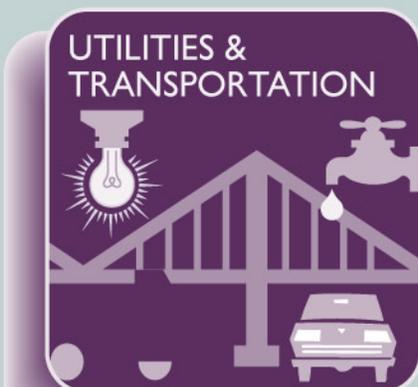
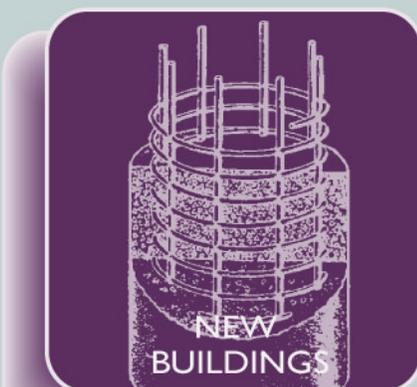
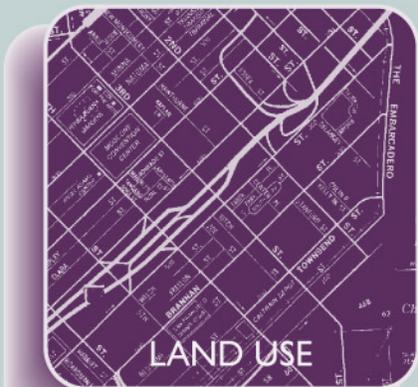
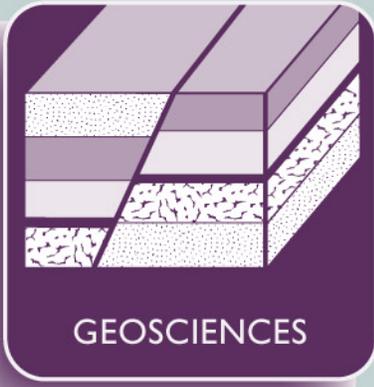


# California Earthquake Loss Reduction Plan



2002-2006

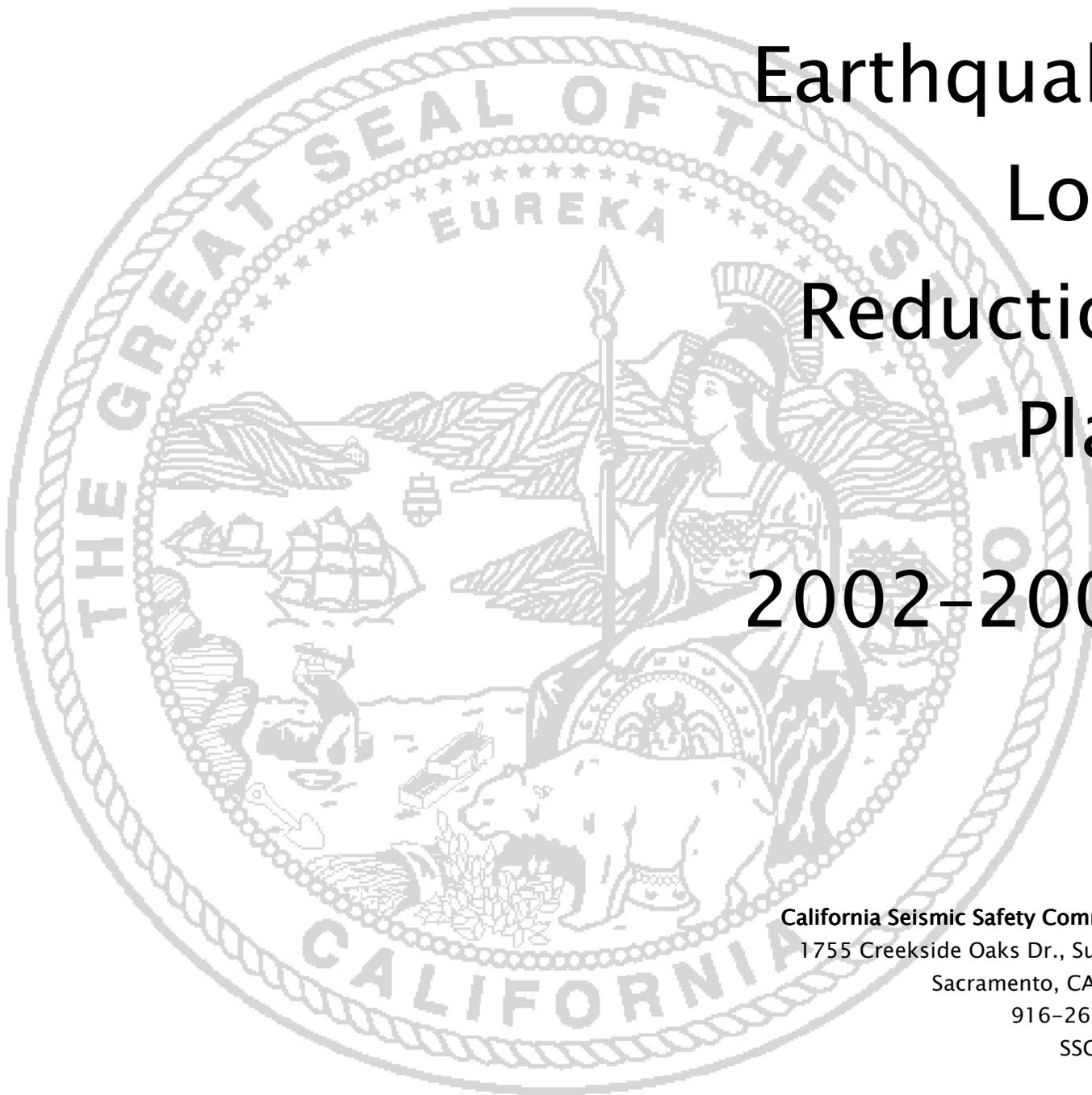
The California Seismic Safety Commission

SSC 02-01





# California Earthquake Loss Reduction Plan 2002–2006



California Seismic Safety Commission  
1755 Creekside Oaks Dr., Suite 100  
Sacramento, CA 95833  
916-263-5506  
SSC 02-01



### **Publishing Information**

The *California Earthquake Loss Reduction Plan* was developed by the California 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 photo-offset production by the staff of the Publications Division, California Department of Education. (See Acknowledgments, p. vii, for a full list of contributors.) It was edited for publication by the California Seismic Safety Commission. The original cover design and interior layout were prepared by \_\_\_\_\_

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 California Seismic Safety Commission publishes a variety of documents related to earthquakes and earthquake safety. To obtain a publications list with prices and ordering information, interested persons may contact the Commission's office or visit its Web site.

### **California 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](http://www.seismic.ca.gov)

# Contents

- [Governor’s Message](#) ..... v
- [Acknowledgements](#)..... vii
- [Executive Summary](#)..... 1
- [The Vision](#)..... 3
  - The Big Picture: Reducing loss and speeding recovery
- [The Perspective](#) ..... 7
  - The History: Where we've been in loss reduction
- [The Benefits](#) ..... 10
  - The Value of Mitigation: Making it happen
- [The Plan](#)..... 13
  - The Critical Elements: How we intend to do it.
- [The Plan Matrix](#) ..... 14
- [Format for the Initiatives](#)..... 17
  - The Working Parts: What needs to be done.
- [Geosciences](#) ..... 19
- [Research & Technology](#) ..... 23
- [Education & Information](#)..... 27
- [Economics](#)..... 31
- [Land Use](#)..... 33
- [Existing Buildings](#)..... 37
- [New Buildings](#) ..... 41
- [Utilities & Transportation](#) ..... 45
- [Preparedness](#) ..... 49
- [Emergency Response](#)..... 53
- [Recovery](#) ..... 57

Progress on the initiatives presented in this Plan will be presented periodically in the Seismic Safety Commission's "Progress Report for the California Earthquake Loss Reduction Plan." Copies of this document may be obtained by contacting the Seismic Safety Commission at:

**Seismic Safety Commission**

DRAFT  
27 JUL 01

# Governor's Message



GOVERNOR GRAY DAVIS

Dear Concerned Citizen:

I am proud to unveil the revised *Earthquake Loss Reduction Plan for California (2002-2006)*. Much effort has gone into the revision of this comprehensive Plan – state and local government, non-profit and private organizations have all contributed. It lays out the goals that California is striving for and provides a complete status of current seismic efforts and activities in California.

We know, all too well the realism of earthquakes in California. In recent memory, the Northridge and Loma Prieta earthquakes have shown us that even though California leads the Nation in earthquake safety and preparedness, improvement is needed. This Plan sets forth our strategy on how to proceed with the State's seismic mitigation efforts by prioritizing specific actions that must be completed.

I ask that all Californians embrace this Plan. We need to make every effort, morally, to save future lives and minimize the economic adversity that earthquakes cause. Although we cannot prevent or predict earthquakes from occurring, we can maintain California's lead in earthquake loss reduction and continued efforts in seismic safety.

Sincerely,

Governor Gray Davis

STATE CAPITOL • SACRAMENTO, CALIFORNIA 95814 • (916) 445-2841



# Acknowledgements

The California Seismic Safety Commission (Commission) wishes to thank the Governor's Office of Emergency Services for granting funds to produce the *California Earthquake Loss Reduction Plan*. This document could not have been produced without Federal Emergency Management Agency agreement EMF-96PA0598.

The Commission also thanks Harry C. Hallenbeck, FAIA, whose expertise and dedication were invaluable in preparing this plan. He spent countless hours with

experts throughout the state who share the Commission's goal of working toward a safer California. His skilled leadership and creative vision are deeply appreciated.

Special thanks are also extended to the California Earthquake Loss Reduction Plan Committee, its chair, Commissioner Pat Snyder, and its sub-committee members for their generous commitment of time and untiring enthusiasm in producing the *California Earthquake Loss Reduction Plan for 2002-2006*.

## Seismic Safety Commission

---

Elaine White Alquist

*Assemblywoman*

William L. Gates

*(Alternate for Assemblywoman Alquist)*

Richard Alarcon

*Senator*

Chris Modrzejewski

*(Alternate for Senator Alarcon)*

Lawrence Klein

*Utilities*

Mark Church

*Local Government*

Linden Nishinaga

*Cities Government*

Jerry C. Chang, P.E.

*Soils Engineer*

Andrew A. Adelman

*Cities/Building Official*

Jeffrey Johnson, Ph.D.

*Seismology*

Stan Y. Moy

*Architecture and Planning*

Daniel Shapiro

*Structural Engineering*

Ashok S. Patwardhan

*Mechanical and Electrical Engineering*

Bruce R. Clark, Ph.D.

*Geology*

Patricia Snyder

*Social Services*

Scott Haggerty

*County Government*

Douglas E. Mochizuki

*Emergency Services*

Donald O. Manning, Chairman

*Fire Protection*

## Seismic Safety Commission Staff

---

Richard J. McCarthy  
*Executive Director*

Robert Anderson  
Karen Cogan  
Kathy Goodell  
Henry Reyes  
Henry Sepulveda  
Fred Turner

Abigail Browning  
Kyshia Davis  
Judy Deng  
Shana Jacob  
Adam Myers  
Vincent S. Vibat

## Consultants

---

Harry C. Hallenbeck, FAIA  
*Vanir Construction Management Inc.*

Andrew Petrow  
*Office of Emergency Services  
State of California*

Edward J. Bortugno  
*Office of Emergency Services  
State of California*

Richard Bernknopf  
*U.S. Geological Survey*

Robert A. Olson  
*Robert Olson Associates*

## Contributors

---

Curt Abdouch  
Massoud Abolhoda  
Norm Abrahamson  
Jonathan D. Adkisson  
Pete Anderson  
Jill H. Andrews  
Christopher Arnold  
Robert Berg  
Frank W. Borden  
Jonathan Brag  
George E. Brogan  
Peggy L. Brutsche  
Dean Cathey  
Kim Carpenter  
Bob Cervantes  
Don Cheu, M.D.  
Lloyd Cluff  
Mary C. Comerio  
Martha Cox-Nitikman  
Lloyd Darrington  
James F. Davis  
Dan Eberle  
Ronald T. Eguchi  
Eric Elsesser  
Michael Foulkes  
Eric G. Frost

Jeffrey L. Gidley  
Peter Gordon  
Ronald O. Hamburger  
Fred Herman  
Steve Ikkanda  
Virginia S. Kimball  
Paul W. King  
Ram Kulkarni  
Robert A. Larson  
Mike Lee  
Adele E. Macpherson  
Brian Maroney  
David Marz  
Edward Matsuda  
Mike Maurer  
David McCormick  
Ellen McNeill  
Richard Meehan  
Robert Mellors  
William Michael  
J. Laurence Mintier  
David M. Mraz  
Sarah K. Nathe  
Carl Nordquist  
Joseph Penzien  
Constance Perett

Jeanne Perkins  
William Petak  
Joe Petrillo  
Dick Phillips  
John A. Popejoy  
Charles Real  
Robert K. Reitherman  
Antero A. Rivasplata  
Jeff Rubin  
Richard A. Rudman  
James E. Russell  
Lee Sapaden  
William U. Savage  
Paula Schulz  
Stephen Sellers  
Guna S. Selvaduray  
Roy J. Shlemon  
Sunil K. Shori  
James E. Slosson  
Harry Strahl  
Charles C. Thiel, Jr.  
Tousson R. Topozada  
Susan K. Tubbesing  
Keith Wheeler  
Frances E. Winslow

DRAFT  
27 JUL 01

# Executive Summary

California's Seismic Safety Commission was established by legislation in January 1975 to set goals and priorities for earthquake safety. The *California Earthquake Loss Reduction Plan of 2002-2006* is a comprehensive strategic plan that sets forth statewide policy and direction in pursuit of the vision for a safer California.

The earthquake policy process 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 strategic plans, formerly known as *California at Risk*, and numerous reports have been published to fulfill the Commission's mandate.

This version of the strategic plan satisfies three needs:

- It continues to be the Commission's policy statement regarding actions necessary to reduce earthquake risk over the long term.
- It guides the executive branch in its overall implementation strategies and priorities for seismic safety.
- It complies with the Federal Emergency Management Agency's (FEMA) *National Hazards Mitigation Strategy* and is a part of the state's hazard mitigation plan required to obtain federal mitigation funding after earthquakes.

This is a living document that continues to evolve. It supports the Commission's vision to the year 2010, in conformance with the *National Hazards Mitigation Strategy*. A continuous evaluation process will refine the direction of the plan and measure the results. Tracking of the results will be done on a periodic basis and will be presented as a separate report. Simply put, the plan is a matrix of eleven elements. Each element addresses a distinct but interrelated area of concern, and each supports and is supported by the others. Forty-four strategies of equal importance are stated in the plan. A total of 148 initiatives each

identify a new or renewed effort to provide direction for implementation. Twelve of the initiatives are considered critically important and should be implemented as having the highest priority. The Administration, the Legislature, and others responsible for earthquake safety will provide the leadership for implementation of the initiatives. Individual implementation plans will describe the actions and costs required to accomplish the intent of the initiatives.

California has already made significant progress toward earthquake safety; with continued commitment, the objectives can be reached by the year 2010. The focus is clear. Mitigation works! Loss reduction is possible and practical



# The Vision

**M**ore than 80 destructive earthquakes of magnitude 5.0 or higher have been recorded in California since the early 1800s. The last fifteen years alone have seen at least ten damaging earthquakes ranging in magnitude from 5.0 to 7.3. These earthquakes were considered of “moderate” size, and fortunately they generally occurred during nonworking hours. Even with such good fortune, however, the resulting devastation clearly demonstrated the need for continued efforts to reduce loss and speed recovery.

Natural hazards exist everywhere, and California is no exception. Throughout its history, the state has experienced floods, tsunamis, wildfires, droughts, landslides, volcanoes, windstorms, and earthquakes. But of all these natural disasters, earthquakes pose the greatest threat to the lives, property, and economy of California. The State’s Division of Mines and Geology estimates that California’s anticipated yearly losses to structures, contents, and income will average \$4.7 billion per year. Hard facts cannot be ignored:

- According to the U.S. Geological Survey, there continues to be a very high probability that at least one major earthquake will strike an urban area in California in the next 30 years.
- The Loma Prieta (1989) and Northridge (1994) earthquakes caused over 100 deaths and more than \$50 billion in reported damage and indirect losses.
- In the Northridge earthquake alone, up to 125,000 people were made homeless, and 82,000 residential and commercial units (of which 60,000 were multifamily residential) and 5,400 mobilehomes were damaged or destroyed.<sup>1</sup>

<sup>1</sup> *The Northridge Earthquake of January 17, 1994: Report of Data Collection and Analysis Prepared by the Geographic Information Systems Group of the Governor’s Office of*

- The majority of California’s growing population of 34 million live within 20 miles of active earthquake faults. According to the Federal Emergency Management Agency’s (FEMA) *National Hazards Mitigation Strategy* (December 1995), the population at risk due to earthquakes will dramatically increase by the year 2010. New homes, communities, and infrastructure will develop to accommodate the population growth, and the risk of human and economic loss from earthquakes will rise accordingly.

California’s frequency of damaging earthquakes plus the effects of a growing population create unacceptable levels of risk. Therefore, the State of California is committed to an aggressive earthquake loss reduction policy.

No one can prevent earthquakes nor accurately predict them, but through the *California Earthquake Loss Reduction Plan*, loss of life and property can be significantly reduced. (Inset below)

## The California Earthquake Hazards Reduction Act

(*Government Code* Chapter 12, Section 8870 et seq.)

The California Earthquake Hazards Reduction Act was authored by Senators Alquist and Campbell and signed into law by Governor Deukmejian on October 2, 1985. The statute requires the Seismic Safety Commission to prepare and administer a program setting forth priorities, funding sources, amounts, schedules, and other resources needed to reduce statewide earthquake hazards significantly by the year 2000.

## Evolution of the Plan

Earthquake loss reduction may be defined as sustained action to reduce or eliminate long-term risk to human life, property, and the economy from earthquakes.

In 1986, the California Earthquake Hazards Reduction Act directed California's Seismic Safety Commission to establish a series of multiyear programs to significantly reduce earthquake risk. The first edition of the program, known as California at Risk, became the state's official earthquake hazard reduction plan for 1987–92. The second and third editions (the plans for 1992–96 and 1997 - 2001) built on the first, adding significant new data and initiatives for action. This edition addresses the period from 2002 to 2006. The earlier editions served well as a catalyst for legislation and significant accomplishments in the areas of identifying seismic hazards and improving the safety of hospitals, homes, mobilehomes, transportation, and infrastructures.

After the Loma Prieta earthquake, FEMA required the state to provide an earthquake hazard reduction plan to establish eligibility for mitigation funding. California at Risk was recognized as the state's earthquake mitigation plan. The plan has evolved into a multiuse document, serving state agencies, local governments, schools, businesses, volunteer and other private nonprofit agencies, and individuals. It presents broad objectives and recommends strategies for achieving them by the year 2010. Responsibility for implementing and accomplishing the objectives rests with individuals, private businesses, and appropriate agencies.

FEMA's National Hazards Mitigation Strategy emphasizes partnerships among all levels of government and the private sector. These alliances form the foundation of the plan to empower all Americans to fulfill their responsibility for ensuring safer communities. The California Earthquake Loss Reduction Plan acknowledges the state's commitment to this multilevel partnership. Included in that partnership are government agencies (federal, state, and local) that carry out seismic safety activities, academic institutions, the private sector, and volunteer organizations.

California has learned important lessons from its earthquakes. By continuing to support new and ongoing efforts to protect its people and the built environment, the state can be more effective in

reducing damage and injury from succeeding earthquakes. California's effective reduction of its seismic risk will ensure environmental and economic viability for the lives of Californians.

Great strides have been taken in protecting the lives, property, and economy of Californians from earthquakes. Although progress to date has been good, there is much more that must be done if the vision of a safer California is to become a reality.

## The Vision

---

The lives and properties of the citizens of California are being made safer from potentially devastating earthquakes by the implementation of an effective, long-term seismic safety policy that has the following as its basic principles:

- Continual advancement in education and science about earthquakes and techniques for mitigating their effects
- Evolutionary advancement in public policy affecting the design, construction, and retrofit of California's built environment
- Effective preparedness, immediate emergency response, and successful personal and economic recovery

## The Goals by the Year 2010

---

To achieve the vision, the *California Earthquake Loss Reduction Plan* presents three basic goals to be accomplished by the year 2010:

### Advancement in Learning About Earthquakes

---

Applicable and effective research in geoscience, engineering, and social sciences about earthquakes, including techniques for mitigating their effects, will be the basis of California's mitigation strategies. The full spectrum of educational opportunities and communication strategies will effectively transfer that knowledge to the policy makers, the professions, and the public.

### Advancement in Building for Earthquakes

---

Public policy affecting the design and retrofit of vulnerable existing structures will encourage cost-effective mitigation. The design and construction of all new structures will be based on higher performance standards that increase reliable levels of protection for

both the lives and property of its citizens, and will ensure continued strength in the California economy.

### **Advancement in Living with Earthquakes**

---

Preparedness and emergency response systems will effectively minimize the pain and suffering from potentially disastrous earthquakes. Both short- and long-term efforts to accomplish personal and economic recovery will significantly reduce the impact. Californians will be better prepared to understand, respond, and recover.

### **Making Progress**

---

Progress on the achievement of these goals should be monitored and reported on a regular basis by tracking measurable progress of key elements for each goal. For example, the Advancement in Learning About Earthquakes can be monitored by the increase in the percentage of mapping of high-risk urban areas with respect to earthquake hazards. Advancement in Building for Earthquakes can be monitored by the reduction in the percentage of buildings at significant risk. Advancement in Living with Earthquakes can monitor the increase in the number of local communities with an integrated and verified response plan. A system should be developed to help public agencies and private organizations set priorities for earthquake risk management efforts.

DRAFT  
27 JUL 01



# The Perspective

The *California Earthquake Loss Reduction Plan* continues an ongoing quest for safety from the hazards of earthquakes and the state's goal-setting policy. The process began in 1974 with the publication of the *Final Report* of the Joint Legislative Committee on Seismic Safety, which was established after the 1969 Santa Rosa earthquake. The *Report* summarized the history of early seismic safety policy and the achievements of the joint committee during its existence from 1970 to 1974. It also made several recommendations, principal of which was the creation of the Seismic Safety Commission.

## Commission Established

---

The Seismic Safety Commission was established by legislation that took effect on January 1, 1975. The legislation directed the Commission to engage in the following activities:

- Set mitigation and recovery goals and priorities in the public and private sectors.
- Request state agencies to devise criteria to promote earthquake and disaster safety.
- Recommend changes in programs to state agencies, local agencies, and the private sector to further seismic safety.
- Encourage research.
- Help coordinate the earthquake safety activities of government at all levels.

Within hours of their doors being opened in Sacramento on August 1, 1975, the nearby Oroville earthquake shook the Commission's offices. Since then, the Commission has investigated virtually every damaging California earthquake in its continuing quest for seismic safety.

Soon after its establishment, the Commission inaugurated a process for updating the joint committee's report to keep the State's vision alive.

## The First Report

---

From its beginning the Commission recognized that adoption and implementation of its recommendations

were critical to successfully reducing earthquake risk.

The Commission's first report, *Goals and Policies for Earthquake Safety in California*, was published in 1979. The report reemphasized many of the joint committee's recommendations and added others. It focused on several common but key subject areas: the roles of governments, private sector, and the professions; land use, especially general plan implementation by local governments; and improved standards for new construction, including enforcement and quality control. The report also addressed locating, designing, constructing, and operating critical facilities and lifeline systems; dealing with existing hazardous buildings; strengthening preparedness and response capabilities; guiding earthquake recovery; and promoting earthquake information, education and training. In addition, the report contained recommendations on financing seismic safety programs, dealing with earthquake prediction, and defining and supporting needed research.

## The SB1279 Report

---

Senate Bill 1279 of 1978 laid the foundation for California's strategic planning process with respect to seismic safety. This legislation followed two significant earthquakes in China that had been predicted by the People's Seismological Bureau, based on a series of increasingly strong foreshocks. Those events were a damaging earthquake in Haicheng in 1975 and a devastating earthquake in Tangshan in 1976.

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 resulting report, *Earthquake Hazards Management: An Action Plan for California*, was published in 1982. In addition to reflecting the Commission's own thinking, the report reiterated the recommendations of a subcommittee of the Assembly Committee on Government Organization and a Governor's Task Force on Earthquake Preparedness. Commonly known

as the 1279 Report, it recommended a five-year, \$721 million improvement program to support major new initiatives.

DRAFT  
27 JUL 01

## California at Risk

---

Because of its desire to maintain the momentum of a goal- and policy-setting process, the Commission sponsored the California Earthquake Hazard Reduction Act of 1986. Enactment followed the devastating Mexico City earthquake of 1985, which brought home the specter of massive urban losses. The legislation was passed by the Legislature, signed by Governor Deukmejian, and became effective January 1, 1986, officially launching the Commission's strategic planning. Its goal was simple:

*To significantly reduce statewide seismic hazards by the end of the century*

The Commission was assigned the tasks of preparing and administering the program, which included setting priorities, finding funding sources, establishing amounts, and dealing with schedules. Implementation of the program involves over 40 state agencies that share responsibilities for seismic safety.

The program was built around the concept of a regular series of five-year plans with annual program reports. The first document, known as *California at Risk*, was published for 1987–92. It contained 70 new initiatives.

The second edition covered the 1992–96 period. That edition reduced the number of initiatives to 42 in the following categories: Existing Vulnerable Facilities, New Facilities, Emergency Response Management, Disaster Recovery, Research, and Information/Education.

The Commission assessed implementation by publishing intervening status reports. Each report contains comments on what has been achieved, what has been delayed, and what remains to be initiated. Many lessons have been learned and relearned from earthquakes that have occurred since 1986. Those events include the damaging earthquakes that occurred in 1987 at Whittier Narrows, in 1989 at Loma Prieta, and in 1994 at Northridge. The resulting data have been incorporated by the Commission into its strategic planning process.

## The 1997 Edition

---

The third edition of the strategic plan covered the 1997–2001 period and continued a thinking and planning process that began over 20 years ago. Although the Commission took an appropriate new

look and somewhat different emphasis, it did so with a continued commitment to the original goals and the intent that the document serves multiple purposes:

- First, it continued to be the Commission's policy statement about what needs to be done to reduce earthquake risk over the long term;
- Second, it is the state's strategic plan guiding the California Executive Branch agencies in their overall implementation strategies and priorities for seismic safety; and
- Third, it complies with the *National Hazards Mitigation Strategy* and serves as the state's federally required hazard mitigation plan for earthquakes.

## The 2002 Edition

---

The 2002 edition of the plan revises and updates the elements and initiatives of the 1997 edition. A critical initiative under each element is prioritized and a completion time frame has been added. The main objective of this edition is to advance three basic goals of the Commission by the year 2010:

- Learning about earthquakes
- Building to resist earthquakes
- Living with earthquakes

Although formats, styles, priorities, and other elements have changed over the years, the strategic planning approach has produced several long-term accomplishments:

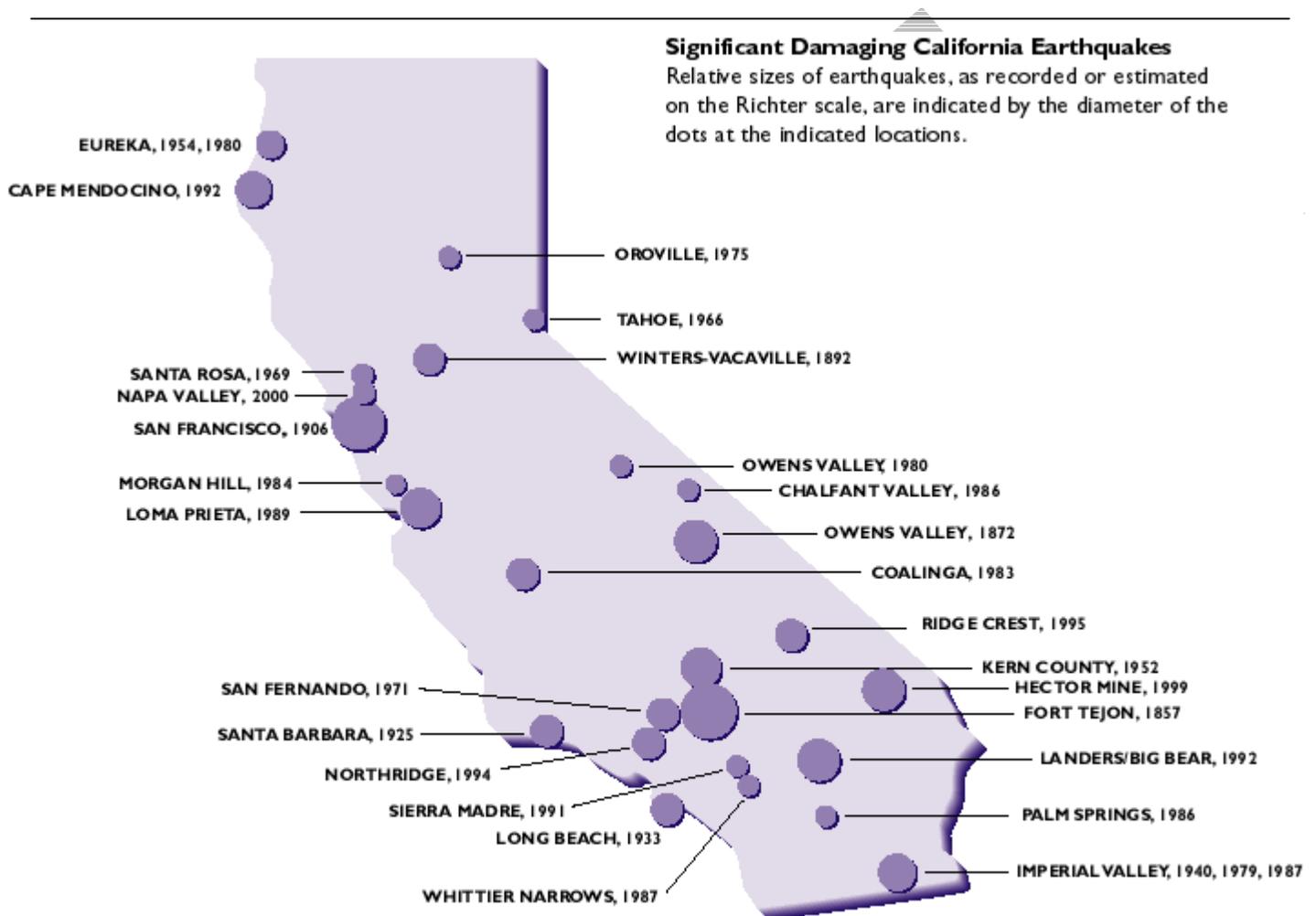
- The Commission has maintained a legislatively required process to define and recommend broad safety policy goals, priorities, and means of implementation.
- The process has influenced the scope and direction of many programs and provided an "agenda-in-waiting" of recommended actions to be proposed when opportunities arise.
- The process has provided a framework for defining the Commission's regular legislative program and for supporting or opposing relevant legislation proposed by others.
- The process has served the broader earthquake constituency by providing an acceptable, policy-oriented, state-level strategic plan.
- The process has provided specific recommendations supporting individual agencies' statutory bases and program

operations.

- The process has helped the Commission and others review and evaluate accomplishments as well as identify remaining seismic safety needs.
- The resulting document is serving as California's qualified and required mitigation plan for earthquakes, helping eligible state and local agencies and other organizations receive

about \$1 billion in federal mitigation grant funds awarded after the 1994 Northridge earthquake.

This edition of the *California Earthquake Loss Reduction Plan*, like all of its predecessors, is dedicated to the continuing quest to reduce loss and speed recovery.



Sources: California Geology, California Department of Conservation, 1986; Earthquake History of the U.S., U.S. Departments of Commerce and Interior, 1982; records of California Office of Emergency Services; compiled and revised by California Seismic Safety Commission, 2001.

# The Benefits

**M**itigation works! Upgrading existing vulnerable structures, using better designs in new construction, and increasing preparedness in all areas are the most cost-effective ways to reduce loss and achieve recovery from earthquakes.

Compared with the criteria used in other seismically active areas of the world, California's higher standards of construction show that the benefits are real even if they cannot be quantified.

In fact, the magnitude of losses in recent earthquakes in Turkey, Taiwan, El Salvador, and India show that, when compared to recent California earthquakes, the State's use of sound design and construction practices is making a difference in controlling losses. However, based on observations from the Northridge earthquake, there is still room for additional improvements to reduce earthquake-related losses in California.

Quantifying benefits is not easy. Common sense tells us that action taken to reduce the loss from earthquakes produces better results than inaction. If a building is constructed to higher performance standards, it will suffer less damage than one not constructed to those higher standards. But the questions often asked—how much better, is it cost-

effective, or has it been proved in an actual event—all go unanswered. Unfortunately, current quantitative cost-benefit analysis is not far enough along to support what common sense and good professional judgment tell us is true about earthquake mitigation. The reason lies in several areas: 1) placing a dollar value on life itself has not reached universal acceptance; 2) placing a dollar value on the speculation of damage and disruption is still an inexact process; 3) predicting when and how earthquakes will impact any particular building cannot be done accurately; and 4) real-life testing before and after mitigation is not possible. The benefits are sure to accrue but the amounts are hard to quantify. Therefore, the deciding factors in mitigation are most often based on qualitative rather than quantitative analysis.

## Taking Action

Post-earthquake investigations show that mitigation works, but there is still the question of cost. Establishing the mandate, committing the resources, and authorizing the mitigation will not happen unless governments complete some evaluation of the required resources.

## Comparison of Major Earthquakes

Event	Mexico City 1985	Loma Prieta, 1989	Northridge, CA 1994	Kobe, Japan 1995	Turkey 1999	Taiwan 1999	El Salvador 2001	India 2001
Magnitude	8.1/7.5 <sup>1</sup>	6.9	6.7	7.1	7.4/7.2 <sup>2</sup>	7.6	7.6/6.6 <sup>3</sup>	7.7
Loss of Life	10,000	63	57	5,400	17,439	2,043	1,159	20,005
Buildings with Severe Damage	5,700	27,000	14,000	150,000	115,000	81,000	258,000	1,120,000

Note 1. A second (magnitude 7.5) earthquake occurred 36 hours after the initial event.

Note 2. A second (magnitude 7.2) earthquake occurred in Turkey near the eastern margin of the area damaged from the magnitude 7.4 Kocaeli, Turkey earthquake. The figures presented in the table are presented for both earthquakes.

Note 3. A second (magnitude 6.6) earthquake occurred near El Salvador

Note 4. Information comes from a variety of different sources and in some cases may not be entirely accurate.

Traditionally, the focus has been on life safety. This minimum level of seismic mitigation has been driven by mandatory government actions. Today, however, there is a growing trend toward mitigating economic loss by voluntarily setting higher standards to protect property and ensure continuance of business operations. The combined economic losses from the Loma Prieta earthquake in 1989 and the Northridge earthquake in 1994 exceed \$50 billion. Northridge alone resulted in the second largest economic loss caused by a natural disaster in United States history. We know mitigation can save lives, but significant increases in economic loss have motivated the movement toward even higher levels of mitigation.

In California the mitigation movement is still emerging. In a 1996 memorandum on the subject of voluntary seismic retrofit in the state, the Senate Office of Research stated: "Very little voluntary commercial retrofit activity is occurring. Most commercial activity is because of mandatory local programs to strengthen, demolish, or reduce occupancy of unreinforced masonry buildings, or as the result of earthquake damage." That finding belies the fact that professionals involved in earthquake loss reduction (structural engineers, insurance specialists, national economists) agree that mitigation works, and that cost-effective means exist by which the losses can be reduced. State-mandated programs, such as the Field Act for public schools and the Hospital Act for private hospitals, have proven their value in loss reduction.

Major corporations and institutions are moving toward mitigation actions that involve seismic retrofit

of existing facilities and higher performance standards for new facilities. These actions are motivated by the need to ensure protection of property, continuance of operations, and greater levels of life safety.

Encouraging cost-effective earthquake loss reduction efforts is good public policy. Effective mitigation requires three steps: 1) creating cost-effective design and construction solutions; 2) setting priorities; and 3) committing the necessary resources. The design and construction solutions are available; priorities will vary with each of the steps and are well within their control; however, committing the resources is a stumbling block. The key to encouraging sustained, voluntary mitigation efforts lies in incentives that stimulate the private sector to take action. Many public and private entities have already initiated earthquake mitigation actions (as indicated in the following examples), and more will do so in the future. The movement is underway. But much more needs to be done if we are to reduce the losses and speed recovery.

---

## Conclusion

---

Recognizing the magnitude of economic loss caused by property damage and operational disruption is becoming the deciding factor in earthquake mitigation throughout California. The economy of the state cannot withstand repeated Loma Prieta or Northridge disasters. The benefits of earthquake loss reduction far outweigh the cost.

# The Plan

**T**he *California Earthquake Loss Reduction Plan* sets forth basic government policy and direction in pursuit of the vision for a safer California. Mitigation works! Loss reduction is possible and practical. Significant progress has already been made, and with continued commitment, the objectives can be reached by the year 2010.

The plan rests on the fact that increased levels of seismic performance—through the upgrading of existing vulnerable structures, better design of new construction, and increased preparedness in all areas—provide the most cost-effective method to reduce loss and improve recovery from earthquakes.

The plan is a road map to achieve a safer California. It contains 11 elements, each addressing a distinct but interrelated area of concern. The plan sets forth statewide objectives and strategies to support the plan's goals. Each element is both a stand-alone avenue to pursue improved levels of risk reduction and

preparedness for that particular element and a cross street interconnected with the other elements. As such, the plan is a matrix, with each element supporting and being supported by others. The goals, objectives, and strategies presented address the state's most pressing seismic issues.

Each element is of equal importance in the quest for a safer California, and each is considered an indispensable part of the plan. The elements are not intended as a listing of detailed action items, but rather a presentation of broad policy and direction from which agencies at all levels of government can be guided. Individual one-page policy statements for each element follow.

More detailed actions that support the plan are presented in "The Initiatives" and provide refinement to the overall plan of action. Ultimately, it is the responsibility of each agency and individual to ensure that their actions fulfill the intent of the plan.

# The Plan Matrix

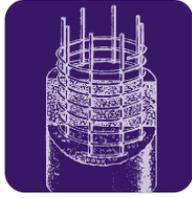
DRAFT  
27 JUL 01

## Learning About Earthquakes



	Geosciences	Research and Technology	Education and Information	Economics	Land Use
<b>Concerns</b>	Insufficient use of current geologic knowledge	Insufficient Technical Knowledge	Insufficiently Educated and Informed Citizenry	Unacceptable Economic Losses	Seismic hazards not incorporated in general plans
<b>Objective(s)</b>	Full application of geosciences	Sustained research, effective transfer of technology	Increased knowledge to make effective decisions	Shift of design and construction polices to economic value basis	Balance between growth and seismic hazards
<b>Strategies</b>	Improve use of current geoscience knowledge	Support research	Promote competency of professionals	Demonstrate cost-effectiveness	Incorporate seismic hazard data in general plans
	Apply consistent geoscience standards	Ensure applicability to risk reduction	Increase public awareness	Develop incentives	Strengthen the California Environmental Quality Act (CEQA) process
	Show cost-effectiveness	Demonstrate value of research for improving seismic safety	Inform public officials	Include property protection in model codes	Develop Mitigation Techniques
<b>Benefits</b>	Support on-going research	Coordinate research activities	Strengthen K-12 earthquake programs	Protect functionality of infrastructure	Protect Areas from inundation
	Better performance to reduce losses	Greater levels of risk reduction	Better educated policy makers and professionals	Improved economic viability & reduced tax impact	Avoid Negative Impact on Planning Goals
<b>Responsibility</b>	State is prime motivator; local entities are enforcers.	State to operate the center	State is prime motivator; local entities are enforcers.	State is prime leader; all level participates.	State to develop data; local entities to implement; owners to use.
<b>Costs</b>	State = ongoing Local = minimal User = < 2 percent	State= minimal Local = none User = varies	State = minimal Local = none User = negligible	State = minimal Local = minimal User = varies	State=minimal Local= varies Owner= minimal
<b>Incentives</b>	Building and zoning trade-offs, insurance rates, and tax benefits	Reduced insurance rates, and tax benefits	Strong state policy public demand	Strong state policy public demand	Zoning trade-offs density rights transfers etc.

## Building for Earthquakes



## Living With Earthquakes



Existing Buildings	New Buildings	Utilities and Transportation	Preparedness	Emergency Response	Recovery
Property protection deficiencies in buildings	Unacceptable levels of personal and economic impact	Catastrophic personal and economic loss	Insufficient, understanding, and action	Insufficient responsive and sustainable systems	Impairments to effective and speedy recovery
Upgrade vulnerable buildings to acceptable performance levels	Increased life, property, and economic safety	Protect life, limit property damage, resume function	Increased understanding and ability to act	Improve communications and medical response	Statewide recovery plan and implementation
Provide incentives to retrofit	Include all new buildings	Ensure performance standards	Increase understanding of potential impact	Improve communications	Establish a statewide strategic recovery plan
Initiate broad educational efforts	Develop integrated approach to seismic design	Mitigate secondary effects	Develop comprehensive approach	Improve medical response	Improve interim and long-term housing
Develop effective methodologies	Adopt California-specific standards	Evaluate and prioritize mitigation measures	Encourage individuals to act	Improve search and rescue	Capability expedite permitting and rebuilding process
Upgrade vulnerable buildings and other structures	Do performance focused research	Retrofit critical systems	Improve K-12 school preparedness	Improve emergency management capability	Provide accurate and timely information
Significant reduction in loss of life and costs	Improved life-safety, reduced economic impact	Economic viability of the region & state	Minimize personal losses	Preservation of lives & property	Minimized economic disaster
State prime motivator; all levels participate	State must enforce plan for its own properties	State is the lead; each system owner must participate	State provides leadership; individual entities implement.	State provides facilities, equipment, and training	State provides leadership; local entities implement
State = minimal Local = minimal User = varies	State = minimal Local = minimal User = < 2 percent	State = minimal Local = none Utility = varies Lifeline = major	State = minimal Local = minimal User = minimal	State = considerable Local = minimal User = negligible	State = considerable Local = minimal User = negligible
Economic & regulatory	Economic & regulatory	Economic & regulatory	Strong state policy, public demand	Strong state policy, public demand	Strong state policy, public demand

# Format for the Initiatives

The *California Earthquake Loss Reduction Plan 2002-2006* sets forth the basic policy and direction with which to seek the vision and reach the goals (see pages 2 and 3) by the year 2010. The initiatives provide definitive statewide strategies that will lead to the intended goal. Just as each element of the plan is considered an integral part of the vision for a safer California, the initiatives provide a necessary and integrated vehicle to focus the state's efforts in that quest. The initiatives have been developed in recognition of, and with experience from, ongoing programs, and are intended to set forth practical plans of action to guide the implementing agencies.

Each initiative is expressed as an action to be accomplished, indicating its priority, and, in the case of those deemed "Critically Important", the time frame for its accomplishment. The primary goal of the plan is loss reduction. The actions called for in these initiatives are intended to help achieve that goal. As the detailed action plans are developed, they must be evaluated for the contribution they make toward achieving the goal, the practicality of their accomplishment, and the economic benefit they provide.

Each initiative has been given a priority. Detailed action plans will be developed and costs will be determined as each initiative is implemented.

## Priority

---

All of the initiatives are considered necessary to achieve the state's goals. However, for effective administration of the overall plan, they have been organized by priority into three levels: *Critically Important, Very Important, and Important.*

## Date

---

Each initiative should be started and completed as soon as practical. The time to accomplish will vary depending on the action plan. The time indicated for those initiatives deemed Critically Important is considered a reasonable time by which the initiative should be accomplished.

## Progress

---

Progress on each of the initiatives is presented in the "California Earthquake Loss Reduction Initiative Tracking Report."

Implementing the initiatives will require a cooperative effort of various entities, both public and private at local, state, and national levels. Precise action plans or tactics that define who is responsible and how an initiative is to be accomplished will be developed by the Administration, the Legislature, and others responsible and affected.

The following pages summarize the initiatives within each element of the plan.





# Geosciences Element

Effective land use planning and design must recognize the geologic environment and identify earthquake hazards. Every major earthquake yields new geologic data. Planning, design, and construction are not adequately incorporating this new knowledge, however. Most advances have been motivated from reaction to disasters rather than from good risk reduction strategies based on current and proven geoscience knowledge.

## Objectives

*To continue to improve the structural performance of new and existing buildings and utility and transportation systems through effective use of current geoscience knowledge. To ensure consistent application of that knowledge and to continuously improve risk reduction strategies based on application of the most current knowledge available.*

## Strategies

### *Improve Use of Current Geoscience Knowledge*

Require land use planning, building codes, and design standards to use the most up-to-date and appropriate geoscience knowledge as the basis for seismic risk reduction policy and application.

### *Apply Consistent Geoscience Standards*

Require consistent statewide geoscience knowledge-based methods and quality standards for seismic and fault rupture risk reduction as basic elements of land use planning, building codes, design, construction quality control, and enforcement. Ensure that geoscience knowledge is infused in all phases of the process.

### *Show Cost-Effectiveness*

Demonstrate the value of using existing geoscience information to reduce seismic losses within the built environment, particularly for identifying site-specific hazards for which project-specific risk reduction measures will have a high benefit to cost ratio.

### *Support On-going Research*

Establish a system for supporting and applying the research and knowledge available from existing research institutions and entities, as a fundamental part of the State's seismic risk reduction policy. Geoscience knowledge should be an integral part of the State's public policy on seismic risk reduction.

## Benefits

The benefits are better use of geoscientific knowledge, which enables professionals to improve planning and design in order to achieve higher levels of performance and ensure reduced losses.

## Responsibilities

The State should take the lead in motivating and coordinating the application of knowledge developed by the geoscience community and the strategies outlined. Local agencies will be responsible for implementation and enforcement.

## Costs

Cost to the State for seismic hazard mapping will be in the \$40 million range; \$20 million for the urban areas are the first priority. Cost to local government will be minimal; their role will be primarily administrators of the policy. Cost to the public will average less than one percent of the value of structures in most areas of the State and less than five percent in high seismicity areas; and can be as low as two percent if proper, cost-effective design solutions are incorporated.

## Incentives

Incentives may include zoning and building code options, reduced insurance rates, and tax relief that

reflect the value of the improved seismic engineering.

DRAFT  
27 JUL 01

# Geosciences Initiatives

Objective: *Full Application of Geosciences*

## Strategies and Initiatives

### 1.1 *Improve Use of Current Geoscience Knowledge*

- 1.1.1 **Ensure efficient, accurate, and reliable completion of the statewide Seismic Hazard Mapping Program for California's high-risk, developed and developing areas. Utilize independent review and acceptance of appropriate procedures to compile the data and construct the maps. Include end users and others affected as part of the independent review.**

Priority: **Critically Important**  
Approximate Time Required: **10 years**

- 1.1.2 Include, as part of the Seismic Hazard Mapping Act, continuous identification and mapping of all potential seismic sources.

Priority: Very Important

- 1.1.3 Develop uniform standards for installing and maintaining strong motion instruments, including timely and effective processing and disseminating of the resulting data, for purposes of real time notification and earthquake engineering as a part of the Strong Motion Instrument Program.

Priority: Very Important

- 1.1.4 Require Federal and State dam owners to comply with and pay for strong motion instrumentation of their dams as a part of the Strong Motion Instrumentation Program.

Priority: Important

- 1.1.5 Encourage owners of hazardous waste and municipal solid waste containment facilities to pay for strong motion instrumentation of their facilities as part of the Strong Motion Instrument Program.

Priority: Important

- 1.1.6 Expand the network of strong motion reference stations in major urban areas throughout California so there will be one per zip code to provide information critically needed for emergency response and post-earthquake evaluation of structures.

Priority: Very Important

### 1.2 *Apply Consistent Geoscience Standards*

- 1.2.1 Require local governments to provide consistent application and enforcement of the Seismic Hazard Mapping Program and the Alquist-Priolo Earthquake Fault Zone Act criteria in all zoning and building code applications.

Priority: Very Important

- 1.2.2 Incorporate geoscience knowledge and peer review in planning, design and construction processes at the initial phase of public consideration and that the application of site-specific data is a required element of all projects.

Priority: Very Important

1.2.3 Ensure that the design of new, and the performance of existing, facilities (including major transportation and utility systems, and hazardous material facilities) address the appropriate earthquake hazards.

Priority: Important

### **1.3 Show Cost Effectiveness**

1.3.1 Develop and implement effective educational and informational programs demonstrating the cost effectiveness of using site-specific data in designing new and retrofitting existing facilities. Make use of existing case histories where possible.

Priority: Important

1.3.2 Develop and implement effective educational and informational programs aimed at the technical professions to increase their understanding of strong motion phenomena including near-source and ground deformation. Demonstrate success in the use of good standards of practice by the technical professions.

Priority: Very Important

1.3.3 Develop and implement effective educational and informational programs demonstrating the cost effectiveness of the use of data to provide accurate planning scenarios for earthquake preparedness and response planning.

Priority: Important

### **1.4 Support Ongoing Research**

1.4.1 Develop data necessary to provide accurate and useful planning scenarios to reduce the risk from seiches and tsunami hazards.

Priority: Important

1.4.2 Support geoscience research that can be used to reduce earthquake risk and losses.

Priority: Important

1.4.3 Improve methods of assessing the cost effectiveness of geoscience information in earthquake loss reduction policy.

Priority: Very Important



# Research & Technology Element

Earthquake professionals and decision makers still do not have sufficient knowledge to implement effective measures to protect our communities from earthquake losses. Many continue to rely on outdated or ineffective technologies and methods. Several factors have contributed to the problem:

1. Financial support for research has not kept pace with the need;
2. Research on issues critical to California has been inadequate; and
3. Mechanisms to validate, adopt and implement research findings are insufficient.

## Objective

*To develop and sustain research that identifies cost-effective methods to improve seismic safety. To facilitate the implementation of validated research findings.*

## Strategies

### **Support risk reduction research**

Ensure adequate state funding for problem-focused research as presented in the Seismic Safety Commission's Research and Implementation Plan.

### **Ensure Applicability to Risk Reduction**

Involve earthquake professionals and decision makers in the research process to help set priorities, validate results, and provide feedback on implementation.

### **Demonstrate Value of Research for Improving Seismic Safety**

Demonstrate the effectiveness of research for improving seismic safety using laboratory tests, seismic simulations, and post-earthquake investigations.

### **Coordinate Research Activities**

Review and evaluate federal, state, and industrial earthquake research activities to ensure that California earthquake risk reduction priorities are being adequately addressed.

## Benefits

The benefits are more cost-effective techniques to retrofit existing structures in order to provide life safety, and to design new construction to achieve higher protection of both lives and property.

## Responsibilities

The State is responsible for creation and operation of the Risk Reduction Program; universities and private research institutions, local agencies, building code officials, industry, corporations, and the professional communities will be involved in the process.

## Costs

Cost to the State for the Risk Reduction Program will be \$5-\$10 million annually. Cost to local agencies and the design professionals will be negligible since The Plan envisions a better use of research results. Cost to end users will vary; large entities may share in the cost since they will benefit significantly. Cost to small entities will be negligible.

## Incentives

Incentives for using advanced performance technology may include reduced insurance rates and tax policies that reflect the value of improved seismic performance without penalizing user

# Research & Technology Initiatives

**Objective:** *Cost-effective Methods to Improve Seismic Safety*

## Strategies and Initiatives

### 2.1 Support risk reduction research

#### 2.1.1 Support and co-fund California-based seismic research programs funded by federal agencies or the private sector.

Priority: **Critically Important**

Duration: **Ongoing**

2.1.2 Update and carry out the Seismic Safety Commission's *Research and Implementation Plan for Earthquake Risk Reduction in California*. Include provisions for 1) public oversight and priority-setting functions; 2) researchers who work with end users to implement the plan; and 3) research that is conducted by other public and private parties.

Priority: Important

2.1.3 Expand and fund problem-focused research directed at providing information about seismic safety in California, with priority on integrated, multidisciplinary research efforts. Maintain a specific implementation element in the program to facilitate and encourage the incorporation of existing and new knowledge into professional practice.

Priority: Very Important

2.1.4 Continue support of problem-focused research by PEER to provide the technical basis for development of performance-based building codes, standards, and practices.

Priority: Important

2.1.5 Establish a program to systematically gather perishable data from damaging earthquakes, including strong ground motion, ground deformation and failure, facility performance, and impacts.

Priority: Very Important

### 2.2 Ensure applicability to risk reduction

2.2.1 Apply cost-effective defense and space technologies to earthquake risk reduction efforts.

Priority: Important

2.2.2 Require all state-funded seismic research to include active participation by earthquake professionals and decision makers from the outset through implementation and dissemination.

Priority: Very Important

2.2.3 Promote links between earthquake research organizations and industry to evaluate the performance of new technologies, components, and systems.

Priority: Important

2.2.4 Work with federal agencies and research organizations to support development of education programs for design professionals, building officials, and decision makers who implement research results.

Priority: Very Important

2.2.5 Promote programs of continuing education through existing professional associations to communicate research results to design professionals and land-use planners .

Priority: Very Important

**2.3 *Demonstrate value of research for improving seismic safety***

2.3.1 Document the effectiveness of research for improving seismic safety using laboratory tests, seismic simulations, and post-earthquake investigations. Communicate that information to design professionals, researchers, policy makers, and the public.

Priority: Very Important

**2.4 *Coordinate Research Activities***

2.4.1 Convene workshops, seminars, and public hearings involving users of earthquake research to help establish priorities for reducing earthquake risk. Ensure the results of these activities will be reflected in research objectives, plans, and priorities.

Priority: Very Important

2.4.2 Maintain a database of California earthquake research activities, investigations, and research results that are relevant to California's needs.

Priority: Important

DRAFT  
27 JUL 01





## Education & Information Element

Policy makers, professionals, and the public have an increasing awareness of earthquake risks but are still not adequately prepared for making effective decisions in reducing seismic risk. Consistent educational programs and information dissemination systems are still lacking.

### Objective

*To initiate a comprehensive strategy for education and information sharing that will increase the knowledge of policy makers, professionals, and members of the public enabling them to make effective decisions about reducing losses from earthquakes and encourage them to undertake effective implementation action.*

### Strategies

#### **Promote Competency of Licensed Professionals**

Require professionals involved in the design and construction of the built environment to demonstrate competency in seismic design as a licensing and re-licensing requirement. Higher education systems and technical professions should provide appropriate educational programs to develop and maintain that competency.

#### **Increase Public Awareness**

Develop an effective system for communicating information about the overall impact of earthquakes and loss reduction strategies to the general public. Convey demonstrated cost-effectiveness strategies and incentives aimed at reducing losses. Use an informed media and other sources to promote and disseminate accurate information on a continual basis.

#### **Inform Public Officials**

Develop an effective system for communicating information about seismic risk and loss reduction strategies, including demonstrated cost-effectiveness approaches, to public officials at all governmental levels.

#### **Strengthen K-12 Earthquake Programs**

Strengthen the K-12 public and private schools programs to integrate effective earthquake education within existing curricula. Provide teacher training and develop materials that address earthquake science, school preparedness and individual safety.

### Benefits

Public officials, design professionals, and the public will be better educated, informed, and supportive of earthquake loss reduction strategies, and will implement mitigation techniques that will reduce the potential loss of life and property, and minimize business disruption.

### Responsibilities

Responsibility rests primarily at the state level, with other public and private sector involvement in much of the implementation. The State of California should take the lead in promoting and coordinating the strategies outlined and place a high priority on initiating programs necessary to achieve this goal. Local governments are responsible for implementation and code enforcement.

### Costs

Cost to the State will be minimal since the State's role is one of promoter, setting policy and direction. Cost to educational systems and other implementing agencies will be minor since the strategies envision redirecting resources within existing programs as opposed to additional programs. Cost to the professional, for additional educational tuition, will be offset by increased capability and marketability. Cost to the public will be negligible.

### Incentives

An educated and informed public is at the core of the issue without which we cannot hope to achieve the goals of seismic safety that this document envisions.

There is a moral and ethical obligation to focus efforts

on elevating the public understanding of these issues.

## Education & Information Initiatives

**Objective: Increased Knowledge to Make Effective Decisions**

### Strategies and Initiatives

#### 3.1 *Promote Competency of Licensed Professionals*

3.1.1 Require licensing renewal for all professionals associated with siting, design, inspection and construction of structures to include adequate continuing education criteria for all applicable seismic safety issues.

Priority: Very Important

3.1.2 Integrate earthquake loss reduction principles in all appropriate land use, design and construction related professional education programs as a part of the basic curricula.

Priority: Important

#### 3.2 *Increase Public Awareness*

3.2.1 **Develop educational approaches and tools in seismic hazard mitigation including earthquake fundamentals, seismic hazards identification, safety information about potentially hazardous building contents, workplace safety, emergency plans, and risk assessment techniques and tools for those responsible for facilities operation and management.**

Priority: **Critically Important**  
Time to accomplish: **5 years.**

3.2.2 Provide tools to media practitioners to ensure reporting accuracy and to increase the level of understanding among reporters and writers.

Priority: Important

3.2.3 Provide educational tools to homeowners aimed at increasing awareness of fundamental seismic risks, and to encourage implementation of

mitigation efforts.

Priority: Very Important

3.2.4 Develop and communicate information about 1) demonstrated strategies for cost-effective seismic mitigation techniques, and 2) programs and incentives for reducing losses.

Priority: Important

3.2.5 Provide education programs in the higher educational systems that increase knowledge and awareness of earthquake fundamentals, loss reduction, preparedness, and response issues.

Priority: Important

#### 3.3 *Inform Public Officials*

3.3.1 Conduct educational sessions including workshops for officials from State, city, and county as well as other community based organizations, institutions and agencies, on vulnerability assessment and loss reduction measures.

Priority: Very Important

3.3.2 Develop and disseminate information on how public officials can establish and manage community coalitions to support loss reduction.

Priority: Important

3.3.3 Require continuing education in all applicable seismic safety issues for building officials.

Priority: Important

DRAFT  
27 JUL 01

**3.4 Strengthen K-12 Earthquake Programs**

3.4.1 Implement cohesive K-12 curriculum elements on earthquake fundamentals and mitigation as an integral part of the State’s educational standards. The dual aim of this effort is that California schools will produce an informed public and new generations of scientists, planners, legislators, communicators, and business leaders.

Priority: Important

3.4.2 Provide pre-service and in-service training of teachers relating to earthquake fundamentals, loss reduction, preparedness and response issues within the sciences, environment, mathematics, history/social science, and language arts curricula.

Priority: Very Important

DRAFT  
27 JUL 01



## Economics Element

With respect to earthquakes, model codes, design construction, and retrofit have been driven by life safety standards. This approach has provided a high degree of life safety, but the preservation of property and the impact on economic value has been largely ignored. Earthquakes have caused economic losses that could have been significantly reduced if the State had had more effective policies that protect the functionality of buildings and infrastructure.

### Objectives

*To emphasize policies in design, construction and retrofit practices that protect property, contents, and functionality in both public and private sector facilities including infrastructure. To develop incentives for cost-effective loss reduction.*

### Strategies

#### ***Demonstrate Cost Effectiveness***

Demonstrate to decision makers, the cost effectiveness of mitigation policies for seismic loss reduction.

#### ***Develop Incentives***

Develop economic and regulatory incentives to enhance seismic performance of existing and new construction.

#### ***Include Property Protection in Model Codes***

Incorporate cost-effective protection of property and functionality as an integral part of model code regulation.

#### ***Protect Functionality of Infrastructure***

Incorporate protection of system functionality as an integral part of infrastructure design, construction and operation policies.

### Benefits

The benefits are higher levels of seismic mitigation that reduces the risk to life, the vulnerability of the State's economic base, and potential unemployment after an earthquake. It will reduce the tax impact by maintaining a more reliable employment and property tax base, while reducing post earthquake recovery costs and recovery time.

### Responsibilities

Responsibility rests at the State level, with other public and private sector involvement in much of the implementation. The State of California should provide strong leadership in directing a shift in public policy from a minimum prescriptive basis to a higher performance basis for seismic risk reduction. This shift will require participation from all elements of the public-policy spectrum including State and local government agencies, the League of California Cities, financial and insurance institutions, and code organizations.

### Costs

Cost to the State for agency implementation will be minimal, because the State's role is to motivate and to set policy and direction, rather than to undertake new programs. Costs to local governments will also be minimal since they will primarily be administrators of the policy. Cost to the public will depend on the amount of mitigation required, but will be offset by the benefits.

### Incentives

Achieving the objectives of this element, depends on strong State policy as part of its overall risk reduction plan. While reducing seismic risk in each individual structure will be valuable to the building owner, the greatest motivation will be in the public's demand for significant reduction in personal and financial losses normally resulting from earthquakes.

# Economics Initiatives

**Objective:** *Emphasize Earthquake Mitigation Policies that Recognize Economic Value*

## Strategies and Initiatives

### 4.1 *Demonstrate Cost Effectiveness*

4.1.1 **Develop economic models and real case studies that demonstrate the cost-effectiveness of specific design, construction, and retrofit methods based on increased levels of property, contents, functionality, and tax base protection. Make those findings available to the policy-makers, and the lending, insuring and taxing agencies.**

Priority: **Critically Important**  
Time to accomplish: **3 to 5 years**

4.1.2 Develop reliable simulation models that demonstrate the cost-effectiveness of enhanced performance standards.

Priority: Very Important

### 4.2 *Develop Incentives*

4.2.1 Establish State and local revenue generating policies to provide incentives for cost effective loss reduction.

Priority: Very Important

4.2.2 Work with the mortgage lending industry to establish objective criteria in which increased seismic performance of structures is incorporated into mortgages and underwriting practices.

Priority: Very Important

4.2.3 Work with the insurance industry to establish objective criteria in which increased seismic performance of structures is incorporated into insurance and underwriting practices.

Priority: Very Important

4.2.4 Identify and eliminate Federal, State and local regulatory and financial disincentives for seismic retrofit.

Priority: Very Important

4.2.5 Define measurable goals for economic loss reduction as a result of increased incentives.

Priority: Very Important

### 4.3 *Include Property Protection in Model Codes*

4.3.1 Incorporate cost effective seismic design standards in model codes based on protection of property and functionality.

Priority: Very Important

4.3.2 Develop statewide constituency to establish the cost-effective levels of property-based performance codes.

Priority: Important

4.3.3 Define measurable goals for economic loss reduction as a result of performance based codes and standards.

Priority: Very Important

### 4.4 *Protect Functionality of Infrastructure*

4.4.1 Establish public policy that incorporates increased seismic design standards in the design construction, and operation of infrastructure, based on the need to maximize functionality after earthquakes.

Priority: Very Important

4.4.2 Define measurable goals for economic loss reduction as a result of increased standards.

Priority: Very Important



# Land Use Element

Efficient use of land is one of the most critical issues in effective loss reduction and recovery from the disastrous effects of earthquakes. Because the risk of loss from earthquakes increases as the population increases, several areas of concern emerge with respect to land use: 1) generally, seismic hazard knowledge is neither adequately incorporated nor consistently applied in land use decision making; 2) acceptable levels of seismic performance in new developments are not clearly understood; 3) environmental review procedures are not adequately addressing seismic hazards; and 4) developments subject to inundation due to potential dam or levee failure or tsunami effects are not adequately identified and protected.

## Objective

*To improve land use planning to achieve optimum balance between the needs for the State's population and economic growth and the constraints imposed by seismic hazards.*

## Strategies

### ***Incorporate Seismic Hazard Data in General Plans***

Update all urban area general plans with newly discovered information about seismic hazards including potential inundation. Ensure that all local general plans are updated within one year of the date that the state and other recognized agencies publish new seismic hazards maps. Ensure consistent enforcement of all requirements.

### ***Strengthen CEQA Process***

Require that all projects subject to environmental review in accordance with the CEQA are properly evaluated and adequately mitigated for seismic hazards using the latest data published by state and other recognized agencies.

### ***Develop Mitigation Techniques***

Develop and incorporate standards that reflect acceptable levels of seismic performance and loss reduction techniques for new and existing development.

### ***Protect Areas from Inundation***

Ensure that all areas subject to potential inundation from earthquake induced dam or levee failure or tsunami run-up have been adequately identified and appropriate loss reduction strategies incorporated in general plans.

## Benefits

Land Planning that incorporates strategies to deal with seismic hazards will help eliminate loss of life

and mitigate property damage, including potential abandonment ("ghost-town" effects) and their negative impact on long range planning goals and will ensure economic and environmental viability.

## Responsibilities

The State is primarily responsible for development of the data and publication of the seismic hazard maps. Local agencies are responsible for incorporation of the maps into their general plans, and for enforcement. Public and private land owners and property developers are responsible for using the knowledge effectively and incorporating cost-effective mitigation techniques into each of their projects.

## Costs

Additional cost to the state for review and coordination of local general plans will be minimal. Cost to local government for formalizing the seismic hazard maps into their general plans vary depending on how and when updating occurs. Cost to private developers will be vary depending on site specific conditions.

## Incentives

Land use and zoning incentives such as density rights transfer, historic district bonuses, and zoning options should be considered. Incentives should be provided, or negative incentives removed, for owners who voluntarily comply with the latest known seismic hazard data and upgrade the

# Land Use Initiatives

**Objective:** *Achieve Balance Between Growth & Seismic Hazards*

## Strategies and Initiatives

### 5.1 *Incorporate Seismic Hazard Data in General Plans*

5.1.1 **Require geotechnical and geological reports addressing seismic hazards for all subdivisions pending completion and adoption of mapping under the Seismic Hazards Mapping Act for any jurisdictional area.**

Priority: **Critically Important**  
Time to accomplish: **2 years**

5.1.2 Amend the State Planning law to require local governments to review and update the safety element every five years (or sooner if appropriate) to incorporate the most recent geologic and technical information available.

Priority: Very Important

### 5.2 *Strengthen CEQA Process*

5.2.1 Amend the California Environmental Quality Act (CEQA) Guidelines, including Appendix G and Appendix I, to explicitly require initial studies and Environmental Impact Reports (EIRs) to address and provide for adequate mitigation of seismic hazards.

Priority: Very Important

5.2.2 Require the seismic hazards portion of initial studies and EIRs to be prepared by appropriate technical experts.

Priority: Very Important

5.2.3 Give local government emergency managers opportunity to review initial studies and EIRs so that seismic hazards may be adequately

identified.

Priority: Very Important

### 5.3 *Develop Mitigation Techniques*

5.3.1 Require local governments to list and catalog, in accordance with geological data, seismic and geologic hazards reports submitted to them with normal environmental, sub-division, and other project review procedures. Make reports available to the public as required by the Public Information Act.

Priority: Important

5.3.2 Amend the State Planning Law to establish policies and mitigation requirements in safety elements of local general plans, related to the use, occupancy, and rehabilitation of buildings that are considered seismically vulnerable.

Priority: Very Important

5.3.3 Review potential tsunami hazards, prepare inundation maps and recommend appropriate mitigation strategies and responsibilities.

Priority: Important

5.3.4 Encourage general plan policies to recognize the aggregate effect of potential seismic hazards on adjacent uses and consider appropriate mitigation.

Priority: Very Important

### 5.4 *Protect Areas from Inundation*

5.4.1 Require owners, developers, and flood control districts to prepare and revise inundation maps every ten years in light of

major new downstream development. Amend land use laws to require current and updated dam inundation maps to be available, and reviewed, before approving development of critical facilities and large scale developments.

Priority: Important

5.4.2 Require proponents of critical facilities and major large-scale developments located downstream of dams to review the latest inundation maps and update the maps as necessary in light of their development.

Priority: Important

5.4.3 Amend statute to impose sanctions on dam owners who fail to prepare and submit inundation maps as required.

Priority: Important

5.4.4 Amend the State Planning Law to require that State and local agencies make specific findings known regarding the acceptability of inundation hazards before approving development of critical facilities and major large-scale developments.

Priority: Important

DRAFT  
27 JUL 01





## Existing Buildings Element

Many of California's existing buildings, including homes, are vulnerable to damage or collapse from earthquakes. Most seismic retrofit projects to date have focused appropriately on life safety and have not significantly reduced the potential loss to property, personal disruption, and productivity. Continuing occurrence of earthquake damage to older and recently constructed buildings clearly demonstrates the need for heightened awareness of the benefit of increased performance levels beyond that of life safety.

### Objective

*To initiate aggressive efforts toward reducing loss of life and vulnerability of property in existing buildings. To ensure that all existing high-occupancy and essential services buildings are upgraded to remain occupiable following earthquakes.*

### Strategies

#### ***Provide Incentives To Retrofit***

The economic structure affecting property ownership and the building industry should provide compelling incentives for retrofitting structural and nonstructural elements of existing buildings in accordance with standards that improve seismic performance.

#### ***Initiate Broad Educational Efforts***

Educate building owners, design professionals, and others involved in the retrofit design and construction process about the benefit of retrofitting existing buildings for improved performance including basic structures, nonstructural components, and operational elements.

#### ***Develop Effective Methodologies***

Continue to develop a reliable and practical performance-based methodology to ensure that seismic retrofit design and construction can be accomplished with consistent results.

#### ***Upgrade Vulnerable Buildings and Structures***

Establish effective risk reduction programs to upgrade seismically vulnerable buildings. Focusing of priorities should include essential services buildings, public and private schools, single and multi-family housing, parking structures and facilities housing hazardous materials.

### Benefits

The benefits are significant reductions in life loss, property damage, and business interruptions, which may lead to loss of market share and tax revenue, will result from applying aggressive retrofitting strategies to vulnerable buildings.

### Responsibilities

Responsibility rests at all levels of the public and private sector. The State of California should take the lead in motivating and initiating the strategies, in implementing them for State-owned buildings, and should place a high priority on legislation, education, financial approaches, and code development which are necessary in order to achieve this goal.

### Costs

The State's cost in setting policy and direction will be minimal. Cost to local jurisdictions for implementation will be nominal. Retrofit costs to state, school districts, local governments and other property owners for upgrading may be significant and will vary depending on the effectiveness of design and the incentives.

### Incentives

Economic incentives for seismic retrofit may include alternative funding, reduced insurance rates, tax benefits, and extended longevity of the property function. Experience indicates the value of retrofitting is stifled by a lack of clear financial incentive.

Significant improvement, within an accelerated time frame, can only be accomplished by recognition of the

economic advantage of improved seismic performance.

## Existing Buildings Initiatives

**Objective:** *Upgrade Vulnerable Buildings and Structures*

### Strategies and Initiatives

#### 6.1 *Provide Incentives To Retrofit*

- 6.1.1 **Encourage economic incentives, such as improved mortgage terms, reduced insurance rates, and positive tax benefits, for upgrading structural and non-structural elements in buildings.**

Priority: **Critically Important**  
Time to accomplish: **10 years**

- 6.1.2 Amend the California Building Code to allow upgrading of the structural and non-structural elements of buildings without triggering other code upgrade requirements, providing the work is intended to improve seismic performance.

Priority: Important

- 6.1.3 Amend local regulations to allow increased use or area in consideration of seismic retrofit.

Priority: Important

#### 6.2 *Initiate Broad Educational Efforts*

- 6.2.1 Develop and implement continuing education programs aimed at raising the standards of those responsible for enforcing seismic design principles. This includes building inspectors, plan checkers, and others involved in the construction trades.

Priority: Very Important

- 6.2.2 Develop and implement plans to increase the building owner's general knowledge of and appreciation for the value of seismic upgrading of the structural and non-structural elements of a building.

Priority: Very Important

#### 6.3 *Develop Effective Methodologies*

- 6.3.1 Continue efforts to develop reliable and practical methodologies and codes for: 1) minimum prescriptive retrofit standards; and 2) enhanced performance-based retrofit standards for the structural and non-structural elements of all types of existing public and private buildings, including essential services buildings and higher educational institutions, that can provide cost-effective improved seismic resistance.

Priority: Very Important

#### 6.4 *Upgrade Vulnerable Buildings and other Structures*

- 6.4.1 Report to the public the changes in understanding of the seismic vulnerability of selected buildings, or conditions that warrant wide attention. Address the problems learned through continual study of earthquake effects on buildings. Include methods to handle the technical, administrative, and public policy issues they present.

Priority: Very Important

- 6.4.2 Ensure that essential service and hospital buildings remain occupiable and the time to regain full operability is minimized. Operation includes the continuance of all utility services and systems necessary for proper function of such facilities.

Priority: Very Important

6.4.3 **Identify and prioritize all seismically vulnerable public and private buildings. Establish a mitigation plan to reduce the risk posed by those buildings, including structural and non-structural elements, equipment and contents. The most vulnerable and the most essential buildings should be addressed as the highest priority.**

Priority: **Critically Important**  
Time to accomplish: **10 years**

6.4.4 Adopt, by legislation, Appendix Chapters 5 and 6 of the Uniform Code for Building Conservation, or comparable sections of successor documents, for the seismic retrofit of tilt-up buildings and older homes.

Priority: Very Important

6.4.5 Adopt modifications to the building code, including the Historic Building Code, to require seismic retrofit of seismically vulnerable buildings when major modifications, alterations, or additions to the building occur that require issuance of a building permit.

Priority: Important

6.4.6 Enforce the California Building Standards Code for all modifications, alterations, or additions to state-owned buildings.

Priority: Important

6.4.7 Encourage building occupants, lease holders, mortgage providers, and insurers, to require building owners to disclose seismic risks and the options to mitigate them prior to executing new or continuing financial commitments in connection with the building use.

Priority: Important

6.4.8 Adopt legislation to require compliance with the current Unreinforced Masonry (URM) Law in accordance with the Uniform Code for Building Conservation (UCBC) .

Priority: Important

6.4.9 Develop and adopt post-earthquake repair and retrofit standards for damaged buildings.

Priority: Very Important





## New Buildings Element

Earthquake protection of new buildings based on providing life-safety and collapse resistant structures has been reasonably successful in moderate earthquakes. Protection of property and economic loss control has not received as much emphasis and is not yet as successful. As a result, property and economic loss due to earthquake damage to recently completed buildings and contents has been unacceptable. Losses have been due to: 1) limited knowledge of the performance of materials and systems; 2) lack of a complete approach to seismic design including all elements of buildings and their contents; and 3) inadequate quality control of design and construction. The damage from recent earthquakes clearly demonstrates the need for continued improvement in these three areas to achieve cost-effective seismic performance of new construction.

### Objective

*To achieve more consistent levels of safety by developing techniques that provide higher levels of earthquake resistance that will reduce potential property losses, minimize environmental damage, and protect the economic viability of the State.*

### Strategies

#### ***Include All New Buildings***

Require all new construction including publicly owned facilities and other buildings now effectively exempt from regulation to conform to state-of-the-art seismic safety provisions.

#### ***Develop Integrated Approach to Design***

Design new facilities based on an integrated approach considering all elements of the construction (structural and non-structural elements, support systems, building contents, and site improvements) that contribute to seismic performance.

#### ***Adopt California-Specific Standards***

Develop, adopt, and enforce state-of-the-art model building codes and amendments that affect seismic safety and meet the specific needs of the state.

#### ***Do Performance-Focused Research***

Sponsor and encourage problem-focused research and development to improve the reliability and economic effectiveness of performance-based seismic design and construction methods.

### Benefits

The benefits are significant reductions in life loss,

property damage, and business interruptions.

### Responsibilities

The State should, by example, take the lead in implementing the strategies, and motivate all public entities to enforce current seismic regulations on all new construction.

### Costs

Costs to the State and to local jurisdictions and building owners will be minimal. Overall, the cost will be an insignificant fraction of the total life-cycle cost of a building.

### Incentives

Incentives are the key to achieving increased levels of performance. Direct-to-owner economic incentives may include improved funding options, reduced insurance rates, tax relief, and the availability of unconventional funds similar to the "energy fund". Other incentives should be considered such as zoning and building code options which reflect the value of improved seismic performance.

# New Buildings Initiative

**Objective:** *Increased Reliability for Life Safety and Property Protection*

## Strategies and Initiatives

### 7.1 ***Include All New Buildings***

7.1.1 Require that all State, local agencies, and special districts have construction projects regulated by independent building code enforcement entities with enforcement, citation, and stop-work authority. Assign government officials to be responsible for enforcement of codes and regulations.

Priority: Very Important

7.1.2 Require public utilities, essential facilities, public owned facilities and hazardous waste facilities not currently regulated under the Alquist Priolo Earthquake Fault Zone Act and the Seismic Hazards Mapping Act to incorporate mitigation for earthquake induced site instability.

Priority: Very Important

### 7.2 ***Develop Integrated Approach to Design***

7.2.1 Clarify the California Building Code to assign responsibility for seismic resistance design coordination and quality assurance during construction of all building elements and components.

Priority: Very Important

7.2.2 Implement training, quality control, and enforcement procedures to ensure that all new construction is built in accordance with the design and the building code.

Priority: Very Important

### 7.3 ***Adopt California-Specific Standards***

7.3.1 **Amend statute to allow California to adopt seismic specific amendments to national model building codes that meet the specific needs of the state and that apply to all State and local jurisdictions.**

Priority: **Critically Important**  
Time to accomplish: **2 years**

7.3.2 Amend the California Building Code to require that seismic design strategies of public and private acute-care hospital facilities be applied to equipment and contents as well as structural and non-structural elements so that they remain functional after an earthquake.

Priority: Very Important

7.3.3 Ensure that essential service and hospital buildings can continue to operate in the event of earthquakes, as required by current law, including the continuance of all utility services and systems necessary for proper operation of the facility.

Priority: Very Important

7.3.4 Amend the California Building Code to require independent professional review for important, irregular, complex, special-occupancy, and critical facilities, and for all buildings where mandated enhanced performance objectives are required.

Priority: Important

7.3.5 Amend statute to allow any interested party to submit proposed seismic specific amendments to the California Building Code for consideration and adoption by the California Building Standards Commission.

Priority: Important

7.3.6 Require every Building Department to have an appropriately licensed design professional, on staff or under contract, for advice regarding structural and seismic safety issues.

Priority: Very Important

**7.4 *Do Performance-Focused Research***

7.4.1 Provide substantial, continuing support to develop the knowledge and practice basis for developing performance-based design procedures for buildings and systems.

Priority: Important

7.4.2 Provide continuing support to develop performance-based design and construction procedures for buildings and systems, participating with other organizations to the extent practical.

Priority: Important

DRAFT  
27 JUL 01





## Utilities & Transportation Element

Utilities and transportation systems can experience severe disruptions under earthquake conditions: 1) major supply lines and high-volume routes are insufficiently resistant to earthquakes or lack adequate redundancy (alternate systems); and 2) when secondary lines and routes are seismically vulnerable and alternate systems are overwhelmed by earthquake damage. Primary concerns about utilities include the critical lack of redundancy or upgrading in public and private facilities. This applies to water and waste water (including dams), natural gas, communications, and electrical systems. Transportation concerns are similar and include highway bridges, roadways, railroads, airports and harbors. Significant disruption of these systems would cause extensive long-term economic losses, societal disruption, and personal danger.

### Objective

*To ensure that all public and private utilities and transportation systems can withstand earthquakes to the degree that they will be able to: 1) provide protection of life; 2) limit damage to property; and 3) provide for the resumption of system functions as soon as practicable. The intent of this objective is to limit the impact to only short-term interruptions, with minimal life loss and economic disruption to the affected regions.*

### Strategies

#### ***Ensure Performance Standards***

Establish seismic performance standards for utilities and transportation systems, including interdependency of different systems (such as water and gas), to ensure adequate risk reduction strategies.

#### ***Mitigate Secondary Effects***

Establish a comprehensive program for minimizing the secondary effects (such as gas fires, hazardous material spills, sanitation overflows) resulting from damage and disruption to a utility or transportation systems in order to minimize life and property losses, environmental damage, and economic degradation.

#### ***Evaluate and Prioritize Mitigation Measures***

Evaluate each system to identify vulnerabilities for life safety and service disruption, and prioritize risk reduction strategies, including redundancy, to minimize those vulnerabilities.

#### ***Retrofit Critical Systems***

Ensure that retrofit of all critical utilities and transportation systems are funded and authorized so that the work can be accomplished in the funding time frame.

### Benefits

Benefits to California include timely restoration of utilities and transportation systems that ensure a significant reduction in loss of life, societal costs and economic disruption.

### Responsibilities

Public and private owners of utility or transportation systems are responsible for attaining the objective and for preparing and carrying out their own seismic safety implementation plan. The State should establish policies on acceptable levels of performance, and monitor state-wide utilities and transportation systems to accomplish the strategies outlined.

### Costs

Cost to the State for agency administration will be minimal. Cost to public and private owners of a utility or transportation systems will depend on the amount of mitigation work required. The retrofit of critical systems may require considerable expenditures.

### Incentives

Incentives may include improved funding options, reduced insurance rates, positive tax benefits, public recognition of good performance, governmental certification of reliable service, and regulatory options or trade-offs that reflect the value of the system's

improved seismic performance.

## Utilities & Transportation Initiatives

**Objective:** *Protect Life, Limit Property Damage, and Resume Functions*

### Strategies and Initiatives

#### 8.1 *Ensure Performance Standards*

8.1.1 Establish and/or update performance standards for system and facility design, construction, maintenance, operation, and inspection of all public and private utility and transportation systems. Include related critical facilities and consideration of the interdependency between systems. Include minimum performance standards for critical wireless systems such as cellular telephones, the Internet, and emergency radios, including their related fiber-optics, towers and emergency power. Include minimum performance standards for natural gas pipelines, oil pipelines, refineries, and electrical transmission lines. Include minimum performance standards for water conveyance systems, tunnels, elevated roadways, rail systems, and ports.

Priority: Very Important

8.1.2 Require utilities that are not regulated by the California Public Utilities Commission (PUC) to adopt the equivalent seismic performance standards required of utilities that are regulated by the PUC. (Editor's Note: To be Confirmed by Commissioner Klein)

Priority: Very Important

8.1.3 Require public and private utilities and transportation systems to address the earthquake hazards identified in the Alquist Priolo Earthquake Zone Act and the Seismic Hazards Mapping Act

Priority: Important

#### 8.2 *Mitigate Secondary Effects*

8.2.1 Develop and implement a comprehensive educational program aimed at instructing providers and users about potential secondary hazards inherent in disruption or failure of a system. Include all forms of secondary hazards such as, but not limited to those, from major transportation spills of hazardous materials, natural or liquefied petroleum gas leaks at mobile home parks, electrically ignited fires, and unbraced gas water heaters.

Priority: Important

8.2.2 Educate local governments and the public on the application of gas safety devices such as automatic shut-off valves.

Priority: Very Important

#### 8.3 *Evaluate and Prioritize Mitigation Measures*

8.3.1 Develop effective methods of minimizing utility system disruption from earthquake damaged transmission and distribution lines (gas, oil, electrical, water and waste water) including earthquake activated shutoff and restart, monitoring and management systems.

Priority: Important

8.3.2 Develop methods to ensure effective inter-provider coordination for maintaining and restoring critical systems to reasonable levels of service subsequent to damaging earthquakes. Encourage the voluntary actions of existing and future inter-provider seismic working groups, consisting of representatives of each type of utility and transportation provider.

Priority: Important

#### 8.4 *Retrofit Critical Systems*

8.4.1 Identify potentially vulnerable public and private primary water supply and distribution facilities, including State and Federally regulated dams, and public and private levees. Upgrade vulnerable systems to ensure timely reactivation of essential systems after damaging earthquakes.

Priority: Very Important

8.4.2 Identify potentially vulnerable major transportation arteries that have minimal redundancy whose service disruption would cause significant hardship on the communities served. Establish functional priorities and upgrade or replace as appropriate to ensure restoring major arteries to reasonable levels of service.

Priority: Very Important

8.4.3 **Identify potentially vulnerable public and private utility systems including electric, gas, oil, water, and communication. Upgrade vulnerable systems to ensure the operation and timely restoration of essential systems to reasonable levels of service.**

Priority: **Critically Important**

Time to accomplish: **5 years**





# Preparedness Element

Individual business owners, and corporate decision-makers do not fully understand the potential loss of life, property personal dislocation, social disruption, and economic losses resulting from earthquakes. Several areas are of concern: 1) limited awareness of the potential for loss of life and property; 2) a false sense of security based on the assumption that the government will protect against all economic losses; 3) no clear understanding that a problem really exists (“It won’t happen to me”); 4) an attitude that fails to recognize the need for self-reliance (“Preparedness starts at home”) expressing itself instead as “There is nothing I can do about it”; and 5) limited knowledge of what to do and how to pay for it.

## Objective

*To increase understanding of the consequences (personal loss, social disruption, and economic impact) that can result from earthquakes. To increase understanding of the options for mitigation, and the need to take action. To develop a comprehensive approach to preparedness for individuals, business owners, and corporate decision makers.*

## Strategies

### ***Increase Understanding of Potential Impact***

Develop an effective program for increasing the understanding of the potential for loss of life, personal dislocation, social disruption, and economic losses. Provide presentation of consistent, focused, in-depth, information to individuals, business owners, and corporate decision-makers on proper earthquake preparedness steps.

### ***Develop Comprehensive Approach***

Develop a comprehensive approach to cost-effective earthquake loss reduction. Include all aspects of an individuals life, from home to work place, including such areas as: personal planning, securing contents and fixtures, building retrofit and the stockpiling of critical supplies.

### ***Encourage Individuals to Act***

Develop a methodology that will encourage everyone to act and will assist them in their actions. Develop economic and regulatory incentives to facilitate and reward actions that will reduce potential losses.

### ***Improve K-12 School Preparedness***

Ensure effective preparedness of K-12 public and

private schools, their staffs, students, and facilities. Provide emergency response training for staffs and students. Minimize nonstructural hazards and stockpile critical supplies.

## Benefits

A fully informed and prepared citizenry will reduce loss of life and property, personal dislocation, social disruption, and indirect economic losses.

## Responsibilities

The State should take the lead in motivating and coordinating the statewide preparedness system and the strategies outlined. Local agencies working with the statewide plan will be responsible for implementation within their jurisdiction. The private sector efforts need to be coordinated with state and local government implementation plans.

## Costs

Overall, the cost of preparedness is expected to be low. Cost to the State and to local jurisdictions, individuals, and building owners will be minimal depending on the extent of preparation undertaken.

## Incentives

The greatest incentive to improve the current system will be the public’s demand for significant reduction

of the personal and financial losses that normally

result from earthquakes.

# Preparedness Initiatives

**Objective:** *Comprehensive Approaches to Preparedness*

## Strategies and Initiatives

### 9.1 *Increase Understanding of Potential Impact*

9.1.1 Develop information for individuals, families, and the business sector, about the human and economic impact of earthquakes. Disseminate consistent information in appropriate forms and languages.

Priority: Very Important

9.1.2 Develop information for Community Based Organizations about the impact of earthquakes on their organizations and those they serve. Include information about actions they can take to prepare for and mitigate the effects.

Priority: Important

### 9.2 *Develop Comprehensive Approach*

9.2.1 Encourage Community Based Organizations to expand training programs for individuals in preparedness so that they can effectively help their constituents to reduce potential losses and continue to serve them after an earthquake.

Priority: Important

9.2.2 Extend scope of the existing Home Owner's Guide to include all multi-family housing.

Priority: Important

9.2.3 Develop public policy establishing a comprehensive, program for seismic upgrading of private homes. Include procedures for strapping water heaters, reinforcing masonry chimneys, bolting foundations, bracing cripple walls and strengthening weak (soft story) configurations.

Priority: Important

9.2.4 Encourage voluntary seismic inspections (including estimates of the cost for correcting deficiencies) at the time of resale of any residential property as part of the Home Warranty inspection process.

Priority: Important

### 9.3 *Encourage Individuals to Act*

9.3.1 Promote the establishment of Community Emergency Response Team (CERT) programs in all communities throughout the State.

Priority: Important

9.3.2 Expand the scope of Neighborhood Watch programs to include earthquake preparedness and neighborhood earthquake response information in all communities in the state.

Priority: Important

9.3.3 Develop economic and regulatory incentives for home and business owners to facilitate and reward actions that will reduce potential losses, such as securing non-structural elements, contents, and fixtures that pose potential hazards.

Priority: Very Important

9.3.4 Develop and maintain a state presence on the Internet that spotlights earthquake preparedness, inviting discussion and informing the public about regulations, methods and procedures for loss reduction. Include related public-domain documents.

Priority: Important

DRAFT  
27 JUL 01

**9.4 *Improve K-12 School Preparedness***

- 9.4.1 *Require compliance with the Standardized Emergency Management System (SEMS). Ensure school and district boards and administrators develop and implement school emergency plans and staff training as required by the current Education Code.***

Priority: **Critically Important**  
Time to accomplish: **3 to 5 years**

- 9.4.2 Ensure school and district boards and administrators to implement the requirements for minimizing nonstructural hazards, and ensuring a sufficient stockpile of water and other critical supplies to be used for first aide, sanitation, and food.

Priority: Very Important

DRAFT  
27 JUL 01



## Emergency Response Element

Emergency management and response systems continue to improve with each event; however, systems can be further strengthened through greater collaboration and partnership with and between public, private, non-profit agencies, and the community. Deficiencies still exist in: 1) resources needed for better communication during an event; 2) resources in and coordination among the public and private medical response system; 3) resources for sustained search and rescue operations; 4) reliable and timely information management; and 5) adequate and sustained resources for emergency management at all levels of government.

### Objective

*To improve emergency management and response systems.*

### Strategies

#### ***Improve Communications***

Improve statewide communication systems to provide for effective transmission of information among response organizations.

#### ***Improve Medical Response***

Encourage and support the public and private medical response system with an emphasis on adequate resource, planning, training, and coordination.

#### ***Improve Search and Rescue***

Expand the local, regional and statewide urban search and rescue capability including strategically located search and rescue training facilities, additional teams, and adequate equipment, through a sustained funding source.

#### ***Improve Emergency Management Capability***

Develop a workable system for enhancing emergency management including the collection and dissemination of damage assessment and other critical information.

### Benefits

The benefits are improved and effective emergency responses leading to preservation of lives and property.

### Responsibilities

The State should take the lead in motivating and coordinating the state-wide emergency response system. The State is responsible for creating and operating training facilities. Local agencies will be responsible for staff utilization. Other public levels, the medical community, media, and private sector will be involved in much of the implementation

### Costs

Cost to the State for implementation of the strategies will be considerable. Cost to local agencies could also be considerable although the strategies envision using existing personnel and resources.

### The Incentives

Achieving the objectives of this element will be dependent on strong State policy as part of its overall risk reduction plan. While the need for effective emergency response is obvious, the greatest motivation to improve the current system will be in the public's demand for significant reduction in personal and financial losses normally resulting from earthquakes.

# Emergency Response Initiatives

**Objective:** *Improved Emergency Management and Response Systems*

## Strategies and Initiatives

### 10.1 *Improve Communications*

10.1.1 **Provide interoperable upgraded regional and local emergency communications, including: 1) mutual-aid channels for police, fire, and emergency medical services; 2) regional emergency communications councils with authority to establish regional standards for emergency communication; and 3) response and recovery public broadcast channels for the public.**

Priority: **Critically Important**  
Time to accomplish: **3 years**

10.1.2 Provide more efficient use of the wireless rapidly changing cellular, and potential satellite, telephone system during emergencies. Include priority access to wireless cellular service for emergency use, the deployment of portable wireless satellite cell sites, and limited public access to wireless cellular phone service during emergency. and the possible extension of communications ability by use of other emergency technologies.

Priority: Very Important

10.1.3 Equip all operational areas local government operations area to both send and receive Emergency Digital Information Systems (EDIS) messages.

Priority: Important

### 10.2 *Improve Medical Response*

10.2.1 Provide sustainable resources including funding for regional planning personnel and other improvements in the medical and health mutual aid system.

Priority: Very Important

10.2.2 Integrate public and private outpatient clinics, skilled-nursing facilities, and speciality clinics in the local medical and health disaster response system.

Priority: Very Important

10.2.3 Provide adequate training for non-governmental staff and personnel providing medical and health disaster response in accordance with the Standardized Emergency Management System Approved course of Instruction and the Hospital Emergency Incident Command System.

Priority: Very Important

### 10.3 *Improve Search and Rescue*

10.3.1 Establish and maintain strategically located search and rescue training facilities to provide real-time preparedness training for emergency response personnel that are properly equipped and staffed.

Priority: Very Important

10.3.2 Ensure that all teams have a complete cache of specialized urban search and rescue equipment .

Priority: Very Important

10.3.3 Improve emergency response coordination between all State and local levels of government, emergency response organizations, and supporting private sector entities.

Priority: Important

10.3.4 Evaluate the need for expanded urban search and rescue capability, which could include additional teams and/or support to local urban search and rescue providers.

Priority: Important

10.3.5 Provide adequate resources for maintenance and replacement of specialized urban search and rescue equipment cache.

Priority: Very Important

#### **10.4 Improve Emergency Management Capability**

10.4.1 Improve the capability and quality of computer simulation models for projecting where to expect damage in the immediate aftermath of an earthquake.

Priority: Very Important

10.4.2 Finalize procedures and training for use of Emergency Managers Mutual Aid (EMMA). Ensure input from local emergency officials. Include criteria for selection and methods for reimbursement.

Priority: Important

10.4.3 Develop and distribute coordinated public informational products for governmental public information officers and news media representatives' pre- and post-earthquake use.

Priority: Important

10.4.4 Develop emergency response and recovery public information that is broadcast ready.

Priority: Important

10.4.5 Develop improved tools and technologies for use by emergency responders to make accurate and rapid initial damage assessments.

Priority: Very Important

10.4.6 Develop sustainable funding sources for adequate emergency management at all levels of government.

Priority: Very Important

10.4.7 Develop procedures and training for use by emergency managers when providing or receiving mutual aid. Ensure input from local emergency managers, and include criteria for selection and methods for reimbursement.

Priority: Important





# Recovery Element

Recovery methods have improved with each earthquake; however, there are still a number of deficiencies that impair effective and speedy recovery and have resulted in unacceptable levels of personal and financial loss. Deficiencies exist in: 1) funding for effective management of the recovery process (including mitigation) 2) adequate interim shelter and housing, particularly for those with special needs; 3) plans and resources to accommodate interim and long-term post-earthquake housing; and 4) adequate knowledge and preparation by the public, business and service sectors for effective recovery.

## Objectives

*To establish and fund a statewide earthquake recovery plan aimed at social and economic recovery in the public and private sectors through better and more responsive plans, procedures and utilization of resources.*

## Strategies

### ***Establish Statewide Recovery Plan***

Establish a statewide strategic earthquake recovery plan aimed at normalizing the social and business environment, public and private and minimizing the time and cost of recovering from an earthquake.

### ***Expand Interim and Long-term Housing Capability***

Develop plans for interim and replacement housing responsive to varying levels of loss and strategies for the financing of long-term housing reconstruction based on state-of-the-art data collection on housing losses and recovery costs.

### ***Expedite Permitting and Rebuilding Process***

Develop guidelines to accelerate the permitting and rebuilding process so that disruption of individuals and businesses is minimized, and rapid personal and economic recovery is assured.

### ***Provide Accurate and Timely Information***

Establish a coordinated public information strategy to provide accurate and timely recovery and mitigation information to public and private sectors through all available means.

## Benefits

Economic and social impact over the long term will be minimized, and communities will be able to return to normal more rapidly.

## Responsibilities

The State shall take the lead in motivating and coordinating the statewide strategic recovery plan and the strategies outlined. Local agencies will be responsible for implementation. Other public levels and the private sector will be involved in much of the implementation.

## Costs

Planning cost to the State should be similar to other statewide planning efforts. Cost to local agencies will vary depending on whether existing resources can be used for planning, implementation, and maintenance.

## Incentives

Achieving the objectives of this element will be dependent on strong State policy on recovery and mitigation in the overall risk reduction plan. The strongest motivation to improve the current system will be in the demand for significant reduction in personal, business and public losses resulting from earthquakes

# Recovery Initiatives

**Objective:** *Statewide Recovery Plan and Implementation*

## Strategies and Initiatives

### 11.1 *Establish Statewide Strategic Recovery Plan*

11.1.1 Develop a strategic Statewide Disaster Recovery Plan.

Priority: Very Important  
Time to accomplish: 2 to 3 years

11.1.2 Identify and secure sources of funding for disaster recovery and mitigation.

Priority: Very Important

11.1.3 Maintain and augment, as necessary, provisions for continued human services such as interim housing, feeding, medical care, and psychological assistance.

Priority: Very Important

11.1.4 Develop a public and private partnership program for incorporating disaster assistance recovery teams (including appropriate specialties such as psychology, nursing, communications, clergy, building inspection, etc.) into local emergency plans, including coverage of all areas of assurance and all jurisdictional levels.

Priority: Important

11.1.5 Plan for shelter, interim housing and other recovery needs unique to people with special needs, including frail, elderly, disabled, and others.

Priority: Important

11.1.6 Establish the definition of the emergency period of a disaster to include the beginning phases of

recovery, the organizational responsibilities, the use and coordination of volunteer assistance, and other elements as necessary.

Priority: Important

11.1.7 Develop comprehensive operational guidelines tailored to the needs of each region for the effective removal, recycling and/or disposal of rubble after earthquakes.

Priority: Important

11.1.8 Update and distribute the state's earthquake recovery manuals for local governments.

Priority: Important

### 11.2 *Expand Interim and Long-term Housing Capability*

11.2.1 **Establish plans for accommodating large displaced populations on an interim basis by using military facilities, publicly-owned parks and recreational facilities, manufactured housing, and other appropriate options.**

Priority: **Critically Important**  
Time to accomplish: **5 years**

11.2.2 Develop guidelines and incentives for landlords to make existing vacancies available for interim housing.

Priority: Important

11.2.3 Develop and maintain a database of actual housing losses and recovery costs from all earthquakes.

Priority: Important

11.2.4 Develop a strategy for use of manufactured housing in a post disaster environment.

Priority: Important

### ***11.3 Expedite Permitting and Rebuilding Process***

11.3.1 Develop guidelines to help local governments expedite the permitting and rebuilding process through the use of “one-stop” centers. This process will minimize the disruption of individuals and businesses and accomplish personal and economic recovery in the fastest time possible.

Priority: Important

11.3.2 Develop a model plan, standards and training for post-disaster permitting of repairs and modifications.

Priority: Important

11.3.3 Develop an implementation strategy (such as training manuals etc.) to disseminate the information regarding the permitting and rebuilding process (11.3.1) and the standards for repairs and modifications (11.3.2).

Priority: Important

### ***11.4 Provide Accurate and Timely Information***

11.4.1 Identify stakeholders and develop a strategy to integrate emergency and recovery public information into emergency and recovery management.

Priority: Important