Summary Minutes

Nevada Earthquake Safety Council

25 August 2010

The Nevada Earthquake Safety Council (NESC) met from 9:00 a.m. to 3:30 p.m. at the offices of NV Energy, 6100 Neil Road, Reno, Nevada. These and previous minutes are posted on the NESC website, (http://www.nbmg.unr.edu/nesc/index.html).

Ron Lynn chaired the meeting. Individuals attending the meeting are members of the Council:

Elizabeth Ashby, Nevada Division of Emergency Management (DEM)
Alan Bennett*, City of Reno
Mike Blakely*, Blakely, Johnson, and Ghusn
Maiclaire Bolton, Risk Management Solutions
Ian Buckle*, University of Nevada, Reno – Center for Civil Engineering Earthquake Research
Wayne Carlson*, Nevada Public Agency Insurance Pool
Press Clewe, who held the proxy for Bernie Anderson*, Nevada Assembly
Craig dePolo, Nevada Bureau of Mines and Geology
Diane dePolo, Nevada Seismological Laboratory, who held he proxy for Greg Moss*, The Moss Group
Terri Garside, Nevada Bureau of Mines and Geology
Jeffrey Hahn, Corporate Emergency Management, Boyd Gaming Corporation, Las Vegas, who held the proxy for Jenelle Hopkins*, Clark County School District, Las Vegas
Juliette Hayes, Federal Emergency Management Agency, Region IX
Eric Hubbard, Kleinfelder
Karen Johnson, Nevada Division of Emergency Management
Graham Kent*, Nevada Seismological Laboratory
Steve Koenig*, City Center, Las Vegas
Ron Lynn*, Clark County Department of Development Services
Robert Martinez, Nevada Division of Water Resources
Glade Myler, Office of the Attorney General, representing Nevada Division of Emergency Management
Jim O'Donnell*, Geophysical Contractor, Boulder City
Fernando Ortiz*, Walmart Distributing Centers, Fernley
Jon Price*, Nevada Bureau of Mines and Geology
Jim Reagan*, NV Energy
Rob Reeder, Security and Safety, Regional Transportation Commission
Woody Savage*, U.S. Geological Survey (retired)
Wanda Taylor*, UNLV Department of Geoscience
Jim Walker*, Nevada Department of Transportation
Doni Ward-McAlister*, American Red Cross, Las Vegas
Jim Werle*, Converse Consultants
Don Windeler, Risk Management Solutions
Michael Young, Risk Management Solutions

* indicates member of the Board of Directors.
A quorum of directors (the necessary 11) was present.

Board Members unable to attend or send a proxy included:

Joe Curtis*, Storey County Emergency Manager

Greg Flanigan*, Farmers Insurance
Warren Hardy*, Nevada State Senator
Greg Moss*, Moss Group

The minutes of the 26 May 2010 meeting were unanimously approved, with one correction (changing Churchill County to Pershing County in the section on the Awareness and Education Committee). The corrected minutes will be posted on the NESC website (http://www.nbmg.unr.edu/nesc/index.html).

Awareness and Education Committee

Diane dePolo reported that the committee ascertained how the Earthquake Awareness Week activities align with the State of Nevada science education standards. The standards are general, but do address earthquakes either directly or indirectly in a few areas. Specifically, the following standards apply:

E.5.C.3: Students know landforms may result from slow processes (e.g., erosion and deposition) and fast processes (e.g., volcanoes, earthquakes, landslides, floods, and human activity)

E.8.C.4: Students know the very slow movements of large crustal plates result in geological events.

E.12.C.2: Students understand the concept of plate tectonics including the evidence that support it (structural, geophysical, and paleontological evidence).

Diane also noted that she has sent additional earthquake-hazard information to officials in Pershing County.

Research Committee

Jim Werle reported that the 43rd Symposium on Engineering Geology and Geotechnical Engineering will be held in the UNLV Student Union on 23-25 March 2011. There will be two and a half days of talks and a post-meeting field trip, including a trip to the new bridge across the Colorado River. Registration will begin in October. See the website at http://2011.eggesymposium.com. Craig dePolo is organizing a session during the symposium in honor of Burt Slemmons. The focus of the session in honor of Burt will be on what to do in the future with regard to earthquake science and its applications. Lloyd Cluff will discuss the success in designing the Trans-Alaska oil pipeline to withstand displacement along the Denali fault; as designed, the pipeline successfully shifted without breaking during the 2002 magnitude 7.9 Denali earthquake.

ACTION ITEM: Jim Werle will send notices about the 43rd Symposium on Engineering Geology and Geotechnical Engineering, to be held in the UNLV Student Union on 23-25 March 2011, to Terri Garside, for forwarding to the NESC membership.

Craig dePolo reported that the Wells earthquake volume is nearing completion.

Craig highlighted the new version of *Living with Earthquakes in Nevada*, which is now available as Nevada Bureau of Mines and Geology (NBMG) Special Publication 27 on the web at http://www.nbmg.unr.edu/sales/pbsdtls.php?sku=SP27 or through www.nbmg.unr.edu. Several suggestions were made regarding possible changes for the next edition (probably five years hence). Elizabeth Ashby noted that if there is a disaster declaration in Nevada, there will likely be funds available for updating the document.

Craig also noted that the third Basin and Range Province Seismic Hazard Summit (BRPSHS III) may be held in the spring of 2011.

Policy Recommendations Committee

Wayne Carlson provided an update on the Unreinforced Masonry (URM) Inventory Project. Gary Johnson (NBMG) has been processing data in GIS from county assessors' offices and recently acquired data on state buildings. The criteria used in selecting buildings from the assessors' databases are that the structure was built during or before 1973 and has probable or possible URM construction. Wayne showed preliminary maps of several Nevada communities, showing possible and probable commercial and residential URMs. The database also includes publicly owned buildings. As the database continues to be built, it will be launched as a web application. This will be useful for communities for emergency planning, resource deployment before an earthquake, earthquake response for emergency responders (knowing where the most likely damage will be), and mitigation. Mike Blakely noted that a rapid visual inspection by a qualified person, both inside and outside, can confirm whether the buildings are indeed URMs. Elizabeth Ashby suggested that doing these inspections could be covered in the mitigation plans of local communities.

Ad-Hoc Committee on Visitors

Jeffrey Hahn reported that Craig dePolo and Ron Lynn gave a presentation to the Las Vegas Security Chiefs Association meeting. Their presentation, which was well received, emphasized the local earthquake hazard for Las Vegas Valley. Jeff noted that plans are underway for a similar presentation to the Northern Nevada Security Directors Association

Ron Lynn suggested that these groups should be given an additional presentation on mitigating nonstructural hazards from earthquakes. Such mitigation can be relatively easy and inexpensive.

Jeff noted that the committee is discussing best practices with lodging-industry partners, and the consensus is that the best way to take care of visitors is to educate your employees first. This could include pre-shift briefings of casino employees, which allow for up to three to five minutes on a particular subject.

The committee is eager to participate in the upcoming Great Nevada ShakeOut (see later minutes).

Nevada Working Group on Quaternary Fault Surface Rupture Hazards

Eric Hubbard reported that the working group held its first informal meeting at 8:00 a.m., before the NESC meeting today. They expect to have a draft of recommendations to the Council about a year from now. They will post progress on the NESC website.

Nominating Committee

The Council unanimously approved the following nominations for members of the NESC board of directors:

Doni Ward-McAlister, American Red Cross,
Fernando Ortiz, Walmart, Distribution Centers, and
Woody Savage, U.S. Geological Survey.

They are filling board positions for Community Organizations, Southern Nevada; Business and Industry, Northern Nevada; and Geosciences, Southern Nevada, respectively. Elizabeth Ashby indicated approval by the Nevada Division of Emergency Management (DEM).

Operation of the Nevada Seismic Network

Graham Kent, Director of the Nevada Seismological Laboratory, reported that the seismic instruments that were once funded through the Department of Energy's Yucca Mountain Project have been donated to the Nevada Seismological Laboratory. These instruments can help to improve the geographic coverage of seismometers throughout the state. Additional funds are needed, likely through Congressional action endorsed by the University of Nevada, Reno's leadership, for the continued operation and maintenance of these instruments. Furthermore, there are needs to improve the communication network, some of which is as much as 30 years old. No action is required from the Council at this time because efforts are underway through the University of Nevada, Reno to request the additional funds.

The Council unanimously approved a motion to authorize the NESC leadership to issue a letter of support, if needed, in consultation with Graham Kent, to express support for increasing the coverage and upgrading the seismic network for Nevada.

Report from the Nevada Seismological Laboratory on Seismic Activity Since the Previous NESC Meeting and on the Great (California and Nevada) ShakeOut

Graham Kent reported that the largest earthquake in the last few months was a magnitude 4.2 near Pyramid Lake on July 30. There was a magnitude 3.6 26 miles north of Las Vegas on August 4. There has also been a swarm of earthquakes near Davis Lake in California; the largest earthquake in this swarm was a magnitude 3.8 on August 9.

At 10:21 a.m. on October 21, 2010, there will be a simulated earthquake as part of the Great (California and Nevada) ShakeOut. This is an exercise to be prepared for a major earthquake. It will involve businesses, schools, and individuals. "Drop, cover, and hold" will be emphasized. A webpage for Nevada will be made public in a few days. California is anticipating that approximately 10,000,000 people will participate. Nevada will be broken into five regions. This year will have a fairly low level of activity, but next year there will be an increase in effort. There may be university-wide exercises this year.

ACTION ITEM: Graham Kent will see that there are links to the Great (California and Nevada) ShakeOut website from the Nevada Seismological Laboratory website (http://www.seismo.unr.edu/); Wanda Taylor will see that links are established from the UNLV Department of Geoscience website (http://geoscience.unlv.edu/); and Terri Garside will see that links are made from the NBMG (www.nbmg.unr.edu) and NESC (http://www.nbmg.unr.edu/nesc/index.html) websites. Terri will also distribute the ShakeOut website information to the NESC e-mail list, so that Council members and others can sign up to participate.

Diane dePolo noted that last year all K-12 school districts and charter and private schools in Nevada were required to submit emergency plans to DEM. The school districts are promoting a new program called Project SPARTIN (*Schools Prepared and Ready Together In Nevada*). There will be a meeting of this group in Las Vegas in mid-October.

Report from the Division of Emergency Management

Elizabeth Ashby reported that a major earthquake exercise was conducted in Virginia City involving preliminary damage assessment teams. The teams examined sewer systems, water systems, roads, and buildings. Six teams of four individuals each, including some Storey County officials, participated.

Elizabeth noted that FEMA has encouraged DEM to apply for approval of the Nevada Hazard Mitigation Plan as an enhanced plan, which will allow for up to 20% in additional funding for mitigation efforts after a Presidential declaration of disaster (instead of the current 15%).

Bridge-Code Implications of the Offshore Maule Earthquake (Chile), February 27, 2010 (magnitude 8.8, 35-km depth)

Ian Buckle, Director, Center for Civil Engineering Earthquake Research at the University of Nevada, Reno, discussed his experience examining bridges during a Federal Highway Administration and Earthquake Engineering Research Institute reconnaissance trip to Chile. Chile is extremely seismically active, with subduction of the Nazca plate under South American plate at a rate of 70 mm/year. Historically, there have been earthquakes as large as magnitude 9.6 (in 1960) along this subduction zone. The U.S. is particularly concerned about lessons learned from this recent earthquake because of the similar geological settings offshore from northern California, Oregon, Washington, and British Columbia (giving rise to the Cascade volcanoes) and along the subduction zone beneath the Aleutian Islands in Alaska (where a magnitude 9 earthquake in 1964 damaged much of Anchorage).

The recent earthquake caused shaking and tsunami damage in much of Chile. Interestingly, the tsunami caused $2 million in damage in San Francisco Bay, California (the one to two-foot rise in sea level damaged some moorings). The earthquake affected communities over 300 km away. There were many aftershocks, some as large as magnitude 7. The length of the aftershock zone was approximately the same as the length of the coastline along Oregon and Washington. There was 60 seconds of strong shaking and up to 100 seconds of significant shaking. This is important because few areas have experienced this length of shaking, and codes currently do not account for shaking lasting this long.

Bridge-design codes in Chile have largely followed U.S. codes. Before the mid-1980s, the basic requirement involved expected horizontal forces equal to 10% of weight of the structure.
They adopted the American Association of State Highway and Transportation Officials (AASHTO) bridge codes in the late 1990s, including taking into account scour (from floods) that could damage the integrity of bridges. Since the 1990s, Chile has been outsourcing construction of its highways, allowing the private sector to recover costs from tolls. During the earthquake, the older, government-constructed bridges tended to survive the earthquake better than the newer, privately built bridges. Of the 450 privately built bridges, 100 were damaged and 8 collapsed. In contract, of the 6,800 government-constructed bridges, many of which were older than the privately built bridges, 103 were damaged and 10 collapsed. Bridge damage occurred due to rotation, liquefaction, and tsunami impact. Ian showed examples of "skew" bridges, which cross underlying roads or rivers at an angle other than 90 degrees. They tended to fail through rotation, when the highway moves off or is "unseated" from its supports. An example in Santiago documented lack of diaphragms on one of the privately owned bridges, which collapsed, whereas an adjacent, otherwise similar government-built bridge with diaphragms survived. The codes didn't explicitly require the diaphragms.

Straight bridges also locally experienced collapse due to rotation, which had not been seen in any earthquakes before.

Along the Biobio River in Concepción, bridges collapsed due to liquefaction and lateral spreading.

There were four damaging tsunami waves. The first one hit the Chilean coast shortly after the main earthquake shock; the last one hit about 4 hours later. Bridges were damaged by water pressure of the waves. The girders on a bridge across the Maule River at Constitución failed probably because of the shaking for the long amount of time that occurred during this earthquake. Another bridge at Constitución failed perhaps because of scour by the tsunami wave.

An 1870 unreinforced masonry bridge at Rio Claro failed, despite having survived many previous earthquakes. It may have collapsed because of failure of the abutment rather than directly from collapse of the arch supports.

A wharf (pier) in Concepción, which was designed to float by as much as 45 cm as an isolated structure, survived, but a wharf to the north, which was built in a conventional manner and was unable to float, was damaged.

Lessons learned include:

- Superstructures need to be explicitly designed for earthquake loads. This should be in the code, not just engineering practice.
- Current codes assume sufficient strength is available, provided minimum detailing is satisfied. This should be revisited.
- Absence of column damage due to separation of superstructure from substructure "validates" design strategy No. 2 in AASHTO 2008 specifications.
- Support lengths should be increased on liquefiable sites to accommodate lateral flow and vertical settlement.
- The questions should be asked: Should coast bridges be specifically designed for tsunami impact?
- Surviving one earthquake does not mean that the structure will survive the next earthquake.
- Seismic isolation is a valid strategy for protecting wharves, bridges, and buildings against large earthquakes.

Earthquake Insurance in Nevada

Wayne Carlson, Executive Director, Nevada Public Agency Insurance Pool, spoke on behalf of Greg Flanigan, about the availability of earthquake insurance. Neither flood nor earthquake insurance are covered in standard homeowners' policies. Unlike floods, there is no requirement that homeowners get insurance for earthquakes when they get a loan underwritten by the federal government. Earthquake policies generally have a deductible of 5 to 15% of the value of the building, with a similar deductible percentage for contents. Price generally doubles the homeowner's basic policy. Similar constraints apply to commercial properties. The Nevada Division of Insurance released a brochure on earthquake insurance in February 2010. In most markets, including Nevada, the majority of the people don't purchase earthquake insurance, in part because of the high deductible.

Some insurers will not offer earthquake insurance. A few years ago Allstate quit writing earthquake insurance in Nevada. The California Earthquake Authority (CEA) was created in 1996 because many companies were not offering insurance there. The CEA helps underwrite the insurances and spread risk as it works with private insurance companies to provide the insurance to individuals. Some properties are not insurable. The CEA gives credit for mitigation measures for some properties. In California, residential property insurers are required to offer earthquake insurance. The CEA has over $9 billion in claims-paying capacity.

Other insurance policies may cover certain losses from earthquakes. For example, auto comprehensive coverage generally includes earthquake damage. Workers' compensation covers injury from earthquakes for employees at work.

Most private insurers suspend availability of earthquake insurance for a period of time after a significant earthquake or while aftershocks are occurring. Some set thresholds for suspension based upon the magnitude of the earthquake.

Wayne distributed an earthquake insurance market report, showing the amount of insurance premiums sold, by company, in Nevada in 2007.

Fewer than 15% of property owners in Nevada (and California) have earthquake insurance. In California, about 12% of the residential properties are covered, and about 10% of commercial properties are covered with earthquake insurance.

In the western U.S., premiums are typically three to fifteen dollars per $1,000 of property value, whereas in the eastern U.S., they are $0.30 to $0.60 per $1,000.

The Nevada Public Agency Insurance Pool, which started in 1987, has been offering earthquake insurance. Their limit on payments is $100 million. They insure local governments (counties, cities, towns, school districts, and special districts). There is a deductible per event (ranging from $500 to $100,000 at the option of the member) but not as a percentage of total value. The earthquake coverage includes damage from not only earthquakes but also volcanic eruption, subterranean fire, landslide, subsidence, and earth sinking, rising, shifting, or any such "convulsion of nature." The policies include coverage for costs of upgrades to meet current building codes, damage to contents, rental of temporary locations, expenses to move to temporary locations, engineering and inspection expenses, fencing, and demolition and removal expenses. There are some exclusions (land, water, timber, plants, and animals; underground mines and mining property, bridges, tunnels, reservoirs, canals, and dams, docks, piers, and wharves, aircraft, watercraft over 50 feet in length).

In 2008, Belfor International, which had been contracted by the Nevada Public Agency Insurance Pool, came to Wells to assess the damage the day of the earthquake and meet with adjusters within five days after the earthquake. On February 27 (six days after the earthquake), Wayne contacted the Wells city manager to offer assistance with a FEMA non-insured damage assessment using an independent expert, at the Pool's expense. There was some concern about doing temporary repairs while aftershocks were still strong (well into mid-March). The high school had some hidden damage between walls in its partial URM structure. That fix cost about $2 million. The city had adopted the 1997 building code, but the State Fire Marshall had adopted the 2003 code. The Pool helped provide information to DEM regarding insured and non-insured damages, so that the city knew what might be covered.

In mid-April, Wayne met with reinsurers in London. Rates went up, and reserves had to increase because of the newly found information at the high school. In contrast to hurricanes, damage for earthquakes tends to rise over the time of the claim, because of hidden damage. The City of Wells was approached by The Greenspan Co., who asked to be paid to be a public adjuster. The city agreed to pay Greenspan 8% of all monies recovered from insurance companies. A spokesman from Greenspan told the city council that insurance companies "are not looking out for you. They are looking out for their stockholders. We will be your advocates. We know what to look for, the right questions to ask, and the answers they should be giving." They promised a higher amount of money than would otherwise be given by the insurer. The Pool, of which the City of Wells is a part, denied Greenspan's requests for up-front money and for exclusive communication with them, rather than directly with the City of Wells. The other entities in the Pool did not sign agreements with Greenspan. The Pool has essentially settled the claim, after two years for the city, whereas the claims were basically settled within 7 months for the school district. Greenspan cost the city $132,000 out of pocket; its involvement resulted in considerable delays in getting repairs done and settling the claims. The Pool ultimately paid out about $4 million for damages.

Lessons learned regarding the insurance issues in Wells:

- Understand and follow the loss adjustment process with the insurer.
- Cooperate and coordinate decisions with the insurer's adjuster.
- Insurance is designed to put you back in the condition you were before a loss, not to make you better off. (However, the Pool includes a clause to cover costs for bringing structures up to code.)
- Public adjusters tactics cause delays, cost more if not monitored, and create adverse relations between in insured and the insurers.

In answering questions, Wayne noted that few people in Wells had earthquake insurance on their private properties. The Pool does not differentiate specific building types, but the underwriters take the building types into account, and the fact that there are many public URMs in the rural counties drives up the insurance cost. Also, the Pool has encouraged the local governments to retrofit for earthquake hazards. For example, Eureka County has retrofitted some of its historic buildings.

Earthquake Risk Model for Nevada

Don Windeler, with Risk Management Solutions (RMS), described RMS's earthquake catastrophe model. RMS was the original author of FEMA's loss-estimation software, HAZUS. Their primary clients are insurance companies. They are using the new (2008) changes in the U.S. Geological Survey's probabilistic seismic hazard analysis, including new ground attenuation relations. For California, they are also using time-dependent probabilities from a joint study by the Southern California Earthquake Center, the USGS, and the California Geological Survey. They add local detailed information on amplification into local data sets. The RMS model uses loss-exceedance curves (plots of the probability of exceeding a particular loss level in a year) in their models. Their output includes deterministic scenarios (as with HAZUS), average annual loss, information on volatility or uncertainty, and other features. The RMS model shows an increase in risk for Utah, because they assume a time dependence for the Wasatch fault (suggesting that an earthquake is more likely there than expected from the random model used by the USGS). For most other western states, they are showing a lower average annual loss than would be derived from the older USGS models, because of the new ground attenuation relations.

Average annual losses are generally less than $1 per year per $1000 of property value for the western United States, including most of Nevada.

RMS has developed a model for Nevada, which makes assumptions about soil conditions based on simplified geologic map coverage in the state. They have estimated that commercial properties will contribute most of the insured loss.

Western States Seismic Policy Council

The Council reviewed the new policy recommendations adopted by the Western States Seismic Policy Council at its 2010 annual meeting (see www.wsspc.org or the appendix to these minutes).

ACTION ITEM: Terri Garside will put an item on the agenda for the 17 November 2010 NESC meeting to discuss and vote on possible adoption of the 2010 policy recommendations of the Western States Seismic Policy Council.

Soliciting Year-End Funding and Proposals from the Council

Jon Price noted that DEM occasionally has funds that become available near the end of the federal fiscal year, if grants that they pass through from FEMA are not fully used. The typical emergency management program grants from FEMA require a 50:50 federal:non-federal match.

In addition, FEMA has granted extra earthquake funds to Nevada in each of the last two years. These funds do not require a match. These extra funds are being used to pay for updating and printing *Living with Earthquakes in Nevada*, using the USGS ShakeMap output as input in HAZUS scenarios, and printing extra copies of the Wells earthquake report.

Craig dePolo suggested preparing a publication on issues regarding URMs, given the pending work described earlier by Wayne Carlson. Ron Lynn advised that such a publication should include policy options.

ACTION ITEM: Individuals proposing projects for possible year-end and other FEMA funding available to the NESC should submit a written proposal to the chair of one of the NESC committees, using the form at http://www.nbmg.unr.edu/nesc/proposal.pdf, at least one month before the 17 November 2010 NESC meeting. Please keep in mind that a 50:50 match is generally required for these projects.

Review of Action Items from the Previous NESC Meeting

Ron Lynn reviewed action items from the previous NESC meeting, most of which had been accomplished.

New and remaining action items include:

Jim Werle will send notices about the 43rd Symposium on Engineering Geology and Geotechnical Engineering, to be held in the UNLV Student Union on 23-25 March 2011, to Terri Garside, for forwarding to the NESC membership.

Graham Kent will see that there are links to the Great (California and Nevada) ShakeOut website from the Nevada Seismological Laboratory website (http://www.seismo.unr.edu/); Wanda Taylor will see that links are established from the UNLV Department of Geoscience website (http://geoscience.unlv.edu/); and Terri Garside will see that links are made from the NBMG (www.nbmg.unr.edu) and NESC (http://www.nbmg.unr.edu/nesc/index.html) websites. Terri will also distribute the ShakeOut website information to the NESC e-mail list, so that Council members and others can sign up to participate.

Terri Garside will put an item on the agenda for the 17 November 2010 NESC meeting to discuss and vote on possible adoption of the 2010 policy recommendations of the Western States Seismic Policy Council.

Individuals proposing projects for possible year-end and other FEMA funding available to the NESC should submit a written proposal to the chair of one of the NESC committees, using the form at http://www.nbmg.unr.edu/nesc/proposal.pdf, at least one month before the 17 November 2010 NESC meeting. Please keep in mind that a 50:50 match is generally required for these projects.

Terri Garside will schedule a presentation about the Stateline fault study by Jonathan Carter, UNLV graduate student supervised by Wanda Taylor, at a future NESC meeting, perhaps as early as 17 November 2010.

Public Comments and Announcements

There were no comments from the public.

Future meeting dates for NESC are as follows:

Wednesday, November 17, 2010, in Las Vegas (City Center)
Wednesday, February 9, 2011, in Reno
Wednesday, May 25, 2011, in Las Vegas
Wednesday, August 24, 2011, in Reno
Wednesday, November 9, 2011, in Las Vegas

The meeting adjourned at approximately 3:30 p.m..

Respectfully submitted, Jonathan G. Price, 1 October 2010

Nevada Earthquake Safety Council
c/o Nevada Bureau of Mines and Geology
University of Nevada, Reno/MS 0178
Reno, Nevada 89557-0178
775-682-8746

NEVADA EARTHQUAKE SAFETY COUNCIL
Members of the Board of Directors and Officers
(as of 1 October 2010)

Business and Industry, Southern Nevada	Steve Koenig Bellagio Resorts
Business and Industry, Northern Nevada	Fernando Ortiz Walmart Distribution Centers
Insurance Industry (statewide)	Greg Flanigan Farmers Insurance (Las Vegas)
State Government (statewide)	Jim Walker Nevada Department of Transportation
Local Government, City	Wayne Carlson Nevada Public Agency Insurance Pool (Carson City)
Local Government, County	Joe Curtis Storey County Emergency Management
Seismology (statewide)	Graham Kent Nevada Seismological Laboratory (UNR)
Geosciences, Southern Nevada	Woody Savage U.S. Geological Survey (retired)
Geosciences, Northern Nevada	Jonathan G. Price Nevada Bureau of Mines and Geology
Engineering, Southern Nevada	Jim Werle Converse Consultants (Las Vegas)
Engineering, Northern Nevada	Mike Blakely Structural Engineers Association of NV
Education (statewide)	Jenelle Hopkins Clark County School District, Las Vegas
Community Organizations, Southern Nevada	Doni Ward-McAlister American Red Cross
Community Organizations, Northern Nevada	Jim Reagan Sierra Pacific Power Company
University, Southern Nevada	Wanda Taylor UNLV Geoscience Department
University, Northern Nevada	Ian Buckle UNR Center for Civil Engineering Earthquake Research
Building Official, Southern Nevada	Ronald L. Lynn Clark County Department of Development Services
Building Official, Northern Nevada	Alan Bennett City of Reno
State Senate	Warren Hardy Nevada State Senator (Las Vegas)
State Assembly	Bernie Anderson Nevada State Assemblyman (Sparks)
Member at Large, Southern Nevada	Jim O'Donnell UNLV
Member at Large, Northern Nevada	Vacant

Members of the Executive Committee

Chair	Ronald L. Lynn
First Vice Chair-South	Wanda Taylor
First Vice Chair-North	Jim Reagan
Second Vice Chair-South	Jim Werle
Second Vice Chair-North	Vacant
Secretary	Jonathan G. Price
Past Chair	John Anderson
Division of Emergency Management Representative	Elizabeth Ashby
Senior Deputy Attorney General, counsel for NESC	Glade A. Myler

APPENDIX: Policy Recommendations
Adopted by the Western States Seismic Policy Council
at the annual business meeting on 9 July 2010

WESTERN STATES SEISMIC POLICY COUNCIL POLICY RECOMMENDATIONS 10-1 and 10-2
Rapid Tsunami Identification and Evacuation Notification

Policy Recommendation 10-1
WSSPC recommends that each coastal state, province, and territory emergency management agency promote the development of tsunami evacuation and re-entry notification systems, supplemented with an education campaign, that ensures all populated coastal areas in the WSSPC coastal states, territories and provinces are guided by at least one type of system, appropriate to local conditions.

Policy Recommendation 10-2
WSSPC recommends the implementation of modern technological systems that rapidly identify the tsunami potential generated from a local earthquake and that immediately alert locally responsible emergency operations personnel about coastal areas likely to be affected by a tsunami. Information provided by these systems would augment public education programs regarding local tsunamis, including instructions to evacuate based on ground shaking.

Background
Tsunamis have caused considerable damage and casualties to populated areas in the Pacific region over the last 100 years. Tsunamis usually are created by the rapid uplift of the sea floor during subduction zone earthquakes and locally by landslides triggered by the shaking. Tsunamis not only affect nearby coastlines within a few minutes following an earthquake, but they can travel long distances and impact distant shorelines within several hours.

Where nearby coastlines are affected, the public is instructed to move away from the shoreline and to high ground whenever strong or long ground shaking is felt, or in some cases, when any ground shaking is felt. People would only return to low lying coastal areas following receipt of an official all clear message. Whether the tsunami is generated from a distant source or from a local source, effective notification of the public is paramount.

Permanent residents and visitors occupy a variety of geographical locations and structures along the shoreline. Therefore, the use of redundant warning systems (such as radio broadcasts and outdoor sirens on beaches) would increase the immediacy and the coverage of the evacuation notification. Only with multiple systems can the best and most immediate coverage be obtained, thereby potentially minimizing the number of injuries and loss of life from the tsunami.

In some instances, ground shaking may be a precursor, and an “early warning”, to the occurrence of a tsunami. People in all coastal communities should be prepared to evacuate for higher ground when they feel strong or long duration ground shaking. Because many earthquakes do not cause tsunamis, a tsunami warning system should also be able to determine as quickly as possible if evacuation activities are necessary. Unnecessary evacuations are costly not only in terms of human risk and lost commerce, but in the public's negative reaction to the next earthquake experienced on the coast. The warning system should include: 1) earthquake and tsunami detection by a modern seismic network and Tsunami Warning Centers, respectively; 2) tsunami warning transmissions from the Tsunami Warning Centers to state and local emergency operations personnel; and, 3) direct notification to the coastal inhabitants, through the

use of broadcast media, as well as other locally appropriate measures (such as sirens, reverse 911, phone tree, etc.) to initiate emergency response plans.

Continued education is crucial to inform coastal residents and visitors of procedures to evacuate coastal areas upon feeling strong or long ground shaking and not wait for official notices.

Facilitation and Communication

1. Encourage representatives from state agencies and state lobbyists to use Policy Recommendation 10-1 in efforts with their legislative delegations to develop rapid, multiple tsunami education and notification systems in their respective states, territories and provinces. This includes promoting tsunami task forces or similar groups, soliciting local government support, and requesting funds. In addition, education and evacuation planning are critical components of overall tsunami risk reduction and, therefore, should be promoted along with tsunami notification systems.
2. 2. Forward Policy Recommendation 10-2 to the National Oceanic and Atmospheric Administration (NOAA), National Aeronautics and Space Administration, United States Geological Survey, and other organizations as appropriate, for their budget and technical support.

Assessment

The assessment of these policies can be measured by: 1) the adoption of tsunami hazard policies by state, territorial and provincial, as well as local governments on tsunami warning dissemination and evacuation; 2) comprehensiveness of notification systems adopted by state, territorial, provincial and local jurisdictions; 3) implementation of Public Law 109-424 that requires improvement in tsunami detection, forecasting, warning, notification, outreach, and mitigation in tsunami communities; 4) communities being designated by NOAA/National Weather Service as a TsunamiReady™ Community; and 5) number of public education workshops and surveys completed in at-risk tsunami communities.

History

Policy Recommendations 10-1 and 10-2 were first adopted as Policy Recommendations 01-1 and 01-2 by unanimous vote of the WSSPC members at the Annual Business Meeting October 24, 2001. PR 01-1 was revised and adopted as PR 04-1 by unanimous vote of the WSSPC membership at the Annual Business meeting September 30, 2004. PR 01-2 was re-adopted as PR 04-2 by unanimous vote of the WSSPC membership at the Annual Business meeting September 30, 2004. The Assessment section was revised and Policy Recommendations 04-1 and 04-2 were re-adopted as PR 07-1 and PR 07-2 by unanimous vote of the WSSPC membership at the Annual Business Meeting October 3, 2007. PR 07-1 and PR 07-2 were revised and re-adopted as PR 10-1 and 10-2 by unanimous vote of the WSSPC membership at the Annual Business Meeting July 9, 2010.

WESTERN STATES SEISMIC POLICY COUNCIL POLICY RECOMMENDATION 10-3 Post-Earthquake Technical Clearinghouses

Policy Recommendation 10-3

WSSPC recommends that each member state, province, and territory establish a plan for a post-earthquake technical clearinghouse to be activated if possible within 24 hours after each major earthquake within its jurisdiction. WSSPC also recommends that multijurisdictional agreements between and among WSSPC members and Federal agencies be in place that would allow for the establishment of a single comprehensive technical clearinghouse in the event of a large earthquake.

Background

Post-earthquake technical clearinghouses have been an important component of emergency response, recovery, and mitigation following large earthquakes. Seismologists deploy instruments that measure aftershocks and investigate the mechanics of earthquakes. Geologists and geotechnical engineers document ground failures, including fault displacements, fissures, landslides, rock falls, and liquefaction. Geodesists investigate ground deformation and related strain. Structural engineers evaluate the effects of the earthquake on various types of buildings, bridges, dams, utilities, and other structures. Social scientists study direct and indirect impacts to people and businesses. This information is then used to improve our assessments of earthquake hazards, earthquake engineering, mitigation strategies for nonstructural hazards, and emergency response to damaging earthquakes.

The data collected in the days immediately following a major earthquake can be critical during emergency response and recovery. Scientists and engineers can determine the likelihood that landslides will move (from rain or aftershocks), and can assess the susceptibility of structures to collapse. Some data are perishable and must be collected as soon as possible, before erosion or bulldozers eliminate the evidence or before aftershocks die out.

Data collected through clearinghouses help us to be better prepared for future large earthquakes. In addition, data on strong ground motion and damage to buildings helps to calibrate loss-estimation models. The Federal Emergency Management Agency's (FEMA) HAZUS, can be an important component of a Governor's or the President's disaster declaration as well as provide useful information for response, recovery and hazard mitigation.

A technical clearinghouse, either physical or web based (virtual), can serve to coordinate post-earthquake investigations and to share resources and information among investigators. The clearinghouse also serves to integrate and disseminate information so that it is available to decision makers and the media. Post-earthquake technical clearinghouses were successfully implemented following the Landers, California (1992); Northridge, California (1994); Nisqually, Washington (2001); and Wells, Nevada (2008) earthquakes. A clearinghouse provides a place for scientists and engineers to report on their findings each day. In some post-earthquake situations, a clearinghouse may serve as one of the chief mechanisms for relaying critical information from scientists and engineers investigating the earthquake to emergency managers.

Only California, Utah, and Nevada have developed plans for post-earthquake technical clearinghouses. Few WSSPC members have the resources to fully staff and operate a clearinghouse. Opportunities exist for members to collaborate with one another and to coordinate with the U. S. Geological Survey (USGS), FEMA, Earthquake Engineering Research Institute (EERI), university researchers, and other groups. The National Earthquake Hazards Reduction Program (NEHRP) agencies (USGS, FEMA, National Institute for Standards and Technology, and National Science Foundation) developed *The Plan to Coordinate Post-Earthquake Investigations* in 2003 (USGS Circular 1242) that includes provisions for cooperating with states to establish post-earthquake technical clearinghouses. Under this plan, the NEHRP agencies can step in and take the lead if WSSPC members are not prepared to establish a clearinghouse. Multijurisdictional cooperation is especially important in the evident of a large earthquake that affects multiple WSSPC members. Previously established Memoranda of Agreements (MOA) between and among WSSPC members and Federal agencies would allow for the establishment of a single comprehensive technical clearinghouse for such an event.

Facilitation and Communication

WSSPC recommends that its members establish a plan for a post-earthquake technical clearinghouse (physical or virtual as circumstances dictate) to be activated if possible within 24 hours after a major earthquake within its jurisdiction. WSSPC further encourages its members to form MOAs to facilitate the operation of clearinghouses, including sending employees from one jurisdiction to another to assist in

collection of field data and in staffing a clearinghouse. WSSPC will construct a roster of experts who are willing to participate and disseminate information on clearinghouses that are established after an earthquake.
The NEHRP agencies' post-earthquake investigations plan specifies coordination with states to operate clearinghouses. WSSPC members should develop MOAs with NEHRP agencies to facilitate clearinghouse staffing and operations, and to specify whether a member wishes the NEHRP agencies to take responsibility for establishing a clearinghouse. These MOAs could include triggers, such as USGS or EERI deployment only if moment magnitude or earthquake intensity exceeds certain values for an urban epicenter or for a rural earthquake. WSSPC members may wish to activate clearinghouses at lower triggers for purposes of training or when sufficient resources exist to respond to the earthquake. Any MOA should recognize the considerable role and interest of FEMA in post-earthquake technical clearinghouses.

To achieve the above goals, WSSPC will establish a Post-Earthquake Technical Clearinghouse Committee (PTCC) to update the WSSPC model post-earthquake technical clearinghouse plan, create a model virtual clearinghouse template for use by WSSPC members, and develop model MOAs for use among members and between members and NEHRP agencies for post-earthquake technical clearinghouse operation and assistance. PTCC should conduct workshops and use other means to help members establish individual post-earthquake technical clearinghouse plans and implement clearinghouse MOAs.

WSSPC recommends that the USGS provide mirrored or parallel access to its post-earthquake website. One ultra-high volume portal should be available to the general public. A second, password-protected site should be maintained. State emergency management agencies, state geological surveys, state seismic safety commissions and councils, earthquake consortia, university

seismological laboratories, and engineering-research centers should have access to the password-protected site.

WSSPC recommends that emergency response and recovery plans incorporate and refer to post-earthquake technical clearinghouse plans. There should be links between the technical clearinghouse and emergency management operations. Because the clearinghouse can provide vital information during emergency response and recovery, FEMA should work with emergency managers to assure that appropriate federal funding and FEMA staff support are provided for the clearinghouse, whenever a clearinghouse is established following an earthquake.

Once members have established post-earthquake technical clearinghouse plans, WSSPC recommends that they hold regular training sessions and exercises to ensure readiness and compatibility with other emergency response functions. WSSPC also recommends that those responsible for mobilizing post-earthquake clearinghouses participate in large-scale earthquake exercises sponsored by states or local jurisdictions to test procedures that link research activities with emergency operations centers.
Funding will be required to pay travel to update WSSPC's model post-earthquake technical clearinghouse plan, create a virtual clearinghouse template, prepare model MOAs, and hold workshops. WSSPC and the PTCC should take the lead in developing a proposal to acquire the necessary funding if work cannot be performed at WSSPC annual meetings and by electronic means.

Assessment

Measures of the success of this Policy Recommendation will be (1) the number of additional WSSPC members that develop post-earthquake technical clearinghouse plans, and (2) the number of MOAs established to facilitate clearinghouse operation. A periodic assessment should be made to determine the number of functioning clearinghouse plans and supporting MOAs. WSSPC will periodically update its model post-earthquake technical clearinghouse plan, and will post this and individual member plans on the WSSPC website.

History

Policy Recommendation 10-3 was first adopted as Policy Recommendation 01-3 by unanimous vote of the WSSPC membership at the Annual Business meeting October 24, 2001. PR 01-3 was revised and re-adopted as PR 04-3 by unanimous vote of the WSSPC membership at the Annual Business meeting September 30, 2004. The Background section was revised and PR 04-3 was re-adopted as PR 07-3 by unanimous vote of the WSSPC membership at the Annual Business Meeting October 3, 2007. PR 07-3 was re-adopted as PR 10-3 by a majority voice vote of the WSSPC membership with Hawaii voting against the policy recommendation at the Annual Business Meeting July 9, 2010.

WESTERN STATES SEISMIC POLICY COUNCIL POLICY RECOMMENDATION 10-4
Seismic Provisions in the 2009 International Building Code

Policy Recommendation 10-4

WSSPC endorses the prompt adoption and enforcement of the seismic provisions of the 2009 *International Existing Building Code*, the 2009 *International Building Code*, and the 2009 *International Residential Code* as minimum standards by states, territories, provinces and/or local jurisdictions. Further, WSSPC discourages modifications or amendments that would weaken the Code or its required inspections. WSSPC also encourages Code organizations to continue the development and refinement of building codes and consensus standards to remain substantially equivalent to the National Earthquake Hazards Reduction Program (NEHRP) Recommended Seismic Provisions for New Buildings and Other

Structures (FEMA 750) with a specific focus on purpose, education, incentives, lifelines and the business/industry and homeowner sectors.

Background

Some states, and many jurisdictions, have not adopted the *International Building Code*, potentially leaving their citizens at continued risk. States should be encouraged to remove obstacles which hinder adoption, and to motivate local jurisdictions to diligently update existing codes. It is recognized that some jurisdictions which have adopted the International Codes have drastically modified or omitted the seismic provisions of the Codes. This action not only jeopardizes their structures by not providing for earthquake resistant structures, but provides a false sense of security to their communities. Once adopted, the Codes must be uniformly and consistently enforced if they are to be effective. This will necessitate the training of building inspectors to some required standards for certification. Partnerships with the homeowners, residents, builders, insurers, owners, elected officials, scientific groups, and others with focused concerns on lifelines and public safety will be required to overcome the inertia of commitment to meet the desired outcomes.

Facilitation and Communication

Incentive measures will need to be developed that involve federal, state, territorial, provincial and local funding to "encourage" adoption of building codes that recognize local natural hazards caused by earthquakes. Education of the public on the need and purpose for codes must work towards a mindset to mitigate damage from earthquakes before they happen. Local building code inspectors will require training and certification in the new codes.

Assessment

A measure of the acceptance of this policy recommendation is the number of states, provinces, territories and local jurisdictions that have adopted seismic provisions that meet or exceed the seismic provisions in the 2009 editions of the *International Existing Building Code*, the *International Building Code*, and the *International Residential Code*.

History

Policy Recommendation 10-4 was first adopted as Policy Recommendation 01-4. PR 01-4 was revised and re-designed as PR 04-4 and re-adopted by unanimous vote of the WSSPC membership at the Annual Business Meeting September 30, 2004. The Policy Recommendation statement was revised and PR 04-4 was re-adopted as PR 07-4 by unanimous vote of the WSSPC membership at the Annual Business Meeting October 3, 2007. PR 07-4 was revised and re-adopted as PR 10-4 by unanimous voice vote of the WSSPC membership at the Annual Business Meeting July 9, 2010.

WESTERN STATES SEISMIC POLICY COUNCIL POLICY RECOMMENDATION 10-5 Basin and Range Province Earthquake Working Group(s)

Policy Recommendation 10-5

WSSPC recommends convening a technical Basin and Range Province Earthquake Working Group(s) (BRPEWG) to meet with experts from Basin and Range Province (BRP) states to arrive at consensus average recurrence intervals (RI) and slip rates (SR) and other seismic hazard parameters with related uncertainties for active faults. Best available RI and SR values with appropriate uncertainties are critical to U.S. Geological Survey (USGS) seismic-hazard evaluations and for determining which faults should be included on the National Seismic Hazard Maps (NSHMs). The BRPEWG(s) should be convened under the auspices of the USGS NSHM project.

Background

With release of the Quaternary fault and fold database of the U.S. by the USGS, based in part on completion of databases by states, the need arises to look critically at existing paleoseismic-trench data, and where the data permit, develop consensus regarding appropriate average RI and SR values and related uncertainties for faults in each state.

Only three BRP states (California, Utah, and Nevada) have completed comprehensive reviews of their paleoseismic trenching data to determine consensus RI and SR values. In most instances, currently available RI and SR values are the result of individual studies performed over a period of decades by a variety of investigators with varying levels of experience and resources. Older studies lack the advantage of recent advances in paleoseismic techniques, particularly refinements in sampling strategies and dating technologies. Consequently, available RI and SR values are not all of equal reliability, and often uncertainties associated with those data are either poorly defined or not reported.

Achieving consensus on complex technical issues requires a process of inquiry, discussion, and agreement. Technical working groups have successfully reached consensus in many instances, including the Working Groups on California Earthquake Probabilities, the Utah Quaternary Fault Parameters Working Group, and various Utah geologic-hazards-mapping working groups. A previously convened BRPEWG successfully brought together scientists to identify issues, discuss evidence, and define strategies for resolving issues regarding fault behavior in the BRP important to the next update of the NSHMs.

Facilitation and Communication

WSSPC recommends that individual BRP states identify the faults for which sufficient paleoseismic trenching data are available to develop average RI and SR values and related uncertainties. The national Quaternary fault and fold database and state Quaternary fault databases form the basis for identifying these faults. Once identified, the BRPEWG(s) can meet with appropriate state experts to arrive at consensus RI and SR values as has already been done in California, Utah, and Nevada. Where consensus can be achieved, the BRPEWG can make recommendations for the USGS to consider in future updates of the NSHMs. Where consensus is not yet possible, an interim recommendation can be made for consideration in the NSHMs, and a research program outlined to resolve the issues so that consensus can ultimately be reached. Thus, a principal product of the process will be a list of priorities for future studies needed to achieve consensus that can provide support for the USGS in setting priorities both for internal studies and for the National Earthquake Hazard Reduction Program (NEHRP) External Grants program.

Funding will be required to pay travel and some salary expenses to hold workshops and to prepare reports. The WSSPC Basin and Range Committee, BRP state geological surveys, or other organizing entity should take the lead in developing a proposal to acquire funding. The BRPEWG(s) will serve only for the time it takes to complete their work, and then will be suspended until additional information becomes available for consideration.

Given the importance of RI and SR data to the NSHMs, the completion of such reviews is critical in all WSSPC BRP states. WSSPC should work with the USGS to encourage such work by giving it a priority in the annual NEHRP Request for Proposals to help provide necessary funding. Other potential funding sources include the Federal Emergency Management Agency and internal funding from individual BRP states.

Assessment

The success of this Policy Recommendation can be assessed based on: (1) the number of states that empanel a BRPEWG to develop consensus RI and SR values, (2) the use of the resulting consensus RI and SR values by the USGS in future updates of the NSHMs, and by states and local governments in regulations and ordinances, and (3) the presentation of BRPEWG results to state emergency managers to ensure that the results reach the general public in a timely manner. A periodic assessment should be made to determine the extent to which the consensus RI and SR values are being incorporated into the NSHMs; individual probabilistic seismic hazard analyses; and state and local seismic-hazard rules, regulations, and guidelines.

History

Policy Recommendation 10-5 was first adopted as Policy Recommendations 04-5 by unanimous vote of the WSSPC membership at the Annual Business Meeting September 30, 2004. The Policy Recommendation statement was revised and PR 04-5 was re-adopted as PR 07-5 by unanimous vote of the WSSPC membership at the Annual Business Meeting October 3, 2007. PR 07-5 was revised and re-adopted as PR 10-5 by unanimous voice vote of the WSSPC membership at the Annual Business Meeting July 9, 2010.

WESTERN STATES SEISMIC POLICY COUNCIL POLICY RECOMMENDATION 10-6 Post-Earthquake Information Management System

Policy Recommendation 10-6

WSSPC supports the development of a national Post-Earthquake Information Management System. The Management System would provide permanent archiving of essential data related to natural and socio-economic earthquake effects and the performance of the built environment from earthquakes within the United States, and could be combined with similar data systems that assemble and archive data from other natural hazards events, or geosciences data repositories that archive physical and electronic data

Background

Future improvements in the ability to engineer and construct buildings and other structures and infrastructure systems that can perform as needed in strong earthquakes depends on knowing about the performance resulting from current and past design and construction practices. No mechanisms are in place to systematically collect and archive these performance data for future use. Technical clearinghouses provide a means to assemble damage data reports that provide decision support for emergency management operations immediately following a significant event; however, much of that data is incompletely documented and becomes essentially lost soon thereafter. Data collected through post-earthquake technical clearinghouses (see WSSPC Policy Recommendation 07-3) and activities such as those sponsored by the Earthquake Engineering Research Institute (EERI) can help us to be better prepared for future earthquakes – if the data are adequately documented, securely archived, and identified in a manner to make them available for use decades into the future.

The Management System data archive would contain technical information collected by post-earthquake clearinghouses as well as other information related to the particular event. The Post-Earthquake Information Management System would be consistent with the recommendations in National Earthquake Hazards Reduction Program (NEHRP) Plan to Coordinate Post-Earthquake Investigations (USGS Circular 1242):

"It is critical to develop strategies for the formal and systematic archiving of data collected during post-earthquake investigations. These data, which focus on the natural, built, and socioeconomic environments, address a wide variety of phenomena. The data are voluminous and are acquired in many forms (for example, digital recordings, digital images, clipboard survey sheets, photographs, and narratives). If not organized and archived soon after an earthquake event, these data are often lost. No mechanism currently exists either to archive these data or to make them readily accessible to the research community. Because of this failure to adequately document, preserve, and access data, an enormous volume of highly relevant data has been effectively lost."

A similar national effort of scientific data preservation has been undertaken by the state geologic surveys and the USGS. The National Geological and Geophysical Data Preservation Act of 2005, Section 315 of the Federal Energy Act of 2005, authorizes $30 million for each of 5 years to help develop databases and sample repositories across the nation. Where applicable, the Post-Earthquake Information Management System could coordinate with this effort and provide a comprehensive data repository for all earth science and hazard information.

Facilitation and Communication

Adequate funding is necessary to establish this data collection guidance, and WSSPC supports use of federal funding, through NEHRP and/or the Stafford Act to support these activities for significant events. Earthquake clearinghouses may be established through specific mission assignments under the Stafford Act or through individual state authorizations.

WSSPC supports the development of a pilot or demonstration Post-Earthquake Information Management System project as soon as possible. This pilot could use data previously collected from a recent disaster, and would serve as a model to facilitate the implementation of a more general Management System following the next earthquake disaster.

WSSPC members are encouraged to develop public and private partnerships and Memoranda of Understanding with owners and regulators for the purpose of assuring that earthquake performance and damage information would be collected and made available for future use. These partnerships would identify critical data gaps and work to develop data collection strategies to fill those gaps in the aftermath of a significant event. These memoranda will need to address such issues as the need for inventory information, restrictions on facility access, security of confidential or sensitive data, etc.

WSSPC encourages its members to support operation of a standardized national Post-Earthquake Information Management System. Members are encouraged to coordinate their data post-earthquake collection and clearing house activities with the national Management System, and provide collected data and information to the post-earthquake data archive that is a component of the Management System. A key element in the Management System is standards for the specification of the types and formats of information necessary to be collected to ensure a thorough and accurate documentation of performance of the built environment during the earthquake.

Assessment

Measures of the success of this policy will be (1) the annual communication of WSSPC members' support to NEHRP (and to other federal agencies as appropriate) for the establishment of a national Post-Earthquake Information Management System, (2) written support for the establishment of a pilot or demonstration Post-Earthquake Information Management System as developed by the American Lifelines Alliance or some other entity, and (3) preparation of an annual summary of WSSPC members' state-level progress in establishing in their jurisdictions one or more local or regional partnerships and agreements for the purpose of assuring the collection of post-earthquake performance and damage information for long-term use. This assessment procedure assumes that the success of the policy may take many years to accomplish.

History

Policy Recommendation 10-6 was first proposed for adoption as PR 07-6 at the Annual Business Meeting October 3, 2007, where it was unanimously approved by the WSSPC membership as amended. Policy Recommendation 07-6 was re-adopted as PR 10-6 by unanimous voice vote of the WSSPC membership at the Annual Business meeting July 9, 2010.

WESTERN STATES SEISMIC POLICY COUNCIL POLICY RECOMMENDATION 10-7
Seismic Design of New Schools

Policy Recommendation 10-7

WSSPC recommends that each member state, province, and territory establish and fund an active program to improve the seismic safety of new schools and ensure that seismic building code provisions for new schools are followed. WSSPC also recommends that FEMA provide dedicated financial support for the establishment of a program that improves the seismic safety of new schools.

Background

School facilities are used by communities for meeting places and are frequently utilized as areas of refuge or impromptu command centers during natural disasters and other emergencies. The use of schools in this fashion is commonplace throughout most of America, particularly so in rural areas. Current building codes and design standards typically identify schools as an intermediate priority occupancy classification (Occupancy Category III). School facilities that are designed and built under this set of assumptions essentially end up being constructed to ensure that the structure has earthquake survivability and is not specifically designed to remain functional (i.e. safe and habitable) after a design level seismic event. Additionally, in most instances there are no special seismic performance requirements for utilities such as water, electrical, sewer, Heating Ventilation and Air Conditioning. This presents an obvious problem where school facilities are used as emergency shelters or impromptu command centers.

If the Occupancy Category were increased to level IV and a minimum of Seismic Design Category C is required, then school facilities with an occupant load greater than 250 persons would be designed and constructed as essential facilities or in conformance with the community's actual use. The structures

themselves would have greater seismic resistance and be able to remain functional after a design level seismic event. The increase in design level will also facilitate greater community and economic resilience after an earthquake by allowing parents of school-aged children to return to work more rapidly.

Individual School Districts and private operators should also be made aware of FEMA 241 which addresses mitigating non-structural hazards from building contents and occupancy habits. Post disaster assessments have identified that many common injuries and some types of damage can be prevented by properly mitigating non-structural hazards. There is also the additional benefit that school children would be better protected while attending classes.

Facilitation and Communication

This policy recommendation will be sent to all identified policy and decision makers (elected officials, heads of key departments such as emergency managers, building officials and planners and chairs of State Seismic Safety Commissions and Boards) as well as to WSSPC representatives in the member states.

Assessment

A measure of the acceptance of this policy recommendation is the number of states, provinces, and territories that adopt these or similar elevated seismic design standards for school facilities.

History

Policy Recommendation 10-7 was adopted by majority voice vote of WSSPC members July 9, 2010 at the Annual Business Meeting in Broomfield, Colorado. Hawaii was opposed.

WESTERN STATES SEISMIC POLICY COUNCIL POLICY RECOMMENDATION 10-8 Identification and Potential Mitigation of Seismically Vulnerable School Buildings

Policy Recommendation 10-8

Children have the right to be safe in school buildings during earthquakes. WSSPC recommends each state, province, territory, and community adopt a program that would identify and rank the potential seismic vulnerability of schools in their communities in a timely manner. Furthermore, programs to reduce the seismic vulnerability of those schools at greatest risk should be developed. WSSPC also recommends that FEMA provide dedicated financial support for the establishment of a program that improves the safety of seismically vulnerable schools.

Background

Every community is required to educate children and it is the responsibility of governmental agencies to design and construct safe buildings to house them. While current building codes and construction practices have recognized the effects of earthquakes and provide state-of-the art design considerations, many older school buildings were built before these principles were understood. Additionally, many existing buildings are constructed of materials such as unreinforced masonry, which are not in common use today due to their poor performance in past earthquakes throughout the world. These older buildings have not been properly graded or passed the test of seismic safety. Consequently, many students face significant seismic risk.

Schools are a vital piece of the fabric of communities and are often considered to be part of their critical infrastructure. Some communities view these resources as potential post-disaster gathering places, yet virtually all will agree that their loss of function as an educational facility after an earthquake would seriously affect recovery.

With the economic emphasis on the reuse of existing resources, it is important to recognize the need to assure that existing buildings are properly retrofitted to extend their life and create greater assurance of their safety against future earthquakes. Public safety is a distinct presumption and should be considered outside of the realm of education spending. Furthermore, the costs for seismic retrofitting can often be

segregated into discreet projects that can be incrementally achieved through the existing maintenance and upkeep programs already a part of most school building programs.

WSSPC strongly believes that protecting children from preventable injury during a seismic event is of the highest priority. Jurisdictions must proactively address this issue by undertaking a systematic program to inventory and rank unsafe buildings in their communities, and to develop a related follow-on program to reduce the seismic vulnerability of those buildings. Occupant safety should not be deemed "lucky" as has occurred in many school buildings in past earthquakes when they occur outside of school hours.

WSSPC understands the costs associated with such a program can be challenging and needs to be fully justified in order to be properly assessed and ranked within the budgeting process. Therefore it is necessary to put sufficient energy and resources into quantifying the extent of the problem in communities and provide measurable metrics that will help decision-makers adequately measure the degree of risk within their communities. The first step toward seismic safety of schools should be to demonstrate the magnitude of the problem; then the community can prepare to take the necessary preventative measures.

Facilitation and Communication

A program to identify, rank, and address the risk presented by unsafe schools in their communities in a timely manner should consist of the following steps:

1. **Inventory All Existing School Buildings.** The creation of an initial rapid visual inventory of all existing school buildings should be undertaken in order to quantify the extent of buildings that should be further investigated. The inventory should be made available to the public. This process can be achieved through the use of the Federal Emergency Management Agency's procedures described in FEMA 154, *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Second Edition.* Buildings which fail to meet an appropriate building performance level should be investigated by more advanced means. An available tool is ASCE-31, *Seismic Evaluation of Existing Buildings,* to allow for proper ranking within the inventory for appropriate rehabilitation measures.

2. **Rank School Buildings for Seismic Safety.** This step will include the determination of the state, province, territory, or community's appropriate building performance level (Table C1-2, Damage Control and Building Performance Levels, in ASCE-41, *Seismic Rehabilitation of Existing Buildings)* such that the building stock may be prioritized. It is recommended that this process include a broad number of stakeholders in order to engage the largest possible audience in determination of thresholds for public school safety. All schools that are collapse prone under current design levels should be ranked as a high priority. The rankings should be made available to the public.

3. **Develop a Program to Reduce Seismic Vulnerability of School Buildings**. Each state, province, territory, or community will want to balance its available resources and degree of public concern with programs to achieve seismic safety for their schools. This may range from short-term mandatory programs to implement retrofitting to phase-out programs to eliminate the most dangerous buildings. Additionally, incentive-based, grant funding, or incremental strengthening programs which move toward safer schools within a certain timeframe can also be effective.

Assessment

The effectiveness of this policy can be determined by maintaining an inventory of states, provinces, territories, and communities that have developed programs to address unsafe school buildings. This should include the type of program, its stage of development and any legislative initiatives, which are in support of the policy. By collecting and identifying these individual efforts, WSSPC will provide a

clearinghouse of information that can be used to help promote public policy and advocate the need for greater safety for school buildings.

History
Policy Recommendation 10-8 was adopted as amended by unanimous voice vote of the WSSPC members on July 9, 2010 at the WSSPC Annual Business Meeting in Broomfield, Colorado.

WESTERN STATES SEISMIC POLICY COUNCIL POLICY RECOMMENDATION 10-9 Earthquake Early Warning Systems

Policy Recommendation 10-9
WSSPC supports the development of earthquake early warning systems in those states or regions with high seismic risk and a seismic network that can, or can be enhanced to, support an early warning capability.

Background
Earthquake early warning differs from earthquake prediction in that an earthquake prediction provides the time, location, magnitude and probability of occurrence of an earthquake, that is, an earthquake that is expected to occur hours, days, weeks or years in the future. In contrast, earthquake early warnings are issued as the earthquake is occurring and provide alerts to people and communities that have not yet experienced ground motion from the earthquake. Earthquake early warnings are possible because earthquakes produce differing types of waves that travel at different speeds. The faster P waves travel at about 6.5 kilometers per second and are first to arrive at seismic monitoring stations. Although they are of low amplitude and unlikely to cause damage, these P waves contain important information about the size and location of an evolving seismic sequence. Slower moving S waves (3.5 km per second) arrive after the P waves and cause more intense shaking capable of damage to buildings and infrastructure.
Based on information from the earlier arriving P waves, the expected maximum shaking can be estimated through rapid analysis and alerts can be issued to communities likely to be impacted by the earthquake. These alerts can be transmitted at the speed of light so communities that are distant from the earthquake epicenter but vulnerable to strong motion may receive a few to a few tens of seconds warning prior to the arrival of damaging S waves. Alert times vary from almost no warning in the area nearest the epicenter to 60-80 seconds in areas at some distance from the epicenter. As implied in this description, earthquake early warnings are of greatest benefit in large, though rare, major earthquakes in which regions remote from the epicenter are vulnerable to very strong ground motions from an earthquake.

A nationwide earthquake early warning system was implemented in Japan on October 1, 2007. The system is based on Japan's extensive and dense seismic and strong motion networks that were enhanced following the January 17, 1995 Hanshin-Awaji (Kobe) earthquake. Japan's earthquake early warning system has been gradually deployed and warnings are received through computers, the media and signaling devices installed in homes, critical facilities and businesses. Early warnings are used to slow or stop trains, alert drivers of motor vehicles, control elevators (to prevent people being trapped), regulate industrial processes and notify people at home or work that they should move away from hazards and protect themselves. Limited systems are in place in Mexico, Turkey, Italy and Greece and Taiwan plans to introduce a system like Japan's in the near future.

Although the United States has followed scientific and technological developments in other nations, it has not yet implemented an earthquake early warning system anywhere on U.S. soil. Currently, the U.S. Geological Survey is providing funding for the development of early warning algorithms and discussions among scientists, engineers and emergency managers on the topic have intensified over the last 2 years. A little known early experiment with earthquake early warning took place in the days and weeks following

the Loma Prieta Earthquake of October 17, 1989. Within a few days after the M6.9 main shock, portable instruments were installed at three locations near the epicenter of the earthquake and early warnings of aftershocks were transmitted to search and rescue workers at the I-880 Freeway collapse, and later, to those doing demolition work on that structure (Bakun *et al.*, 1994). The system was in place for approximately six months, then dismantled.

Although earthquake early warning systems should not be advocated at the expense of hazard education, preparedness activities and programs of mitigation, earthquake early warning systems, if implemented, have the potential to save lives, reduce damage and limit down time particularly for large regional earthquakes. Those states that have urban populations and infrastructure vulnerable to major earthquakes as well as modern digital seismic and strong motion networks may consider earthquake early warning as another useful tool for addressing the earthquake hazard. Earthquakes are often described as hazards without warnings, but seismic-network-based early warning systems could provide an alert with sufficient time to implement life safety actions and rapid mitigation.

Facilitation and Communication

WSSPC recommends that its members establish state level working or study groups on earthquake early warning that include interested scientists, engineers and emergency managers. These working groups will serve in several capacities: as clearinghouses of information on this new technology and as a body of experts who are able to speak on the subject at scientific and emergency management meetings; to assess the need for seismic and strong motion network enhancement or upgrades to support earthquake early warning; to identify local areas within states where earthquake early warning system deployment is feasible or functions to which early warning will be applied; to address the broader policy issues of the organization and management of an earthquake early warning system; and, serve as advocates for earthquake early warning before legislative bodies, the media and the public.

Earthquake early warning technical prerequisites include dense station coverage, modern digital seismic and strong motion stations, real-time telemetry from stations to a central processing site and algorithms to rapidly analyze an evolving seismic sequence. High sample rate GPS and other rapid analysis technologies may also be useful. Within the working groups, earth science representatives must take the lead in assessing existing networks and recommend modifications, as necessary, to support an earthquake early warning capability. Scientists and engineers within the working groups will be essential in developing proposals to funding agencies to implement network enhancements that will facilitate the development of earthquake early warning systems. It should also be noted that enhancements to regional networks and the Advanced National Seismic System (ANSS) will yield benefits in addition to earthquake early warning capability, benefits that include more rapid and accurate source information and ShakeMaps.

Given resource limitations and considerations, choices may be required regarding where an earthquake early warning system will be deployed, including what processes or functions will be affected. In most cases, earthquake early warning systems will be deployed in areas that will potentially protect the largest number of people or in areas that include critical infrastructure. Japan introduced earthquake early warning decades ago to slow or stop high speed trains (Shinkansen) that might be derailed by strong ground motion in an earthquake.

Earthquake early warning systems involve far more than the technical capacity to issue early warnings, so working groups should provide a forum for discussions of how an early warning system will operate and be managed. Basic questions include: what agency will have lead responsibility for the system? What will be the division of labor between science agencies, seismic and strong motion network operators, emergency management organizations, private consultants and others? How will issues of legal authorities and liabilities be managed? The working groups should include both scientists and emergency managers who can speak on behalf of the technology at scientific meetings, meetings of emergency services personnel and provide clear and cogent explanations of the working of an earthquake early warning system to the media and public.

Finally, the working groups should think strategically about implementation of an earthquake early warning system by developing a long-term plan. This plan should include all of the elements discussed in this section as well as articulate a process for achieving a working earthquake early warning system. The plan may include model legislation or a proposal that includes goals, objectives and costs of implementation.

Assessment

Measures of the success of this Policy Recommendation will be (1) the number of WSSPC members that form earthquake early warning working or study groups, and (2) the number of WSSPC member states that implement earthquake early warning systems. A periodic assessment should be made to determine whether working groups have been formed and whether early warning systems have been developed or are being considered. WSSPC will post information on state efforts to implement earthquake early warning systems on the WSSPC website.

History

Policy Recommendation 10-9 was adopted unanimously by voice vote of the WSSPC members at the July 9, 2010 Annual Business Meeting in Broomfield, Colorado.

Reference Cited

W.H. Bakun, F. G. Fischer, E.G. Jensen, and J. VanSchaack, April 1994, Early Warning System for Aftershocks: *Bulletin of the Seismological Society of America*, V. 84, No. 2, p. 359-365.