Legislation Pertaining to the Seismic Safety of Schools

by

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Preface

The intent of this report is to provide general information about legislation as it pertains to the seismic safety of schools. Because United Sates' schools are not owned by a singular governing entity, current legislation can be characterized by an unsystematic, "each to their own" type of approach, occurring on a county or community-by-community basis. The only known exception where state-wide legislation has been uniformly adopted is in California and Oregon. Complicating the issue is continual advances in scientific understanding of earthquake risks and associated hazards; the consequential and recurrent revision of building codes; predictable reluctance by communities to adopt new codes that increase construction costs; and limited funding resources.

Because the legislative history of California, as it pertains to schools and seismic safety, serves as the basis for building codes presently adopted by most seismically active states, this report examines California's legislative history more comprehensively than other states. The report also cursorily examines how the combination of earthquakes, science, politics, and governments influence building code legislation. Funding is yet another separate subject, because it influences the means for understanding, predicting, and preventing earthquake damage, and impacts the rate at which successful mitigation occurs. Lastly, the report summarizes what some states have already accomplished, with a focus on western states with high seismicity.

In most cases, the key to states' success in mitigating seismic risks has been 1) recognition of seismic hazards by scientists, the public, and local/state/federal government officials, 2) acceptance that science and building codes continually evolve, enforcement is easier said than done, and structural integrity can deteriorate; merely adopting a code does not ensure safe buildings, 3) systematically identifying and ranking high-risk structures in conjunction with estimating retrofit costs in a way that allows mitigation to occur in a prioritized manner; there is not enough money to retrofit all at-risk buildings, 4) systematically pursuing funding at the local, state, and federal levels using a combination of bonds, grants, and legislated set-asides.

Brief History of Earthquakes and Legislation in California[1]

In general, California leads the nation in legislation regarding building codes for schools. This is primarily due to the large number of damaging earthquakes in populous areas within the state. Noted California seismic events resulting in new building codes, legislation, and/or scientific funding include the 1906 Great San Francisco earthquake, M 8.25; the 1925 Santa Barbara earthquake, M6.3; the 1933 Long Beach earthquake, M 6.3; the 1989 Loma Prieta earthquake, M 7.1; and the 1994 Northridge earthquake, M6.7. California subsequently leads the nation in studying, developing, adopting, and enforcing seismic design and building codes. Other states with seismic activity have generally adopted the resultant building codes via the Uniform Building Code, which California originally established. A table summarizing California earthquakes and associated legislation is provided as Attachment 1. This section summarizes some of the highlights.

Despite the magnitude of destruction and death of about 3,000 people, there was little legislation associated with the 1906 San Francisco earthquake. The need for legislation was apparently downplayed by chambers of commerce, politicians and the press for fear that expensive building codes would prevent the state from rebuilding and returning to normal as quickly as possible. Scientists, nonetheless, worked together to document and understand the event; marking the birth of modern earthquake science.

Following the 1925 Santa Barbara earthquake, the same entities claimed that statewide public awareness of earthquake risks would be "bad for business". However, in 1927, the Pacific Coast Building Officials — now the International Conference of Building Officials (ICBO) — published the first Uniform Building Code (UBC). The ICBO family of Uniform Codes has been adopted by reference or used as a pattern by most local governments. The UBC established uniformity of building codes in California. It will not be until 2007 that the California Building Standards Commission will change from referencing the UBC to the IBC.

Resistance to legislation ultimately changed in California when the 1933 Long Beach earthquake destroyed 70 schools, significantly damaged 120 others, and left 300 more requiring minor repair.[2] The public realized that it was pure luck the quake occurred at 5:54 p.m.; had it struck during school hours, children would have been injured and killed by the thousands. A month following the event, the Field Act became law as a legislative response to the Long Beach earthquake. The law established state control over the design and construction of elementary, secondary and community college educational facilities. Also passed that year was the Riley Act, making earthquake safety a legal requirement for all buildings. In 1939, the Garrison Act established that corrective steps be taken to retrofit or abandon pre-Field Act structures.

Figure 2. Damage to Franklin Junior High School in Long Beach, 1933

In a 1986 report commemorating fifty years of the Field Act, California had constructed or reconstructed 7,400 public schools and 110 community colleges under the provisions of the Field Act. Over $10.5 billion had been spent on earthquake resistant construction with an estimated replacement value of approximately $45 billion.[3] Even today, though, the California Seismic Safety Commission is working to mitigate schools that were constructed post-1933 (Field Act), but do not meet current building performance standards. In a 2002 report to the California Legislature, 7,537 schools were suspected of not meeting basic life-safety performance objectives.[4]

Improved Science, Revised Codes

It should be recognized that comprehension of existing seismic hazards and risks by many states/communities is comparatively recent. Furthermore, building codes evolve on a continuing basis. The change from the Uniform Building Code (UBC) Seismic Zone (0, no hazard - 4, most hazardous) system, which was sometimes political in nature, to scientifically predicted peak ground motions is just being adopted in some states via the International Building Code that was introduced in 2000. Figure 1 (below) demonstrates the chronological change in seismic ground motion maps for the Pacific Northwest Region, and how local building codes have had to change as a result.

Peak Acceleration (% gravity), with 10% Probability of Exceedance in 50 Years, 2002 IBC

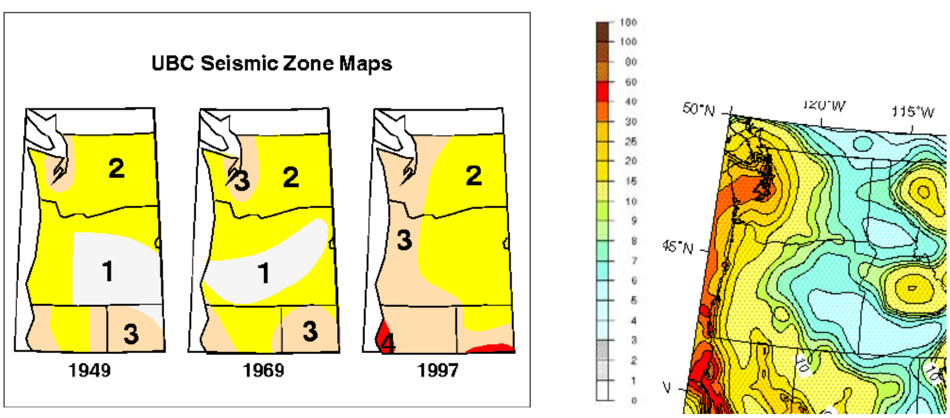


Figure 1: Seismic ground motion map change example, (Pacific Northwest Region, 1949-2002).

Much of the available funding in seismically active states has thus far been directed primarily into trying to better understand the risk as opposed to mitigating the hazard. As an example, detailed mapping of liquefiable soils (in Las Vegas[5], Salt Lake City[6], Memphis[7], etc.) has only recently become available (advances began in the mid-1980s at the earliest, and is ongoing today).[8] In these instances, seismically active states have not mandated mitigation legislation because the public and their elected officials are only just learning the degree to which specific buildings might be at risk. The associated expense to mitigate existing structures is often viewed as cost-prohibitive. Consequently, local and state governments have not allocated funding.

As a note, the increase in scientific understanding is chiefly the result of the 1977 Earthquake Hazards Reduction Act. The federal legislation was enacted after the 1971 San Fernando earthquake killed 65 people and caused $500 million in damage. Following the Act, there was the subsequent establishment of the National Earthquake Hazards Reduction Program (NEHRPS), along with the integration of supporting roles by the Federal Emergency Management Agency (FEMA), the National Institute of Standards and Technology (NIST), the National Science Foundation (NSF), and the United States Geological Survey (USGS).[9]

Historically, when states face code increases in UBC or IBC ground motions, communities become concerned about the impact of increased cost and liability. When Utah faced such a change in 1994 from a UBC Zone 3 to Zone 4 designation, a formal report stated that the increased cost in construction at the time would be approximately only 0.5-1.5%, based on prior experience in California. The report also declared that no additional liability for owners of existing structures would be incurred. The report advised that Tort Liability Law would not apply to older buildings if they were constructed to the existing code at the time.[10] Therefore, by the same argument, there is no legislative impetus to retrofit schools. It is probably fair to say that damaging earthquakes in populous areas have been the primary motivators, and that is why California stands out in legislation.

Federal Funding Sources for Seismic Mitigation, and Associated Legislation[11]

Obtaining money for the retrofit of school buildings is characteristically limited, competitive and cumbersome. Federally available financial assistance for seismic mitigation is available through FEMA's Hazard Mitigation Grant Program (HMGP), and the Pre-Disaster Mitigation (PDM) grant program. HMGP funding is made available following Presidentially-declared disasters, while PDM funding is usually made available within three months of Federal appropriation (usually by April of each year).

Hazard Mitigation Grant Program

Mitigation funding became available as a set-aside under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), created in 1988. Much of this program was rewritten during the Disaster Mitigation Act of 2000. The Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390) provides an opportunity for states, Tribes and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the Stafford Act by repealing the previous mitigation planning provisions (Section 409) and replacing them with a new set of mitigation plan requirements (Section 322). This new section emphasizes the need for state, Tribal, and local entities to closely coordinate mitigation planning and implementation efforts.

The requirement for a State mitigation plan is continued as a condition of disaster assistance, adding incentives for increased coordination and integration of mitigation activities at the State level through the establishment of requirements for two different levels of state plans: “Standard” and “Enhanced.” States that demonstrate an increased commitment to comprehensive mitigation planning and implementation through the development of an approved Enhanced State Plan can increase the amount of funding available through the Hazard Mitigation Grant Program (HMGP). DMA 2000 also established a new requirement for local mitigation plans and authorized up to 7% of HMGP funds available to a state to be used for development of state, Tribal, and local mitigation plans.

Federal HMGP funds made available following a disaster can provide a federal share of up to 75% of the costs of an approved project. Therefore, the remaining 25% must be met through non-federal funds. The remaining portion (25%) of the project cost must be covered by other funds from appropriate sources such as local government funds, community development block grants, and in-kind donations of supplies, materials, volunteer service, etc.

There is another significant caveat. The funding is made available only if states have adopted an adequate state-wide building code (among numerous other requirements). Not all seismically active states have accomplished this. As of August, 2006, California, Colorado, Delaware, Hawaii, Illinois, Mississippi, and Massachusetts had not yet adopted the International Building Code on a statewide level that would cover the construction of new school buildings.[12] This does not imply that these states have not adopted an approved alternative. FEMA 313, Promoting the Adoption and Enforcement of Building Codes, is an important document outlining the history, importance, and cost-benefits of state-wide building code adoption.[13]

Pre-Disaster Mitigation Grant Program

FEMA's Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, and communities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds.

Funds: Approximately $50 million is available for competitive grants, technical assistance, and program support for the FY 2006 PDM program.

Eligible Activities:

- Mitigation planning: $1M cap on Federal share, not to exceed 3 years
- Mitigation projects: $3M cap on Federal share, not to exceed 3 years
- Information dissemination activities: not to exceed 10%, must directly relate to planning or project sub-application
- Applicant management costs: not to exceed 10%
- Sub-applicant management costs: not to exceed 5%

Cost-share: 75% Federal/25% non-Federal. Small Impoverished Communities may be eligible for up to a 90% Federal cost-share. The remaining portion of the project cost must be covered by other funds as listed in the Hazard Mitigation Grant Program portion of this section. Requirements for in-kind contributions can be found in OMB Circular **A-102**, Common Rule, 44 CFR 13.24. Generally, the non-Federal cost share may not include funds from other Federal agencies, except for Federal funds that have authorizing statutes that explicitly allow the funds to be used as cost share for other Federal grants. PDM funds do not lose their Federal identity and cannot be used as cost share for another Federally funded activity. In addition, neither Federal PDM program funds nor non-Federal funds used to cost share the PDM program can be used as cost share for another Federal grant program.

Funding varies from year to year with $47 million allocated in 2006, $235 million in 2005, $26 million in 2004, and $150 million in 2003. According to FEMA, the application statistics for 2006 Pre-Disaster Mitigation Grants are:

- Applications received: 46 States, 14 Indian tribal governments, and 2 Territories
- Sub-applications received: 190 competitive (planning and project) totaling $134 million
- Sub-applications selected for further review: 26 planning sub-applications totaling $2.8 million and 32 project sub-applications totaling $38.8 million

Other Federal Legislation or Programs Pertaining to Seismic Resistant Construction

While discussing funding and codes, it is also worthy to note that, per Federal Executive Order 12699, any project funded via the U.S. Department of Housing and Urban Development (HUD), Department of Education, or U.S. Department of Health and Human Services (HHS) must comply with strict earthquake building design set forth in the NEHRP Recommended Building Provisions. Unless states can construct schools without the aid of federal grants, the most current seismic codes apply for all new school construction. Executive Order 12699 was signed by President George H. Bush in 1990, following the Loma Prieta Earthquake, and became effective February, 1993.[14]

Congress recently reauthorized NEHRP, resulting in the NEHRP Reauthorization Act of 2004, PL 108-360. The reauthorization included minor revisions established to address concerns about the slow implementation of new mitigation technologies, combined with continued widespread development in areas of high seismic risk, which has resulted in rapid, steady increases in societal vulnerabilities to major earthquakes. Potential loss estimates for a large earthquake in a major U.S. urban area now approach $200 billion. (Also see Unofficial Amendment to PL 108-360.)[15]

What Other States are Doing

State seismic risk mitigation activities vary across the country. Many have created State Commissions and Boards to aid in the process of overseeing seismic hazard investigation and risk reduction. The best resource for accessing information is through four regional organizations listed at FEMA's website (http://www.fema.gov/plan/prevent/earthquake/state.shtm). The regional organizations are:

- *Western States Seismic Policy Council (WSSPC)*
  Formed in 1980, WSSPC is a regional earthquake consortium funded primarily by FEMA. WSSPC draws its membership from the emergency manager and geoscientist directors of 13 western states, 3 territories, a Canadian territory, and a Canadian province. WSSPC is the regional consortium for Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming, American Samoa, Guam, and the Commonwealth of Northern Mariana Islands.

  Associated State Seismic Safety Councils and Commissions presently include the Alaska Seismic Hazards Safety Commission, the California Seismic Safety Commission the Colorado Earthquake Hazard Mitigation Council, the Hawaii State Earthquake Advisory Committee, the Nevada Earthquake Safety Council, the Oregon Seismic Safety Policy Advisory Commission, and the Utah Seismic Safety Commission.
- *Cascadia Region Earthquake Workgroup (CREW)*
  CREW is a non-profit coalition of private and public representatives working together to increase the ability of Cascadia Region communities in the Pacific Northwest (California, Oregon, and Washington) to reduce the effects of earthquake events.

- *Central United States Earthquake Consortium (CUSEC)*
  CUSEC serves as the coordinating hub for Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, or Tennessee. Established in 1983 with FEMA funding, the mission of CUSEC is to reduce deaths, injuries, property damage, and economic losses resulting from earthquakes in the Central United States. Ten adjacent states also participate as associates in CUSEC (Georgia, Iowa, Louisiana, Nebraska, North Carolina, Ohio, Oklahoma, South Carolina, and Virginia).

- *Northeast States Emergency Consortium (NESEC)*
  Connecticut, Maine, Massachusetts, New Jersey, New Hampshire, New York, Rhode Island, or Vermont, are coordinated by NESEC. The group develops, promotes, and coordinates "all-hazards" emergency management activities throughout the region. This includes hazard risk evaluation and assessment, public awareness and education, hazard mitigation and information technology transfer.

Summarizing what each state has accomplished towards increasing the seismic safety of schools is beyond the scope of this paper due to the variety of approaches and amount of space required to document it. In general, though, it was determined that California and Oregon have some of the most specific legislation pertaining to schools. The states use a combination of local, state and federal bonds/grants to fund projects. Other western states with high seismicity are also briefly reviewed. As a reference, the following figure summarizes the level of seismic hazards in the United States.

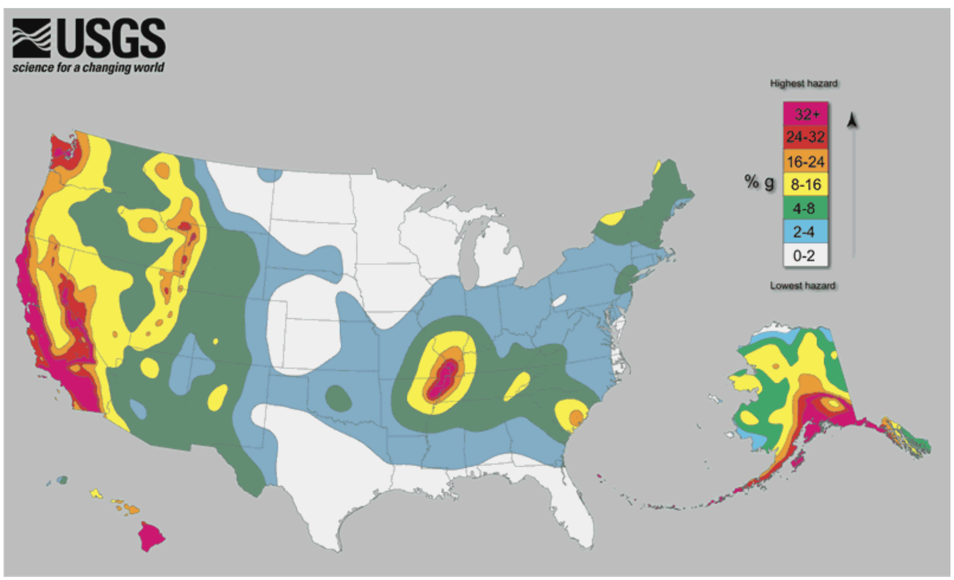


Figure 3: National Seismic Hazards Map, USGS, 2002.

<u>*California*</u>

California legislation was discussed previously and consequently has many of the safest public school buildings in the nation, but it was noted that over 7,000 schools still may not meet basic life-safety performance. Per a 2002 report to the governor, the precursory inventory and risk ranking of their schools was conducted at a cost less than $500,000; examining approximately 16,000 non-wood-frame schools constructed before 1978. The form used to rank schools is provided as Attachment 2, which was developed using FEMA 310, Handbook for Seismic Evaluation of Buildings. The report also established a rough cost estimate of $4.7 billion to further evaluate and rehabilitate at-risk schools. In 2002, a $13 billion measure was passed by California for school construction. The schools with the highest probability of collapse due to construction and located closest to an active fault were recommended to be retrofitted first.[16]

Oregon

In August, 2005, Oregon passed a series of bills to assess and rehabilitate its schools along with other critical facilities. Senate Bill 2 directed a statewide seismic needs assessment that included seismic safety surveys of K-12 public school buildings and community college buildings that have a capacity of 250 or more persons, hospital buildings with acute inpatient care facilities, fire stations, police stations, sheriffs' offices and other law enforcement agency buildings. The assessment included use of FEMA-154, 2002 Edition, Rapid Visual Screenings (RVS), to rank builidings by risk categories. (Attachment 3 and 4 provide examples of the RVS form and a list of Benchmark Code years). Senate Bill 3 directed the Oregon Emergency Management office to create a grant program for local communities. Senate Bills 4 and 5 directed the state treasurer to issue voter approved bonds. Altogether, $1.2 billion was appropriated to improve seismic safety statewide.[17]

Washington

Washington State elected to use the FEMA Hazard Mitigation Grant Program as its primary mitigation resource; obtaining over $90 Million in grants since 1989. Washington carefully examined the negative impacts of inducing legislative mandates at a time when the state was experiencing significant financial stagnation.[18] As of 2004, an accurate inventory of schools vulnerable to earthquake hazards did not exist. The Office of Superintendent of Public Instruction surveyed districts in 1996 to ask about seismic safety of school buildings; about two-thirds of the 296 districts responded. The survey found buildings housing 250,000 students were vulnerable to earthquake damage and needed retrofitting; only one of five districts had completed a study to determine their vulnerability to seismic risk. Further, the survey found that buildings housing 270,000 students were vulnerable to nonstructural hazards.[19]

Nevada

Nevada recognizes that it is the 3rd most seismically active state in the nation, and only recently resolved to inventory structures at risk. A 2000 Mitigation Plan outlined objectives to develop an approach for inventorying critical buildings (including, but not limited to schools) by the year 2001, completing the inventory by 2003, and estimate cost/benefit ratios and financing strategies by 2005.[20] It is unknown whether these objectives were met. Also worth noting is that liquefiable soils mapping was just finished in 2002, and has significant new implications for the Las Vegas Valley; especially given its recent growth.[21]

Figure 4: Excerpt from 1996 report summarizing liquefaction mapping for populated areas, Applied Technology Council. Note that Nevada had not yet been studied.

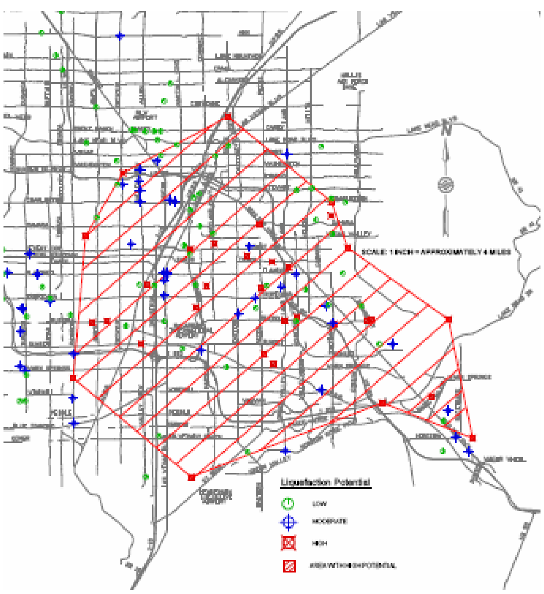


Figure 5. New report showing liquefaction potential for Las Vegas, 2002. (Red hatched area indicates high liquefaction potential.)

Utah

In 1995, Utah listed a series of objectives and strategies in a formal strategic plan. One goal included improving the seismic safety of older public school buildings. At the time the plan was drafted, some schools in Salt Lake City had already been studied for an average of $1,000 per building, and were upgraded for an average of $833,333 per school. Utah's Seismic Safety Commission recommended that the remaining two-thirds of the state's schools be evaluated for a cost of $720,000, and approximately 600 schools retrofitted at a cost of $300 million ($500,000 per school).[22]

What Canada is Doing[23]

The Government of British Columbia, under pressure from citizens and in recognition of the risk posed by the Cascadia subduction zone, recently budgeted $254 million for seismic upgrades to 95 schools. The set-aside was the first part of a $1.5 billion plan to make BC's public schools earthquake safe. School boards are conducting feasibility studies to confirm the seismic risk and scope of required remediation. Construction on the first projects is scheduled to commence in 2006.

The Seismic Mitigation Advisory Committee, formed in March 2004, continues to assist the Ministry with development and implementation of the program. The first school projects to proceed were selected by the Ministry based on structural assessment undertaken by school boards in 2004 using a standard assessment tool, developed with the assistance of APEGBC. The assessment tool is available at the British Columbia's Ministry of Education Seismic Mitigation website. It is similar to forms in Attachment 2-3, but significantly more detailed; totaling 8 pages. See Attachment 5, for details.

Summary

Many states throughout the country have initiated efforts to mitigate damage in the event of an earthquake. It is part of a nationwide attempt to reduce the loss due to any natural disaster including not only earthquakes, but floods, high winds, and landslides. The most successful states have used a combination of events and efforts to enhance mitigation efforts. Damaging earthquakes often provide the impetus to pass legislation. Seismic safety commissions are effective agencies for drafting policies for future adoption by law makers. Developing criteria for inventorying at-risk structures enables municipal and state governments to prioritize and estimate mitigation efforts. State-wide adoption of building codes ensures science's best understanding of earthquake hazards and associated risks can be averted. Adoption of seismic building codes and enactment of mitigation plans increases a state's eligibility for federally available grants.

Attachments

Attachment 1: TABLE SUMMARIZING CALIFORNIA EARTHQUAKES AND ASSOCIATED LEGISLATION				
Date	**General Location**	**Magnitude**	**Damage**	**Resulting Legislation**
1906 (April 18, 5:12 am)	San Francisco	M8.25 300 miles of rupture	3000 deaths; extensive loss due to structural failure and fire.	A Commission of Engineers is established to study the damage, resulting in what is recognized as the birth of modern earthquake science. Well documented research lead to the first theory on plate tectonics. The Seismological Society of America was established "for the acquisition and diffusion of knowledge concerning earthquakes and allied phenomena, and to enlist the support of the people and the government in the attainment of these ends."
1925 (June 29, 6:44 am)	Santa Barbara	M6.3	13 deaths, 61 injured; local dam broke, sending water through the city; 36 city blocks destroyed.	In 1927, the Pacific Coast Building Officials — now the International Conference of Building Officials (ICBO) — published the first Uniform Building Code (UBC). The ICBO family of Uniform Codes has been adopted by reference or used as a pattern by most local governments. The UBC established uniformity of building codes in California.
1933 (March 10, 5:54 pm)	Long Beach	M6.3 10 miles of rupture	120 deaths; 70 schools destroyed, 120 significantly damaged, 300 needed repair.	Field Act passed, mandating improved building codes for new public school construction, and direct state review of public school design. The Riley Act also passed that year, making earthquake safety a legal requirement for all buildings. In 1939, the Garrison Act established that corrective steps be taken to retrofit or abandon pre-Field Act structures.
1971 (Feb. 9, 6:00 am)	San Fernando	M6.5 12 miles deep	65 deaths, 58 injuries; Hospitals badly damaged (Olive View); freeway interchanges collapsed; dams barely survived; extensive surface fault ruptures damaged numerous structures.	The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. In response to the recognized need for superior seismic performance by hospitals, the California Legislature enacted the Alfred E. Alquist Hospital Facilities Seismic Safety Act, which became effective in 1973. Congress passed the Federal Earthquake Reduction Act in 1977, establishing the National Earthquake Hazards Reduction Program (NEHRPS), along with the integration of supporting roles by FEMA, NIST, NSF, and the USGS.

Attachment 1: TABLE SUMMARIZING CALIFORNIA EARTHQUAKES AND ASSOCIATED LEGISLATION				
Date	**General Location**	**Magnitude**	**Damage**	**Resulting Legislation**
1989 (Oct. 17, 5:04 pm)	Loma Prieta	M7.1 25 miles of rupture, large areas liquefy	62 deaths, 3757 people injured; 22 structural fires; Cypress Viaduct collapses, killing 42; 20 buildings at Stanford seriously damaged.	Calif. legislature passed Seismic Hazards Mapping Act requiring geotechnical evaluations in specific zones prior to construction. Executive Order 12699 was signed by President George H. Bush in 1990, requiring any project funded via the U.S. Department of Housing and Urban Development (HUD), Department of Education, or U.S. Department of Health and Human Services (HHS) must comply with strict earthquake building design set forth in the NEHRP Recommended Building Provisions
1994 (Jan. 17, 4:30 am)	Northridge	M6.7 12 miles deep	57 deaths, 9000 injuries, 2500 car garage collapsed @ Calif. State Univ.	Codes significantly changed to improve inspection procedures and construction practices. Formal recognition that lifelines (water supply, electric power, transportation systems, and fuel pipelines) equally critical to disaster preparedness.

STRUCTURAL SYSTEMS
S1 Steel Moment Frame With Rigid Diaphragm
S1A Steel Moment Frame With Flexible Diaphragm
S2 Steel Braced Frame With Rigid Diaphragm
S2A Steel Braced Frame With Flexible Diaphragm
S3 Steel Light Frame Metal siding and/or Rod Bracing
S4 Steel Frames with Concrete Shear walls and diaphragms
S5 Steel Frames w/ Infill Masonry Shear Wall/Conc Diaphragms
S5A Steel Frame w/ Infill Masonry Shear Wall/Wood Diaphragms
C1 Concrete Moment Frame
C2 Concrete Shear Wall Rigid Diaphragm
C2A Concrete Shear Wall Flexible Diaphragm
C3 Conc. Frame w/ Infill Masonry Shear Walls/Conc. Diaphragm
C3A Conc. Frame w/ Infill Masonry Shear Walls/Flex. Diaphragm
PC1 Precast/Tilt-up Concrete Shear Wall with Conc. Diaphragm
PC1A Precast/Tilt-up Conc. Shear Wall with Flex. Diaphragm
PC2 Precast Conc. Frame Conc. Shear Walls/Rigid Diaphragm
PC2A Precast Conc Frame No Conc. Shear Walls - RigidDiaphragm
RM1 Reinforced Masonry Bearing Wall - Flexible Diaphragms
RM2 Reinf Masonry Bearing Wall - Stiff Diaphragms
URM Unreinforced Masonry Wood Diaphragms
URMA Unreinforced Masonry Rigid Diaphragms
M Mixed –indicate systems here

Remarks:	**FILE NUMBER**	
	APPL. NUMBER	
	Firm	Initials

Wood Frame Buildings Questions:
Does this appl. have only wood buildings? **Yes**___ **No**___
Number of Wood Bldgs. on this **Application** ____
No. of Stories ____
If any building is 2 stories or more, provide rough approximate of the sq. ft. per floor in remarks section.
This box must be completed even if there are no wood buildings.

Does this application appear to be for an entire campus?
Yes___ **No**___
This box must be completed for all projects

ZONE 3	ZONE 4	AP ZONE	10Km	5Km	2Km
These	**boxes**	**will be**	**filled**	**by**	**CDMG**

Fill in the box below only for non-wood frame buildings

Bldg. No. →	1	2	3	4	5	6
Struct. Sys. →						
No. of Stories						
Classroom						
Multipurpose						
Library						
Auditor/theater						
Administration						
Shop						
Science						
Gym						
Cafeteria						
Greenhouse						
Equip./storage						
Lunch Shelter						
Canopies						
Other						
Sq. Ft. → Combine the Sq. Ft. for all floors and enter. In remarks describe setbacks if any.						

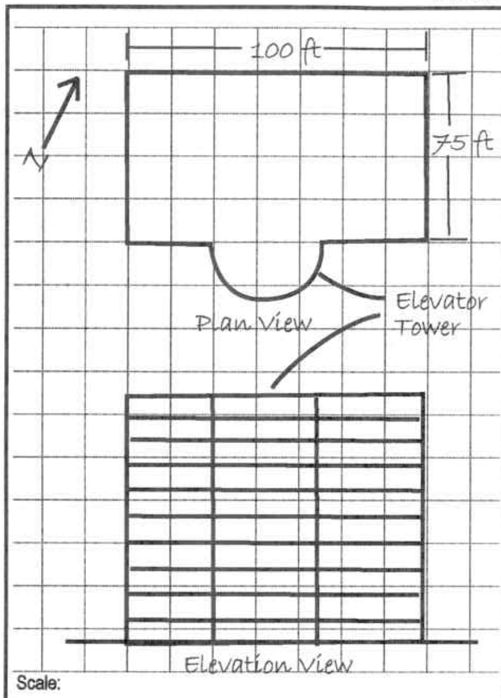
Attachment 2: Data Collection Form used in California public school seismic-safety inventory, as adopted from FEMA 310 Handbook for Seismic Evaluation of Buildings – A Prestandard. (Note: replaced by ASCE 31-03, Seismic Evaluation of Existing Buildings). FEMA publications are available at: http://www.conservationtech.com/FEMA-publications/FEMA.htm

Rapid Visual Screening of Buildings for Potential Seismic Hazards

FEMA-154 Data Collection Form

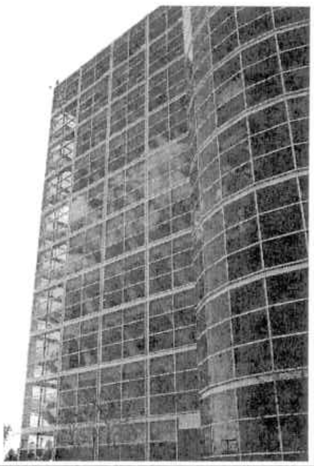
Example 1

HIGH Seismicity



Scale:

Address: 3703 Roxbury St.
Anyplace Zip 91234
Other Identifiers Parcel 7469027035; S2
No. Stories 10 Year Built 1986
Screener A. Jones/D. Taylor Date 2/28/01
Total Floor Area (sq. ft.) 76,000 Sq. ft.
Building Name Smith & Co.
Use Office



OCCUPANCY			SOIL		TYPE						FALLING HAZARDS			
Assembly Commercial Emer. Services	Govt Historic Industrial	(Office) Residential School	Number of Persons 0 – 10 (101-1000)	 11 – 100 1000+	A Hard Rock	B Avg. Rock	C Dense Soil	(D) Stiff Soil	E Soft Soil	F Poor Soil	☐ Unreinforced Chimneys	☐ Parapets	☐ Cladding	☐ Other:

BASIC SCORE, MODIFIERS, AND FINAL SCORE, *S*

BUILDING TYPE	W1	W2	S1 (MRF)	(S2) (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM
Basic Score	4.4	3.8	2.8	(3.0)	3.2	2.8	2.0	2.5	2.8	1.6	2.6	2.4	2.8	2.8	1.8
Mid Rise (4 to 7 stories)	N/A	N/A	+0.2	+0.4	N/A	+0.4	+0.4	+0.4	+0.4	+0.2	N/A	+0.2	+0.4	+0.4	0.0
High Rise (> 7 stories)	N/A	N/A	+0.6	(+0.8)	N/A	+0.8	+0.8	+0.6	+0.8	+0.3	N/A	+0.4	N/A	+0.6	N/A
Vertical Irregularity	-2.5	-2.0	-1.0	-1.5	N/A	-1.0	-1.0	-1.5	-1.0	-1.0	N/A	-1.0	-1.0	-1.0	-1.0
Plan irregularity	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Pre-Code	0.0	-1.0	-1.0	-0.8	-0.6	-0.8	-0.2	-1.2	-1.0	-0.2	-0.8	-0.8	-1.0	-0.8	-0.2
Post-Benchmark	+2.4	+2.4	+1.4	+1.4	N/A	+1.6	N/A	+1.4	+2.4	N/A	+2.4	N/A	+2.8	+2.6	N/A
Soil Type C	0.0	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Soil Type D	0.0	-0.8	-0.6	(-0.6)	-0.6	-0.6	-0.4	-0.6	-0.6	-0.4	-0.6	-0.6	-0.6	-0.6	-0.6
Soil Type E	0.0	-0.8	-1.2	-1.2	-1.0	-1.2	-0.8	-1.2	-0.8	-0.8	-0.4	-1.2	-0.4	-0.6	-0.8
FINAL SCORE, *S*				3.2											

COMMENTS

Detailed Evaluation Required

YES (NO)

* = Estimated, subjective, or unreliable data
DNK = Do Not Know

BR = Braced frame
FD = Flexible diaphragm
LM = Light metal

MRF = Moment-resisting frame
RC = Reinforced concrete
RD = Rigid diaphragm

SW = Shear wall
TU = Tilt up
URM INF = Unreinforced masonry infill

Figure 5-8 Completed Data Collection Form for Example 1, 3703 Roxbury Street.

FEMA 154 **5: Example Application of Rapid Visual Screening** 57

Attachment 3: Data Collection Form used in Oregon seismic-safety inventory, as adopted from FEMA 154 Rapid Visual Screening. FEMA publications are available at: http://www.conservationtech.com/FEMA-publications/FEMA.htm

Table 3-1. Benchmark Buildings

	Model Building Seismic Design Provisions							
Building Type[1, 2]	**NBC[ls]**	**SBC[ls]**	**UBC[ls]**	**IBC[ls]**	**NEHRP [ls]**	**FEMA 178[ls]**	**FEMA 310[ls, io]**	**CBC[io]**
Wood Frame, Wood Shear Panels (Type W1 & W2)	1993	1994	1976	2000	1985	*	1998	1973
Wood Frame, Wood Shear Panels (Type W1A)	*	*	1997	2000	1997	*	1998	1973
Steel Moment-Resisting Frame (Type S1 & S1A)	*	*	1994[4]	2000	**	*	1998	1995
Steel Braced Frame (Type S2 & S2A)	1993	1994	1988	2000	1991	1992	1998	1973
Light Metal Frame (Type S3)	*	*	*	2000	*	1992	1998	1973
Steel Frame w/ Concrete Shear Walls (Type S4)	1993	1994	1976	2000	1985	1992	1998	1973
Reinforced Concrete Moment-Resisting Frame (Type C1)[3]	1993	1994	1976	2000	1985	*	1998	1973
Reinforced Concrete Shear Walls (Type C2 & C2A)	1993	1994	1976	2000	1985	*	1998	1973
Steel Frame with URM Infill (Type S5, S5A)	*	*	*	2000	*	*	1998	*
Concrete Frame with URM Infill (Type C3 & C3A)	*	*	*	2000	*	*	1998	*
Tilt-up Concrete (Type PC1 & PC1A)	*	*	1997	2000	*	*	1998	*
Precast Concrete Frame (Type PC2 & PC2A)	*	*	*	2000	*	1992	1998	1973
Reinforced Masonry (Type RM1)	*	*	1997	2000	*	*	1998	*
Reinforced Masonry (Type RM2)	1993	1994	1976	2000	1985	*	1998	*
Unreinforced Masonry (Type URM)[5]	*	*	1991[6]	2000	*	1992	*	*
Unreinforced Masonry (Type URMA)	*	*	*	2000	*	*	1998	*

[1] "Building Type" refers to one of the Common Building Types defined in Table 2-2.
[2] Buildings on hillside sites shall not be considered Benchmark Buildings.
[3] Flat Slab Buildings shall not be considered Benchmark Buildings.
[4] Steel Moment-Resisting Frames shall comply with the 1994 UBC Emergency Provisions, published September/October 1994, or subsequent requirements.
[5] URM buildings evaluated using the ABK Methodology (ABK, 1984) may be considered benchmark buildings.
[6] Refers to the GSREB or its predecessor, the Uniform Code of Building Conservation (UCBC).

[ls] Only buildings designed and constructed or evaluated in accordance with these documents and being evaluated to the Life Safety (LS) Performance Level may be considered Benchmark Buildings.
[io] Buildings designed and constructed or evaluated in accordance with these documents and being evaluated to either the Life Safety or Immediate Occupancy (IO) Performance Level may be considered Benchmark Buildings.

* No benchmark year; buildings shall be evaluated using this standard.
** Local provisions shall be compared with the UBC.

NBC = *National Building Code* (BOCA, 1993).
SBC = *Standard Building Code* (SBCC, 1994).
UBC = *Uniform Building Code* (ICBO, 1997)
GSREB = *Guidelines for Seismic Retrofit of Existing Buildings* (ICBO, 2001).
IBC = *International Building Code* (ICC, 2000).
NEHRP = FEMA 368 and 369, *NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings* (BSSC, 2000)
FEMA 178 (*See* BSSC, 1992a)
FEMA 310 (*See* FEMA, 1998)
CBC = *California Building Code, California Code of Regulations, Title 24* (CBSC, 1995).

Attachment 4: Benchmark Code years by construction type, ASCE 31-03, Seismic Evaluation of Existing Buildings. FEMA publications are available at: http://www.conservationtech.com/FEMA-publications/FEMA.htm

BRITISH COLUMBIA

Seismic Assessment Report: Facility Summary

Ministry of **Education**

Facility Information

School District No. and Name

Date of Assessment

Facility Name

Assessment Firm

Facility Code

Responsible Assessor (1)

Street Address

Nominal Capacity of Facility

K	Elem. (gr. 1-7)	Sec. (gr. 8-12)

Postal Code

Block Information (2)

School Building Name	Block No.	Block Name	Assessed
			☐ yes ☐ no
			☐ yes ☐ no
			☐ yes ☐ no
			☐ yes ☐ no
			☐ yes ☐ no
			☐ yes ☐ no
			☐ yes ☐ no
			☐ yes ☐ no
			☐ yes ☐ no
			☐ yes ☐ no

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SD No. - Name
School Name

Attachment 5: British Columbia 2004 Seismic Assessment Tool available at:
http://www.bced.gov.bc.ca/capitalplanning/seismic/welcome.htm

BRITISH COLUMBIA

Seismic Assessment Report: Building Block Summary

Ministry of **Education**

Building Block No. and Name

Building Block Capacity (3)

K	Elem. (gr. 1-7)	Sec. (gr. 8-12)

Type of Occupancy

Type of Occupancy	No. of Rooms
☐ Classroom(s)	
☐ Gymnasium(s)	
☐ Multipurpose Room(s)	
☐ Cafeteria(s)	
☐ Auditorium(s)	
☐ Shop(s)	
☐ Administration	
☐ Other	

Year(s) of Construction

No. of Storeys (4)	Gross Floor Area (m^2) (5)

Drawing(s) Available

- ☐ Yes (specify location(s))
- ☐ No

Block Sketch (6)

Filename	

Block Photo (7)

Filename	
Elevation	

Attachment 5 (cont.): British Columbia 2004 Seismic Assessment Tool available at: http://www.bced.gov.bc.ca/capitalplanning/seismic/welcome.htm

Block Construction (8)

Roof System	Suspended Floors	Walls (Load Bearing)	Foundations	Vertical Lateral Force Resisting System
☐ Wood Joists	☐ Wood Joists	☐ Wood Studs	☐ Spread Footings	☐ URM Brick Wall
☐ Shiplap	☐ Shiplap	☐ Post and Beam	☐ Piles - Wood	☐ Unreinforced HCB
☐ Plywood	☐ Plywood	☐ URM Brick	☐ Piles - Steel	☐ Lightly Reinforced HCB
☐ Drywall/Plaster	☐ Drywall/Plaster	☐ Unreinforced HCB	☐ Piles - Concrete	☐ Reinforced HCB
☐ Tongue and Groove Decking	☐ Tongue and Groove Decking	☐ Lightly Reinforced HCB	☐ Combination	☐ Plywood Wall
☐ Metal Decking	☐ Metal Decking	☐ Reinforced HCB	☐ Other (describe)	☐ Shiplap Wall
☐ Concrete Infilled Metal Decking	☐ Concrete Infilled Metal Decking	☐ Concrete		☐ Drywall/Plaster
☐ Concrete Slab	☐ Concrete Slab	☐ Steel		☐ Concrete Wall
☐ Precast Slab	☐ Precast Slab	☐ Other (describe)		☐ Cross Bracing
☐ Timber/Glulam Beams	☐ Timber/Glulam Beams			☐ Steel Moment Frame
☐ Steel Beams/Joists	☐ Steel Beams/Joists			☐ Concrete Moment Frame
☐ Concrete Beams	☐ Concrete Beams			☐ Other (describe)
☐ Other (describe)	☐ Other (describe)			

URM - Unreinforced Brick Masonry
HCB - Hollow Concrete Block or Giant Brick

Attachment 5 (cont.): British Columbia 2004 Seismic Assessment Tool available at:
http://www.bced.gov.bc.ca/capitalplanning/seismic/welcome.htm

Ground Floor Construction

- ☐ Slab on Grade
- ☐ Crawl Space
- ☐ Basement
- ☐ Other (describe)

Historic Register

- ☐ Yes (identify agency name)
- ☐ No
- ☐ Unknown

Adjacency Issues (11)

Pounding
- ☐ Yes
- ☐ No

Falling Objects
- ☐ Yes
- ☐ No
- ☐ Other (describe)

Performance Objective I = 1.3* (12)

- ☐ Yes
- ☐ No
- ☐ Other

Previous Seismic Upgrades (9)

- ☐ Yes (describe)
- ☐ No
- ☐ Unknown

Potential Geological/Site Issues (10)

- ☐ Construction Near Edge of Slope
- ☐ Construction Near Upside Slope
- ☐ Liquefiable Soils
- ☐ Daylighting of Basement
- ☐ Other (describe)

Seismic Factors* (13)

Soil Site Class (est)	
Fa	
Rd	
Ro	
Spectral Acceleration	
V	x W

* Code: National Building Code of Canada (2005 Edition)

Attachment 5 (cont.): British Columbia 2004 Seismic Assessment Tool available at: http://www.bced.gov.bc.ca/capitalplanning/seismic/welcome.htm

British Columbia

Seismic Assessment Report: Building Block Summary

Ministry of **Education**

Structural Deficiency (14)

		Capacity/Demand		Comments
		N/S	E/W	
Roof	Diaphragm			
	Connections			
Floor	Diaphragm			
	Connections			
Vert. Lateral Load System				
Walls - Out of Plane				
Foundations				
Anchorage to Foundations				
Retaining Walls (15)				

Weak or Soft Storey
- ☐ Yes
- ☐ No

High Torsion
- ☐ Yes
- ☐ No

Short Columns
- ☐ Yes
- ☐ No

Covered Play Area
- ☐ Yes
- ☐ No

Adequate Connection Between Adjacent Blocks
- ☐ Yes
- ☐ No

Comments

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Page 5 of 8

SD No. - Name
School Name
Building Block No. - Name

Attachment 5 (cont.): British Columbia 2004 Seismic Assessment Tool available at: http://www.bced.gov.bc.ca/capitalplanning/seismic/welcome.htm

BRITISH COLUMBIA

Seismic Assessment Report: Building Block Summary

Ministry of Education

Identify up to 5 Major Deficiencies (16)

1	
2	
3	
4	
5	

Building Component Deficiencies (17)

URM or HCT Partition Walls
☐ Yes
☐ No

URM over Entrances
☐ Yes
☐ No

Parapets or Gables
☐ Yes
☐ No

☐ Other

Estimated Seismic Risk (18)

☐ Low
☐ Low/Moderate
☐ Moderate
☐ Moderate/High
☐ High

Opportunities to Address Weak Components in the Short Term (19)

☐ Yes
☐ No
(describe)

Other Comments (20)

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SD No. - Name
School Name
Building Block No. - Name

Attachment 5 (cont.): British Columbia 2004 Seismic Assessment Tool available at: http://www.bced.gov.bc.ca/capitalplanning/seismic/welcome.htm

Seismic Assessment Report: Building Block Summary

Construction Estimate (21)

Location

Factor

No. of Construction Estimates

☐ 0 ☐ 1 ☐ 2 ☐ 3

Construction Estimate No. 1 (if necessary)

Occupancy Type

Building Type	Unit Cost	Floor Area (m^2)	Estimated Cost

Premium Cost Allowance	Unit Cost	Floor Area (m^2)	Estimated Cost
☐ Clay Tile Walls			
☐ Wood Frame Crawlspace			

Subtotal Estimated Cost

Adjustment for Previous Partial Seismic Upgrades (100% = No Adjustment) %

Attachment 5 (cont.): British Columbia 2004 Seismic Assessment Tool available at:
http://www.bced.gov.bc.ca/capitalplanning/seismic/welcome.htm

Seismic Assessment Report: Building Block Summary

Construction Estimate No. 2 (if necessary)

Occupancy Type

Building Type	Unit Cost	Floor Area (m^2)	Estimated Cost

Premium Cost Allowance	Unit Cost	Floor Area (m^2)	Estimated Cost
☐ Clay Tile Walls			
☐ Wood Frame Crawlspace			
Subtotal Estimated Cost			
Adjustment for Previous Partial Seismic Upgrades (100% = No Adjustment)		%	

Construction Estimate No. 3 (if necessary)

Occupancy Type

Building Type	Unit Cost	Floor Area (m^2)	Estimated Cost

Premium Cost Allowance	Unit Cost	Floor Area (m^2)	Estimated Cost
☐ Clay Tile Walls			
☐ Wood Frame Crawlspace			
Subtotal Estimated Cost			
Adjustment for Previous Partial Seismic Upgrades (100% = No Adjustment)		%	

Total Estimated Cost

Attachment 5 (cont.): British Columbia 2004 Seismic Assessment Tool available at: http://www.bced.gov.bc.ca/capitalplanning/seismic/welcome.htm

Notes

[1] The California Building Standards Commission website: http://www.bsc.ca.gov/abt_bsc/abt_hstry.html, the California Seimic Safety Commission website: http://www.seismic.ca.gov, and Earthquakes and Schoolhouses, About.com: http://geology.about.com/od/quake_preparedness/a/schoolquakes.htm
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