5	1886

<i>Economic Losses</i>		<i>Tsunami & Other Effects</i>
<i>Actual</i>	<i>In 2012 \$</i>	
~ \$8 billion	~\$8 billion	Damage to agricultural facilities & biotech industries; ~2,000 farms damaged; 10% of Parmesan cheese inventory lost
~\$309 billion	\$315.7 billion	Major tsunami (>30 m); nuclear power plants damaged
~\$16 billion	~\$16 billion	Buildings weakened by 1st quake damaged by subsequent quakes and aftershocks
~\$1.15 billion	\$1.21 billion	Major agricultural losses; about 250 miles of irrigation canal damage
\$30 billion	\$31.57 billion	Agricultural losses
\$7.804 billion	\$8.22 billion	Small (12 cm) Main port in Port-au-Prince suffered extensive damage
>\$16 billion	>\$17.14 billion	
\$85 billion	\$90.73 billion	At least 3,473 dams, 53,000 km of roads and 48,000 km of water pipelines damaged; landslides
\$4.5 billion	\$5.47 billion	Major tsunami (~15 m) affected 14 countries
\$14 billion	\$19.31 billion	Pipeline breaks resulting in fire
\$6.5 billion	\$8.97 billion	Major damage from conflagration triggered by broken gas pipes; fire raged on and off for two days
>\$100 billion	>\$150 billion	Thousands of aftershocks
\$13-\$20 billion	\$20-\$30 billion	
\$6 billion	\$11 billion	
\$3-\$5 billion	\$6.5-\$11 billion	
\$5.6 billion	\$22.62 billion	
\$505 million	\$2.87 billion	Lower Van Norman Dam and the Pacoima Dam severely damaged
\$530 million	\$3.14 billion	
\$311 million	\$2.45 billion	Major tsunami
\$675 million	\$5.24 billion	Tsunami (~ 25 m) caused casualties and losses in Hawaii, Japan and Philippines

Table 2: Agricultural Losses Caused by Earthquakes

<i>Earthquake</i>	<i>Date</i>	<i>Damage Type(s) and Losses</i>
<i>Emilia Romagna Italy</i>	May 20 - June 5, 2012	More than \$300 million, primarily to dairy industry; about 2,000 farms and irrigation canals damaged; localized liquefaction
<i>Tohoku, Japan</i>	March 11, 2011	About \$30 billion; massive damage to fields and facilities, including inundation by sea water and radioactive contamination
<i>Baja California, Mexico</i>	April 4, 2010	More than US\$400 million; agricultural and irrigation facilities damaged
<i>Wen Chuan, China</i>	May 12, 2008	About US\$ 6 billion direct agricultural economic losses
<i>Pakistan</i>	October 2005	More than \$440 million in livestock, crops and irrigation system losses
<i>San Simeon, CA</i>	Dec 23, 2003	Winery facilities damaged
<i>Napa, CA</i>	Sept 5, 2000	Winery facilities damaged
<i>Chi-Chi, Taiwan</i>	Sept 21, 1999	About \$225 million total agricultural losses
<i>New Madrid</i>	1811-1812	About 4,000 square miles of farm land damaged by liquefaction; damage persists to date - 200 years later

Post-Earthquake Economic Recovery

Rapid economic recovery after a major earthquake, or any other natural or human-caused disaster for that matter, is essential for maintaining the economic health of any region. This is particularly true for the State of California which is a world leader in many areas including technology, finance, tourism, and agriculture. Due to the highly competitive and integrated nature of the global market place, producers of the same goods and services are usually available in different parts of the globe. The ease of modern-day communications and transportation networks enables replacement of one supplier with a different one relatively easy.

A major earthquake in California, similar to the 1906 San Francisco Earthquake, or others that have occurred more recently in other parts of the world, can cause major damage to California's economy both in the short-term and long-term. The short-term losses are generally due to damage to public and private (industrial and agricultural) sector facilities. Long-term economic damage results from a combination of businesses suffering losses from which they are not able to recover, such as permanent loss of customers, or from relocating outside California. The latter can be the case with companies that have facilities both in California and outside, and relocating operations to an outside facility can result in faster corporate recovery.

California has indeed been a world leader in improving the seismic safety of the built environment, due to constant improvements in the building codes and inspection standards, mitigation and education. Significant effort has also been devoted to developing response methodologies that are often the envy of the other

states and countries. These have been documented in a very detailed thorough manner in the *California Earthquake Loss Reduction Plan, 2007-2011 Edition*. The Plan, the Plan Matrix, and detailed descriptions of the Elements and the Initiatives within each element have all been retained in their entirety in this document, as Appendix B. to ensure that the knowledge gained in developing that plan will not be lost.

However, the fact that 88% of the economy is accounted for by the private sector needs better recognition. Further, if the resilience and recovery of the private sector is not adequately addressed, then the long-term economic health of California could be damaged by the next major earthquake or similar disaster. The larger corporations frequently tend to have more than one operational site, thus enabling them to shift operations and/or manufacturing to a different site and thus maintain corporate financial health, regardless of the effect on the financial health of California. The smaller businesses and agricultural businesses do not have this luxury. In general, if they are not able to resurrect themselves in the same location, they go out of business, resulting in the loss of economic activity, jobs, and tax revenues for local and state governments.

Rapid economic recovery after a major earthquake is essential for maintaining California's vibrant economy and dominance in the world. This is essential for keeping the jobs in California, which in turn will generate the needed revenues for enabling the recovery and new economic growth. While both preparedness and mitigation are essential elements of recovery, there are several other factors that also come into play in the recovery and rejuvenation process.

In order to enable rapid recovery and maintain employment at acceptable levels, pathways to post-earthquake economic recovery need to be explored and identified prior to the earthquake. This will enable implementation of the measures necessary for the recovery.

The many regions in the USA and other countries have unfortunately suffered damages from major natural disasters such as earthquakes and severe storms. have also implemented a variety of measures to stimulate economic recovery. However, a careful study of the measures and policies that were developed and implemented, and the extent to which these were successful, or not successful, has not been

undertaken. In other words, "*What worked and what did not work?*" By undertaking, such a study California has the opportunity to build upon the lessons learned from the experience of others and develop a set of measures and policies that can have a very high potential for success.

The 2013 Edition of the California Earthquake Loss Reduction Plan is devoted to the topic of post-earthquake economic recovery. The Commissioners and others have come together and contributed their collective wisdom towards identifying the various factors that they have thought are important contributors towards rapid economic recovery. It is anticipated that a more detailed study of this topic will be undertaken next

Factors Affecting Post-Earthquake Economic Recovery

A variety of factors have been identified as being important for post-earthquake economic recovery. These have been categorized into six elements, with each element having initiatives that are recommended for further development and implementation. The significance and relevance of each element is first described, followed by the initiatives recommended. Many of initiatives can be thought of as being a part of more than one element; while duplication has been avoided as far as possible, in some cases this has been unavoidable due to the different implications of the main theme of an initiative.

Elements for further research, development and/or implementation

- Research
- Education and Information
- Economics and Finance
- Recovery
- Utilities and Transportation
- Preparedness and Emergency Response

It is expected that a California Post-Earthquake Redevelopment Plan will be developed so that the knowledge gained during the course of developing the *California Earthquake Loss Reduction Plan, 2013 Edition*, and the subsequent research, will serve to ensure loss reduction in the short-term and long-term, and maintain California's economic might.

Research Element

Different regions in the US, and several nations such as China, Japan, Italy, and Taiwan, among others, have experienced major earthquakes and other natural disasters that have affected urbanized and/or industrialized regions. In each instance the national and local governments have taken several measures to specifically stimulate economic recovery. To date there has been no systematic examination of the measures that were implemented and the extent to which these were effective. The scarce research that has been done in this area has tended to have been carried out by academic researchers with little to no involvement by the business community which would not only be the best judge of its effectiveness but can also add valuable insights into their applicability to California. The purpose of the initiatives identified here is to encourage the type of research that will produce results that can be used by local and state governments, and the business community.

Initiatives

- Encourage and sponsor research on the effects of past earthquakes, worldwide, on their effect(s) on the economy and businesses
- Research economic recovery measures that were effective
 - Include business community professionals in research
- Research the unique risk reduction and recovery needs of small businesses
- Research cost-effectiveness of mitigation approaches in accelerating economic recovery
- Establish formal partnerships with other countries to share economic recovery information
- Research how social media and the Internet can be used effectively to facilitate and promote economic recovery

Education and Information Element

A large amount of information and educational materials related to earthquakes have been created and published thus far. However, the type of information needed to aid policy makers, business owners, and the general public to make effective decisions is still lacking. The initiatives identified in this element are intended to provide information that can be used not only for risk reduction implementation and preparedness before an earthquake, but also to inform business owners and the general public about the economic recovery process and assistance available post-earthquake.

Initiatives

- Demonstrate and communicate benefits of risk reduction programs for building contents and plant facilities, in addition to buildings, to business and government officials
- Establish one location to serve as the information clearinghouse which business owners can contact for reliable information; inform business owners of this location and how to contact it
 - Establish telephone/internet hotline
 - Compile and maintain list of cell phone numbers of business owners
 - Employ social media/SMS manager to inform businesses
- Provide businesses with reliable post-earthquake information regarding restoration of services such as power, water, phone, internet, and transportation
- Convey the importance of, and potential danger from, aftershocks
- Develop a post-earthquake communication strategy publicizing recovery
- Assist businesses develop a strategy for post-earthquake communications with their customers
- Request cities and local governments to inform the business community of local emergency plans and how the business community is included
 - Let businesses know how they can help in recovery
- Inform businesses of economic recovery assistance programs.
 - Develop a marketing campaign to inform businesses of post-disaster assistance and how to obtain it
- Develop “Business Recovery” materials, make them available online, and conduct workshops

Economics and Finance Element

The availability of sufficient capital for both risk reduction and post-earthquake recovery is essential. It has been demonstrated that the benefit-cost ratio for funds invested in mitigation is at least four to one. While no data are currently available for benefit-cost ratios for funds invested in recovery, the alternative to not providing sufficient capital for economic recovery casts a rather bleak picture. The lack of ready availability of capital after a major disaster continues to be an obstacle that needs to be overcome.

Initiatives

- Develop incentives for risk reduction measures taken by home owners and businesses, including non-structural and contents mitigation; seek the cooperation of the insurance industry
- Create funding for mitigation in a manner similar to that provided for clean energy
- Facilitate availability of capital for recovery
 - Speed up insurance payments
 - Simplify paperwork for securing loans and shorten processing time
 - Ensure availability of cash from ATMs
 - Inform businesses where to go to gain access to capital
- Provide special provisions for small businesses that lack collateral
 - Create a Small Business Emergency Loan Program
 - Explore the feasibility of interest-free loans and "bridge" loans
 - Enable rapid capital availability for small businesses
 - Set up Business Counseling Centers
- Create a one-stop shop that explains to businesses the various incentives available for rebuilding as rapidly as possible
 - Loan programs and guarantees
 - Incentive programs
 - USDA loans for agribusinesses
 - SBA loans
 - Consider providing assistance with renting alternate facilities
- Provide marketing assistance to businesses to help them recover their customer base
- Provide tax relief for both physical losses and opportunity losses

- Accelerate depreciation schedule for capital equipment
- Provide tax credits for maintaining employment at pre-earthquake levels
- Provide tax incentives for investment/staying in disaster-affected areas
 - Exempt sales tax for one or two years for businesses that rebuild
 - Delay/postpone tax payments
 - Declare EQ-affected regions as "Enterprise Zones", with extended tax credit periods
 - Attract new investments by creating and publicizing a New Markets Tax Incentive

Recovery Element

While recovery methods have improved with each earthquake, there still exist several areas where further improvements are required. In particular, strategies aimed at improving rapid recovery of the private sector have been insufficient.

Initiatives

- Establish an "A-Team" for post-EQ Economic Recovery and Development
 - Include business representatives in recovery planning, and implementation committees and task forces
 - Seek the assistance of local businesses in the recovery process
 - Develop methods for better coordination between public and private sectors during recovery
 - Establish post-disaster business outreach centers
 - Provide updates on progress of recovery
 - Launch a "California is Open for Business" campaign, with specific disaster-affected regions targeted, e.g., "San Francisco is Open for Business".
- Create a one-stop shop, at the local level, to expedite permitting and rebuilding process
 - Fast-track reconstruction permits
 - Reduce cost of reconstruction related to building codes
 - Accelerate damage assessment of commercial buildings
 - Encourage commercial building owners to contract structural engineering services before the earthquake
- Create employment services clearing houses in affected areas so that employers can connect with potential employees
 - Engage residents in recovery to prevent emigration, especially of skilled personnel
 - Enable employees to return to work as soon as possible
- Make prompt payments for services
- Prioritize debris removal
- Control onset of blight
- Target low-income areas for economic development and redevelopment
 - Limit extent of, or streamline, environmental permits required during a finite post-EQ period, e.g., 6 months

Utilities and Transportation Element

Restoration of utilities and transportation in a timely manner is crucial for the resumption of normal life and economic activities. Previous disasters have demonstrated that even facilities that do not sustain damage need to shut down operations either when the utilities required for operation are not available and/or transportation facilities are not available for the transportation of goods and services.

Initiatives - Utilities

- Investigate all means for accelerating restoration of all utilities including water, natural gas, electricity, sewers, communications (phones, internet), and gasoline supplies
- Consider prioritizing business/industry districts for restoration
- Encourage business owners to install solar and other alternate energy electricity generation capability to make businesses more resilient to post-EQ power outages

Initiatives - Transportation

- Identify alternate routes and means for transportation
- Develop emergency transportation plan for employees, supplies and products
- Identify and upgrade critical points in transportation routes, e.g. overpasses
- Accelerate restoration of roads, airports, ports, railways

Preparedness and Emergency Response Element

The potential for loss of life and injuries, loss of property, and economic losses are all heavily dependent on the extent of preparedness and implementation of mitigation. It is important to convey to business owners the benefits of preparedness so that their recovery can be as quick and smooth as possible. Effective and rapid emergency response is essential for keeping the extent of the disaster at the minimum extent possible.

Initiatives

- Communicate the benefits of preparedness and mitigation programs to business owners in language that is understandable to them
- Include Economic Recovery as an integral part of the Recovery Plan
 - Draft a Plan of Priorities for recovery, e.g., health care first, etc.
- Encourage businesses to develop and sign contracts with contractors needed for recovery
- Create Industrial Zone Mutual Aid Agreements, via trade/business groups, to foster mutual support and assistance
- Permit local governments to provide training for businesses
- Develop Business Continuity Plans suitable for small businesses
 - Assist small business community develop recovery/continuity plans
 - Establish Business Preparedness Clinics
 - Encourage backup of electronic records and data, including for small businesses
- Prioritize areas for reconstruction
- Identify and determine location of Disaster Assistance Center(s) ahead of time
- Establish Mutual Aid agreements with other agencies to provide skilled staff for all aspects of recovery, not just fire, police and rescue
- Secure adequate housing and food for:
 - Mass care and shelter of anticipated number of victims
 - Lodging of aid personnel from outside affected region
- Create network/alliance of major corporations across the State that can assist small businesses in affected areas recover rapidly
 - Capitalize/build upon corporate citizenship and community relations
- Improve K-16 preparedness, mitigation and recovery
- Place limit on post-earthquake lawsuits

CALIFORNIA POST-EARTHQUAKE ECONOMIC RECOVERY

**A Research Proposal Submitted to
The California Seismic Safety Commission**

Proposal Submitted by

The Collaborative for Disaster Mitigation

San Jose State University

San Jose, CA 95192-0082

**Technical Contact: Guna Selvaduray, Ph.D.
Professor
College of Engineering
San Jose State University
San Jose, CA 95192-0082
Tel: (408) 924-3874**

SJSU Research Foundation Contract Manager:

**Michele Vaccaro
SJSU Research Foundation
San Jose, CA 95192-0139
Tel: (408) 924-1430**

January 2, 2013

Table of Contents

	Page
1. Background	1
2. Objective of Research	1
3. Research Approach	2
4. Reporting	3
5. Project Deliverables	4
6. Performance Period	4
7. Project Team	4
8. Project Budget	5

POST-EARTHQUAKE ECONOMIC RECOVERY

The Collaborative for Disaster Mitigation at San Jose State University is pleased and privileged to submit this proposed Statement of Work and qualifications to the California Seismic Safety Commission.

1. Background

The State of California is a region of high seismic activity and has experienced several damaging earthquakes in the past. The 1989 Loma Prieta and the 1994 Northridge earthquakes were the most recent earthquakes, having magnitudes of 6.9 and 6.7, and resulting in damage of approximately \$11 billion and between \$20-30 billion, respectively, in 2012 dollars. The last *major* earthquake to occur in California was the 1906 San Francisco Earthquake. According to the United States Geological Survey the likelihood of an earthquake greater than magnitude 7.5 occurring in California is 46 % over the next 30 years. The occurrence of such a major earthquake can be expected to result in significantly more damage than the Loma Prieta or Northridge earthquakes.

California today is a world leader in industrial and agricultural production, with a 2011 GDP of close to \$2 trillion, 88% of which is derived from the private sector. Industries that California is known for internationally include semiconductors, information technology, and biomedical technology, among others. Earthquake-caused damage to these industries and agricultural facilities can result in California losing its leadership position and the jobs and revenue associated with it.

Damage to California industries and agriculture provides opportunities for competitors, world-wide, to lure away customers who may be "lost" permanently. After the 1995 Kobe earthquake some industries were not able to sustain their pre-earthquake production levels even 10 years later. In other cases companies moved their facilities, along with the jobs and revenue, to other regions or countries thought to be safer.

In practically every instance of major earthquakes the local, and in some cases the national, governments have taken steps to revive the economic activity that existed in that region prior to the earthquake. This is also true in the case of other disasters such as hurricanes and severe windstorms. However, evaluative reports identifying which steps were successful and which were not are scarce.

2. Objective of Research

The fundamental objective of this research is to develop a California Post-Earthquake Economic Recovery Plan, based on the needs of the business community, and on research of policies and initiatives that have proven to be effective, or not effective, after previous earthquakes and other disasters.

3. Research Approach

3.A Research needs of the Business Community

The post-earthquake recovery needs of the business community will be researched by convening focus groups of businesses that have experienced earthquake damage recently. The cooperation of the Chambers of Commerce of Paso Robles and Napa Valley will be sought in convening these focus group. A semi-structured questionnaire will be developed and will be used as the basis of the discussions.

Both Paso Robles and Napa Valley have economies that are dominated by the agricultural sector and by small businesses, as opposed to larger metropolitan areas such as Los Angeles or San Francisco. The obstacles to economic recovery that such communities face can be expected to be significantly different from those faced by urbanized and industrialized regions. Regardless, the lessons learned by investigating the needs of the business community in these regions will also be applicable to the metropolitan areas.

3.B Research Selected Past Disasters

The following past disasters will be investigated to identify the measures policies that local, state and national governments put in place to stimulate economic recovery. The impact each of those measures had will be identified, where possible. In particular, any federal (national) funds provided for economic recovery, the purpose(s) for which they were provided, and the impact these had will also be investigated. The methods used by the jurisdictions to reach out to their business communities will also be studied.

- 3.B.i Hurricane Sandy This is the most recent major disaster to affect the USA. The state governments of New York and New Jersey have begun planning for economic recovery. While it is still too early to determine the effectiveness of these plans, knowledge of their plans can be expected to be relevant to California.
- 3.B.ii Great East Japan Earthquake (March 11, 2011) This earthquake is probably the most devastating earthquake to occur thus because of the massive tsunami that followed it and also because of the nuclear disaster that ensued. Large tracts of land were inundated by seawater and then radioactive fallout. The Japanese government has developed several policies and incentives for the revitalization of the economic activities and repopulation of the affected regions. Evaluating the effectiveness of the policies enacted approximately two years after the earthquake will be of great relevance to California.
- 3.B.iii Florida Hurricanes More windstorms and hurricanes have hit the State of Florida than any other state, the most damaging of which was probably Hurricane Andrew. Florida has had significant experience with recovery after natural disasters. Investigating the policies enacted, the anticipated and actual outcomes, and the sources of funding for the policies will be relevant for California's post-earthquake economic recovery plan.

3. B. iv Emilia-Romagna Earthquakes, Italy These earthquakes damaged the agricultural and biomedical technology sectors. The companies affected had international customers. Investigation of the steps these companies took to make sure that international customers were not lost to competitors will yield valuable results. In addition, investigation of the economic recovery policies that the regional and national governments may have pursued will also yield valuable results for recovery of California's high-tech industries.
- 3.B.v Chi-chi Earthquake, Taiwan This earthquake affected the semiconductor industry to the extent that DRAMs were in short supply for several months. Despite this shortage, the Taiwanese semiconductor industry was able to not only recover but also continue to grow. Investigation of this earthquake will focus on steps that were taken, both by the companies and the national government, to facilitate and encourage economic recovery and growth.
- 3.B.vi Kobe Earthquake, Japan The Hyogo prefectural government and the Japanese national government put major effort into economic recovery of the Kansai region which suffered significant damage from this earthquake. In addition, the Kobe Chamber of Commerce conducted periodic surveys to identify the impediments that businesses were facing on their paths to recovery. While some industries were able to recover, some other sectors such as the non-leather shoe industry and the sake brewing industries were not. The Port of Kobe also lost a significant amount of its traffic to other ports in Japan and in Korea. Investigation and evaluation of the effectiveness of public sector policies, investigation of measures the Port of Kobe took to recover its traffic volume, and knowledge of the results of the Kobe Chamber of Commerce surveys will be of great relevance to California.

4. Reporting

Reporting during the course of this project will be done in two forms: (a) Periodic verbal and written reporting to the Commission and (b) Written Final Report.

It is requested that the Commission create an Oversight Committee with which this Project Team can confer throughout the course of this investigation.

Verbal reports of the status quo of the research will be presented to the California Seismic Safety Commission on a quarterly basis. During the interim period between these reports the project team will hold meetings with, and deliver reports to, the Commission's Oversight Committee. The project team considers these meetings to be very important so that the study can benefit from the collective wisdom represented by the Oversight Committee and also the full Commission.

A Draft Final Report will be submitted to the Commission on or before six weeks prior to the end of the performance period for this research. A Final Report incorporating the comments of

the Oversight Committee will then be prepared. This report will contain all of the findings pertaining to the earthquakes investigated.

The Final Report will be the basis for developing a draft California Post-Earthquake Economic Recovery Plan for consideration by the Commission, and possibly adoption.

5. Project Deliverables

1. Final Report of findings with recommendations for the Commission
2. Draft California Post-Earthquake Economic Recovery Plan for adoption consideration by the Commission

6. Performance Period

A total performance period of 15 months is requested. Based on a projected start date of June 1, 2013, the project will be completed no later than August 31, 2014.

7. Project Team

The proposed project team members are as follows:

Project Director: Guna Selvaduray, Ph.D., Professor, College of Engineering, San Jose State University, and Executive Director, Collaborative for Disaster Mitigation, San Jose State University

Project Co-Director: Steven Vukazich, Ph.D., Professor, College of Engineering, San Jose State University.

Consultants:

Nobumasa Kawabata and Ichiro Matsuo in Japan
Kimberly Shunk

Other members of the Project Team, who will be identified as soon as the project is awarded are:

Project Manager: TBD, @ 20 hours per month

Professional Editor: Editing of reports to ensure readability by a non-engineering audience.

Research Assistants: Two graduate students, TBD

All project team members will report directly to the Project Director.

8. Project Budget

The total budget for this project is expected to be \$199,656. A detailed breakdown of the budget is included.

The major cost item is personnel costs. A total of \$13,000 is requested for travel to Japan, Taiwan, Italy, Florida, and New York as well as local travel within California for meetings in Paso Robles, Napa, and Sacramento.

California Post-Earthquake Economic Recovery Budget					
Performance Period: June 1, 2013 - August 31, 2014					
	Sum 13	Fall 13	Spring 14	Sum 14	Total
Project Director - Selvaduray	20,160	15,422	15,422	20,160	71,165
Co-Project Director - Vukazich	3,000			3,000	6,000
Research Assistant					19,800
80 hrs/month, 15 months, \$15/hr					
Consultants					
Nobumasa Kawabata					10,000
Ichiro Matsuo					10,000
Kim Shunk					20,000
Project Manager					6,600
20 hrs/month, 15 months, \$20/hr					
Professional Editor					2,000
40 hrs, \$50/hr					
Total Personnel					144,725
Travel					
Japan and Taiwan					5,000
Italy					3,000
Domestic and Local Travel					5,000
Supplies					2,000
Subtotal					159,725
University Overhead @ 25%					39,931
Project Total					199,656