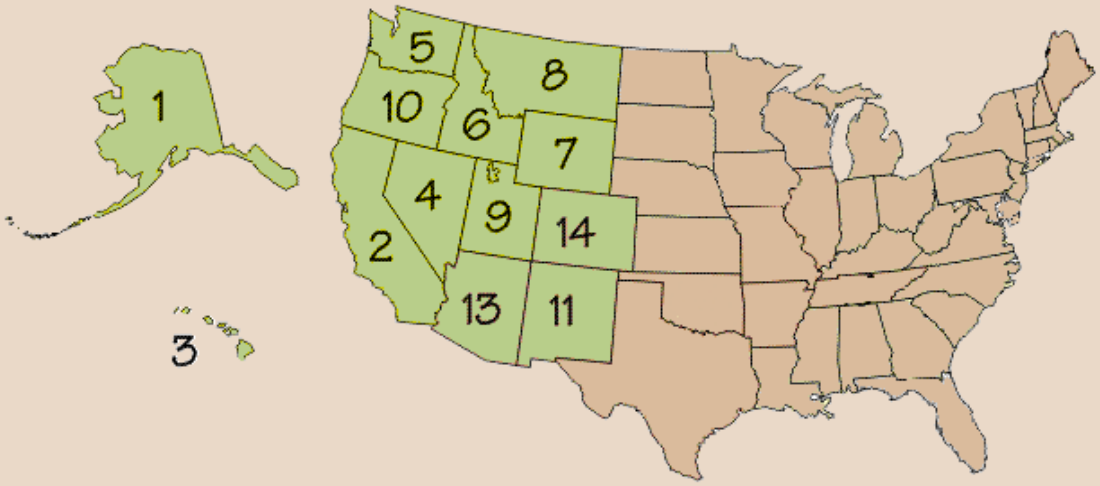
WSSPC
WESTERN STATES
SEISMIC POLICY
COUNCIL

2013 Annual Report



WSSPC U.S. states ranked by national number of annual earthquakes.

Western States Seismic Policy Council

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DISCLAIMER

The views and conclusions contained in this report are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Government. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Government; by the Western States Seismic Policy Council (WSSPC), or by WSSPC members, agencies and affiliates.

Cover image: Map of the United States ranking states by number of earthquakes. States that fall within the WSSPC region are colored green (Canada and U.S. Territories were not included in the original map). Cover map presented as modified from the United States Geological Survey map located at: *http://earthquake.usgs.gov/earthquakes/states/top_states.php*

2013 WSSPC ANNUAL REPORT
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ACKNOWLEDGMENTS

The Western States Seismic Policy Council (WSSPC) is a 501(c)(3) non-profit organization funded by the Department of Homeland Security through its Federal Emergency Management Agency (FEMA). Funding for the WSSPC 2013 annual report was provided through FEMA Cooperative Agreement EMW-2013-CA-K00130. The annual report summarizes seismic policy development and earthquake/tsunami hazard reduction activities conducted by the Western States Seismic Policy Council and its member agencies for the fiscal year that runs from December 1, 2012 through November 30, 2013.

We are grateful to our WSSPC affiliate members who help us defray operating costs not covered by FEMA. The 2013 WSSPC Affiliate members were:

Private Corporation:

California Earthquake Authority, Sacramento, California

Degenkolb Engineers, Inc., San Francisco, California

John A. Martin & Associates, Los Angeles, CA

Saunders Construction, Inc.

State Farm® Mutual, Bloomington, Illinois

Local Government:

City and County of San Francisco, California - Earthquake Safety Implementation Program (ESIP)

City of Las Vegas, Nevada - Building and Safety Department

City of Norwalk, California – Office of Emergency Management

Clark County, Nevada - Building Department

Individual:

Dominic Sims, Chief Executive Officer, International Code Council

Non-Profit Organization:

Applied Technology Council, Redwood City, California

Earthquake Engineering Research Institute (EERI)

SECTION A

WSSPC Organization

MISSION AND GOALS

The Western States Seismic Policy Council (WSSPC) is a regional earthquake consortium representing thirteen states, four territories, and one province in western United States and Canada. Organized as a 501(c)(3) non-profit organization – and funded by the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) – WSSPC is an important component of the U.S. National Earthquake Hazards Reduction Program (NEHRP), serving as an efficient and effective clearinghouse for earthquake mitigation information and ideas.

WSSPC's primary mission is to develop seismic policies and share information to promote programs intended to reduce earthquake-related losses. Our goals are to:

- Promote regional cooperation and the interaction of the State Emergency Management, State Geological Surveys, and State Seismic Councils and Commissions in the formation of, and advocacy for, seismic policy.
- Improve the overall awareness of earthquake hazards and methods to mitigate the associated risks; develop strategies to enhance earthquake preparedness; and support earthquake studies and earthquake preparedness activities that will reduce or eliminate deaths, injuries and property damage.
- Serve as a resource for earthquake and tsunami-related information, in coordination with other regional and national earthquake organizations.
- Advocate adoption and implementation of seismic mitigation policies at all levels of government.

Members consist of the directors of the state, provincial or territorial emergency management agencies and geological surveys in the WSSPC region, as well as a designated representative for their seismic safety commission, board or council. Members represent diverse constituencies geographically, demographically, and culturally – bringing broad expertise and perspective to the policy table.

Total population of the region served by WSSPC is over 22% of the two countries' combined 342 million population, demonstrating the potential reach of policies developed by WSSPC members.

Population Statistics for WSSPC Region

WSSPC Region	Population
USA	**72,214,313.00**
Alaska	710,231.00
American Samoa	55,519.00
Arizona	6,392,017.00
California	37,253,956.00
Colorado	5,029,196.00
Guam	159,358.00
Hawaii	1,360,301.00
Idaho	1,567,582.00
Montana	989,415.00
Nevada	2,700,551.00
New Mexico	2,059,179.00
Northern Mariana Islands	53,883.00
Oregon	3,831,074.00
Utah	2,763,885.00
Washington	6,724,540.00
Wyoming	563,626.00
Canada	**4,433,954.00**
British Columbia	4,400,057.00
Yukon	33,897.00
Grand Total	**76,648,267.00**

Source: 2010 US Census (www.census.gov) and 2011 Canadian census (www12.statcan.gc.ca)

WSSPC BOARD AND STAFF

Chair - John G. Parrish, State Geologist (GS, 2013-2015)
California Geological Survey
801 K Street, Suite 1200, Sacramento, California 95814-3531
john.parrish@conservation.ca.gov

Mark Ghilarducci, Secretary (EM, 2013-2015)
California Governor's Office of Emergency Services
3650 Schriever Ave, Mather, California 95655
mark.ghilarducci@calema.ca.gov

John Madden, Director (EM, 2012 - 2014)
Alaska Division of Homeland Security and Emergency Management
PO Box 5750, Fort Richardson, Alaska 99505-5750
john.madden@alaska.gov

Vicki McConnell, State Geologist (GS, 2012 - 2014)
Oregon Department of Geology and Mineral Industries
800 NE Oregon Street Suite 965, Portland, Oregon 97233
vicki.mcconnell@dogami.state.or.us

Peter McDonough, WSSPC Liaison (AL, 2013-2015)
Utah Seismic Safety Commission
1140 West 200 South/P.O. Box 45360, Salt Lake City, Utah 84145
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Dave Norman, State Geologist (GS, 2012-2014)
Washington Division of Geology and Earth Resources
PO Box 47007, Olympia, Washington 98504-7007
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Stephanie Moreno, Program Manager
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WSSPC MEMBERS, EARTHQUAKE/TSUNAMI PROGRAM MANAGERS & STATE HAZARD MITIGATION OFFICERS

As of November 30, 2013

Area	Geological Survey Director/ Representative	Emergency Management Director	Seismic Council Liaison	EQ Program Manager/Tsunami Program Manager	State Hazard Mitigation Officer
Alaska	Robert Swenson/ Richard Koehler	John Madden	Buzz Scher	Ann Gravier/ Erv Petty	Ann Gravier
American Samoa	----------	Iuniasolua Savusa		Jacinta Brown	Vinnie Atofau (TEMCO)
Arizona	Lee Allison/ Philip Pearthree	Wendy Smith-Reeve		Anthony Cox	Darlene Trammell
British Columbia	Stephen Rowins	Rebecca Denlinger		Teron Moore	
California	John Parrish	Mark Ghilarducci Mark Johnson	Dick McCarthy	Kate Long/ Kevin Miller	Kirby Everhart
Colorado	Karen Berry	Dave Hard	Rob Jackson	Ken Brink	Marilyn Gally
Guam	----------	James McDonald		Pilar Carbullido	Leo Rustum Espia
Hawaii	----------	Darryll Wong	Paul Okubo	Kevin Richards/ Kevin Richards	Ian Duncan
Idaho	Roy Breckenridge/ Bill Phillips	Brad Richy		Mark Stephensen	Mark Stephensen
Montana	John Metesh/ Mike Stickney	Ed Tinsley		Kent Atwood	Kent Atwood
Nevada	Jim Faulds/ Craig dePolo	Christopher Smith	Ron Lynn	Rick Martin	Elizabeth Ashby
New Mexico	L. Greer Price/ Dave Love	Gregory Myers		Susan Walker	Wendy Blackwell
Northern Mariana Islands	----------			Juan Camacho	
Oregon	Vicki McConnell/ Yumei Wang	David Stuckey	Kent Yu	Althea Rizzo/ Althea Rizzo	Dennis Sigrist
Utah	Rick Allis/ Bill Lund	Kris Hamlet	Pete McDonough	Bob Carey	Brad Bartholomew
Washington	Dave Norman/ Tim Walsh	Robert Ezelle		John Schelling/ John Schelling	Peter Tassoni
Wyoming	Tom Drean/ Seth Wittke	Guy Cameron		Melinda Gibson	Melinda Gibson
Yukon	Carolyn Relf	Michael Templeton			

WSSPC MEMBERS' AGENCIES

Area	Agency
Alaska	Alaska Division of Homeland Security and Emergency Management Alaska Division of Geological and Geophysical Surveys Alaska Seismic Hazards Safety Commission
American Samoa	Territorial Emergency Management Coordinating Office
Arizona	Arizona Division of Emergency Management Arizona Geological Survey
British Columbia	Emergency Management British Columbia British Columbia Geological Survey
California	California Governor's Office of Emergency Services California Geological Survey Alfred E. Alquist Seismic Safety Commission
Colorado	Colorado Division of Emergency Management Colorado Geological Survey Colorado Earthquake Hazard Mitigation Council
Guam	Guam Homeland Security & Office of Civil Defense
Hawaii	Hawaii State Civil Defense Hawaii State Earthquake Advisory Committee
Idaho	Idaho Bureau of Homeland Security Idaho Geological Survey
Montana	Montana Disaster and Emergency Services Division Montana Bureau of Mines and Geology
Nevada	Nevada Division of Emergency Management Nevada Bureau of Mines and Geology Nevada Earthquake Safety Council
New Mexico	New Mexico Department of Homeland Security & Emergency Management New Mexico Bureau of Geology and Mineral Resources
Northern Mariana Islands	CNMI Office of Homeland Security & Emergency Management
Oregon	Oregon Emergency Management Oregon Department of Geology & Mineral Industries Oregon Seismic Safety Policy Advisory Commission
Utah	Utah Division of Emergency Management Utah Geological Survey Utah Seismic Safety Commission
Washington	Washington Emergency Management Division Washington Geology and Earth Resources Division
Wyoming	Wyoming Office of Homeland Security Wyoming State Geological Survey
Yukon	Yukon Emergency Measures Organization Yukon Geological Survey

AFFILIATE MEMBERS

As of November 30, 2013

WSSPC welcomes members of the professional community who share our goal of reducing losses from earthquakes and tsunamis. Corporations, local governments or their departments, non-profit organizations, universities, and individuals can join WSSPC as affiliate members; membership fees are used to support program activities not eligible for reimbursement by the federal government.

Corporate	California Earthquake Authority 801 K Street, Suite 1000, Sacramento, CA 95814 *www.earthquakeauthority.com*
	Degenkolb Engineers, Inc. 235 Montgomery, Suite 500, San Francisco, CA 94104 *degenkolb.com*
	John A. Martin & Associates 950 South Grand Ave, 4th Floor, Los Angeles, CA 90015 *www.johnmartin.com*
	Saunders Construction, Inc. 1760 Monrovia, Unit #A-1, Costa Mesa, CA 92627 *www.saundersseismic.com/index.php*
	State Farm Insurance Companies One State Farm Plaza, Bloomington, IL 61710 *www.statefarm.com*
Local Government	City of Las Vegas Building and Safety 333 N. Rancho Drive, Las Vegas, NV 89106 *lasvegasnevada.gov/Government/buildingandsafety.htm*
	City of Norwalk, Emergency Services 12700 Norwalk Boulevard, Norwalk, CA 90650 *www.ci.norwalk.ca.us/publicsafety.asp*
	City of San Francisco, Earthquake Safety Implementation Program 1 Dr. Carlton B. Goodlett Place, Room 362, San Francisco, CA 94102 *www.sfgsa.org/index.aspx?page=6044*
	Clark County Building Department 4701 W. Russell Rd., Las Vegas, NV 89118-2231 *www.clarkcountynv.gov/depts/development_services*
Non-Profit	Applied Technology Council 201 Redwood Shores Parkway, Ste 240, Redwood City, CA 94065 *www.atcouncil.org*
	Earthquake Engineering Research Institute (EERI) 499 14th Street, Suite 220, Oakland, CA 94612-1934 *www.eeri.org*
Individual	Dominic Sims, International Code Council

SECTION B

Financial

Subsection B1

Summary of Financial Documents

WSSPC
WESTERN STATES
SEISMIC POLICY
COUNCIL

Summary of Financial Documents

1. WSSPC Independent Accountant's Review and Financial Statements Report

The financial statements prepared by an accountant for the WSSPC Fiscal Year ending November 30 resulted in a slight increase of $1098 (page 3).

WSSPC had 12 Affiliate members in FY 2013 who contributed $4175, an increase of $300 from FY 2012. Affiliate members help to offset expenses not covered by the FEMA cooperative agreements.

2. WSSPC 2012-2013 FY Income and Expense

This document shows how income and expenses were proportioned among the FEMA cooperative agreements and WSSPC funds as entered into Quickbooks software, before allocating the expenses to tasks in the FEMA Work Plan.

3. FEMA Grant 2012 August 1, 2012 – July 31, 2013, MOD001 August 1, 2013 – December 31, 2013

FEMA Grant 2012 started in the previous WSSPC fiscal year on August 1, 2012 and ended July 31, 2013. An extension was granted until December 31, 2013 to allow California, Hawaii, and Guam to utilize all of the state assistance funding allocated to them through WSSPC. The summary of expenses as allocated to the tasks in the FEMA Work Plan is shown, with the first sheet showing the budget and the second showing the expenses. Total amount of the agreement was $250,000.00.

4. FEMA Grant 2013 August 1, 2013 – November 30, 2013

The current cooperative agreement "FEMA Grant 2013" began August 1, 2013 and is for 12 months. Total amount of the agreement for this year is $250,000.00; the extra amount is to provide travel support for WSSPC members to the National Earthquake Program Managers meeting and to conduct an Earthquake Early Warning training at that meeting.

Subsection B2

Independent Accountant's Review Report and Financial Statements November 30, 2013 and 2012

COOK CPA Group

WESTERN STATES SEISMIC POLICY COUNCIL

INDEPENDENT ACCOUNTANT'S REVIEW REPORT
and
FINANCIAL STATEMENTS

NOVEMBER 30, 2013 AND 2012

CONTENTS

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INDEPENDENT ACCOUNTANT'S REVIEW REPORT

Board of Directors
Western States Seismic Policy Council

We have reviewed the accompanying statements of financial position of Western States Seismic Policy Council as of November 30, 2013 and 2012, and the related statements of activities, cash flows and functional expenses for the years then ended. A review includes primarily applying analytical procedures to management's financial data and making inquiries of company management. A review is substantially less in scope than an audit, the objective of which is the expression of an opinion regarding the financial statements as a whole. Accordingly, we do not express such an opinion.

Management is responsible for the preparation and fair presentation of the financial statements in accordance with accounting principles generally accepted in the United States of America and for designing, implementing, and maintaining internal control relevant to the preparation and fair presentation of the financial statements.

Our responsibility is to conduct the reviews in accordance with Statements on Standards for Accounting and Review Services issued by the American Institute of Certified Public Accountants. Those standards require us to perform procedures to obtain limited assurance that there are no material modifications that should be made to the financial statements. We believe that the results of our procedures provide a reasonable basis for our report.

Based on our reviews, we are not aware of any material modifications that should be made to the accompanying financial statements in order for them to be in conformity with accounting principles generally accepted in the United States of America.

Cook CPA Group

Roseville, California
April 3, 2014

WESTERN STATES SEISMIC POLICY COUNCIL
STATEMENTS OF FINANCIAL POSITION
NOVEMBER 30, 2013 AND 2012

	2013	2012
Assets:		
Cash	$ 146,332	$ 133,250
Grants receivables (Note 2)	31,648	40,483
Books and periodicals	500	500
Office equipment at cost (Less accumulated depreciation of $6,767 and $5,867) (Note 3)	1,377	2,277
Total Assets	$ 179,857	$ 176,510
Liabilities:		
Accrued expenses and accounts payable	$ 9,696	$ 6,504
Accrued vacation	4,069	5,012
Total Liabilities	13,765	11,516
Net Assets:		
Unrestricted	166,092	164,994
Total Net Assets	166,092	164,994
Total Liabilities and Net Assets	$ 179,857	$ 176,510

The accompanying notes are an integral part of these financial statements.

WESTERN STATES SEISMIC POLICY COUNCIL
STATEMENTS OF ACTIVITIES
FOR THE YEARS ENDED NOVEMBER 30, 2013 AND 2012

	Unrestricted	
	2013	**2012**
Revenues and Support:		
Membership dues and registration	$ 4,175	$ 3,875
FEMA cooperative agreements	246,165	207,945
Interest income	198	173
Total Revenues and Support	250,538	211,993
Expenses:		
Program services	209,588	155,538
Management and general	39,852	57,448
Total Expenses	249,440	212,986
Decrease in Net Assets	1,098	(993)
Net Assets at Beginning of Year	164,994	165,987
Net Assets at End of Year	$ 166,092	$ 164,994

The accompanying notes are an integral part of these financial statements.

WESTERN STATES SEISMIC POLICY COUNCIL
STATEMENTS OF CASH FLOWS
FOR THE YEARS ENDED NOVEMBER 30, 2013 AND 2012

	2013	2012
RECONCILIATION OF NET LOSS FROM OPERATIONS TO NET CASH PROVIDED BY OPERATING ACTIVITIES:		
Change in net assets	$ 1,098	$ (993)
Change in operating assets and liabilities:		
Depreciation	900	1,274
(Increase) Decrease in:		
Grants receivable	8,835	7,742
Increase (Decrease) in:		
Accounts payable	3,192	(8,135)
Accrued vacation	(943)	(304)
Cash provided by operating activities	13,082	(416)
NET INCREASE (DECREASE) IN CASH	13,082	(416)
Cash, Beginning of the year	133,250	133,666
Cash, End of the year	$ 146,332	$ 133,250

The accompanying notes are an integral part of these financial statements.

WESTERN STATES SEISMIC POLICY COUNCIL
STATEMENT OF FUNCTIONAL EXPENSES
YEAR ENDED NOVEMBER 30, 2013

	Program Services	Management and General	Total
Salaries and fringe benefits	$ 124,914	$ 24,073	$ 148,987
Payroll taxes	7,271	1,284	8,555
Professional fees - accounting	1,269	5,076	6,345
Professional fees - other	4,029	711	4,740
Rent	15,830	2,794	18,624
Insurance	816	272	1,088
Telephone	2,190	731	2,921
Office supplies and miscellaneous	3,147	1,049	4,196
Internet services	1,145	-	1,145
Staff expenses	8,742	-	8,742
Conference expenses	5,060	-	5,060
State assistance	25,384	-	25,384
Executive committee	9,143	1,017	10,160
Bank and payroll charges	648	1,945	2,593
Depreciation and amortization	-	900	900
Total Expenses	$ 209,588	$ 39,852	$ 249,440

The accompanying notes are an integral part of these financial statements.

WESTERN STATES SEISMIC POLICY COUNCIL
STATEMENT OF FUNCTIONAL EXPENSES
YEAR ENDED NOVEMBER 30, 2012

	Program Services	Management and General	Total
Salaries and fringe benefits	$ 92,475	$ 39,632	$ 132,107
Payroll taxes	8,662	1,529	10,191
Professional fees - accounting	1,226	4,904	6,130
Professional fees - other	1,569	277	1,846
Rent	15,830	2,794	18,624
Insurance	660	220	880
Telephone	2,104	702	2,806
Office Supplies and miscellaneous	5,295	1,765	7,060
Internet services	1,715	-	1,715
Staff expenses	5,854	-	5,854
Conference expenses	8,693	-	8,693
Executive committee	10,389	1,153	11,542
Bank and payroll charges	1,066	3,198	4,264
Depreciation and amortization	-	1,274	1,274
Total Expenses	$ 155,538	$ 57,448	$ 212,986

The accompanying notes are an integral part of these financial statements.

NOTE 1 – SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Description of Organization

The Western States Seismic Policy Council (the Council) was founded in 1979 and incorporated in 1996 as a 501 (c)(3) non-profit organization. The Council provides a forum to develop seismic policies and share information to promote programs to reduce earthquake losses throughout the western region of the United States, three U.S. territories, a Canadian territory, and a Canadian province. It is funded primarily by the Department of Homeland Security's Federal Emergency Management Agency (FEMA) and the U.S. Geological Survey (USGS).

Basis of Accounting

The Council prepares its financial statements in accordance with accounting principles generally accepted in the United States of America, which involves the application of accrual accounting; consequently, revenue and support are recognized when earned, and expenses are recognized when incurred.

Financial Statement Presentation

Financial statement presents information regarding its financial position and activities according to three classes of net assets: unrestricted net assets, temporarily restricted net assets, and permanently restricted net assets. The Council has no temporarily and permanently restricted net assets during 2013 and 2012.

Allowance for Uncollectible Accounts

No allowance for uncollectible accounts has been provided since management considers all accounts to be collectible.

Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management makes estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

Cash and Cash Equivalents

For the purposes of reporting cash flows, the Council considers all unrestricted highly liquid investments with an initial maturity of three months or less to be cash equivalents.

NOTE 1 – SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

Functional Allocation of Expenses

The costs of providing the Council's programs and supporting services have been summarized on a functional basis. Accordingly, certain costs have been allocated among the programs and supporting services.

Grants and Cooperative Agreements

The grants and cooperative agreements are cost reimbursement type agreements; therefore, the Council records income when expenditures are made in compliance with the terms of the agreements.

Income Taxes

The Council under preliminary determination is a not-for-profit organization that is exempt from income taxed under Section 501(c)(3) of the Internal Revenue Code.

Property and Equipment

Property and equipment are recorded at cost when acquisition costs are greater than $5,000. Depreciation is provided on the straight-line basis over five years.

Subsequent Event

The Council has evaluated subsequent events for potential recognition and/or disclosure through April 3, 2014, the date the financial statements were issued.

NOTE 2 – GRANTS AND COOPERATIVE AGREEMENT RECEIVABLES

The Council has a receivable from FEMA in the following amounts as of November 30:

	2013	2012
FEMA	$ 31,648	$ 40,483
	$ 31,648	$ 40,483

Collectability of the above balance is, in some part, dependent on the solvency of the related agencies. The Council's management considers there to be no collection risk as the amounts have historically been received in full.

NOTE 3 – OFFICE EQUIPMENT

Property and equipment consist of the following as of November 30:

	2013	2012
Computer equipment	$ 3,321	$ 3,321
Office equipment	4,823	4,823
Total	8,144	8,144
Less accumulated depreciation	(6,767)	(5,867)
Capital assets, net	$ 1,377	$ 2,277

Depreciation expense for the year ending November 30, 2013 and 2012 totaled $900 and $1,274, respectively.

NOTE 4 – FEMA REVENUE

FEMA revenue consists of the following for the year ended November 30:

	2013	2012
2011 FEMA	$ -	$ 138,201
2012 FEMA	175,549	69,744
2013 FEMA	70,616	-
Total	$ 246,165	$ 207,945

NOTE 5 – LEASE AGREEMENT

The Council leases office space in Sacramento, California on a month to month lease, in arrears, in the amount of $1,552.

NOTE 6 – DEFINED CONTRIBUTION PLAN

The Council sponsors a defined contribution plan (a SIMPLE IRA plan) covering regular employees who meet certain eligibility requirements. The Council matches an employee's contribution dollar for dollar up to 3% per year. Employees who qualify under Internal Revenue Services rules may make catch up contributions to this plan. The contributions made during the years ended November 30, 2013 and 2012 were $2,563 and $2,768, respectively.

NOTE 7 – COMMITMENTS AND CONTINGENCIES

The Council received a grant from FEMA for an amount of $250,000 for the time period from August 1, 2013 to July 31, 2014. Additionally, the FEMA cooperative agreement for the time period from August 1, 2012 to July 31, 2013 was extended to December 31, 2013. As of November 30, 2013, there was a total of $184,091 remaining to be used by the Council for performance of various services in accordance with the terms of the grants.

Subsection B3

FY 12-13 Income & Expense
December 2012 through November 2013

Accrual Basis

Western States Seismic Policy Council
FY 12-13 Income & Expense
December 2012 through November 2013

	TOTAL ALL SOURCES	FEMA Grant 2012	FEMA Grant 2013	WSSPC
Income				
401.0 · Interest Income				
401.1 · Money Mkt Interest Income	179.62	0.00	0.00	179.62
401.2 · CD Interest Income	18.03	0.00	0.00	18.03
TOTAL 401.0 · Interest Income	197.65	0.00	0.00	197.65
410.0 · Membership Dues	4,175.00	0.00	0.00	4,175.00
450.0 · Grants Earned				
460.0 · FEMA Grants Earned				
460.8 · 2012 FEMA Grants Earned	175,549.00	175,549.00	0.00	0.00
460.9 · 2013 FEMA Grants Earned	70,616.44	0.00	70,616.44	0.00
Total 460.0 · FEMA Grants Earned	246,165.44	175,549.00	70,616.44	0.00
Total 450.0 · Grants Earned	246,165.44	175,549.00	70,616.44	0.00
Total Income	250,538.09	175,549.00	70,616.44	4,372.65
Expense				
500.0 · P/R Expenses				
500.1 · Salary	112,999.52	76,144.32	36,855.20	0.00
500.2 · Benefits				
500.7 · Employer IRA Contribution	2,563.00	1,640.32	922.68	0.00
500.2 · Benefits - Other	32,288.75	21,592.10	11,661.04	-964.39
Total 500.2 · Benefits	34,851.75	23,232.42	12,583.72	-964.39
500.3 · Employer Contrib/Taxes	8,555.03	5,900.96	2,654.07	0.00
500.4 · Workers' Comp	1,136.03	817.17	318.86	0.00
500.5 · Payroll Service	2,270.70	1,578.22	692.48	0.00
Total 500.0 · P/R Expenses	159,813.03	107,673.09	53,104.33	-964.39
506.0 · Prof Fees Accounting	6,345.00	6,345.00	0.00	0.00
507.0 · Prof Fees Consulting	4,740.00	0.00	4,740.00	0.00
510.0 · Office Supplies	2,247.32	1,450.22	797.10	0.00
515.0 · Telephone	2,920.83	1,952.85	967.98	0.00
520.0 · Printing	1,282.18	1,282.18	0.00	0.00
522.0 · Postage and Delivery	469.62	369.62	100.00	0.00
525.0 · Internet Services	1,145.23	804.23	341.00	0.00
530.0 · Staff Expenses				
530.1 · Staff Meals	638.37	0.00	0.00	638.37
530.2 · Staff Mileage	105.10	93.23	11.87	0.00
530.3 · Staff Transportation	3,726.24	3,712.24	14.00	0.00
530.4 · Staff Hotel	2,832.68	2,832.68	0.00	0.00

Western States Seismic Policy Council
FY 12-13 Income & Expense
December 2012 through November 2013

530.6 · Staff Meetings	1,440.00	1,400.00	40.00	0.00
Total 530.0 · Staff Expenses	8,742.39	8,038.15	65.87	638.37
535.0 · Executive Committee Expense				
535.1 · Meals Exec Comm	1,831.11	0.00	0.00	1,831.11
535.2 · Mileage Exec Comm	83.07	58.21	24.86	0.00
535.3 · Transportation Exec Comm	5,068.39	1,944.12	3,124.27	0.00
535.4 · Hotel Exec Comm	3,177.94	2,084.81	1,093.13	0.00
Total 535.0 · Executive Committee Expense	10,160.51	4,087.14	4,242.26	1,831.11
550.0 · State Assistance				
550.4 · State Assistance-HI	8,018.91	7,707.16	0.00	311.75
550.5 · State Assistance-CA	8,367.72	7,926.22	0.00	441.50
550.6 · State Assistance-GU	8,997.45	8,997.45	0.00	0.00
Total 550.0 · State Assistance	25,384.08	24,630.83	0.00	753.25
554.0 · Conferences				
554.6 · 2013 Annual Conference	5,059.82	4,708.82	0.00	351.00
Total 554.0 · Conferences	5,059.82	4,708.82	0.00	351.00
570.0 · Insurance				
570.1 · Liability Insurance	819.77	1,054.00	0.00	-234.23
570.3 · Insurance Other	268.00	268.00	0.00	0.00
Total 570.0 · Insurance	1,087.77	1,322.00	0.00	-234.23
575.0 · Rent	18,624.00	12,416.00	6,208.00	0.00
580.0 · Bank Service Charges	321.80	314.90	6.90	0.00
581.0 · Equipment Rental				
581.3 · Postage meter	132.92	89.92	43.00	0.00
Total 581.0 · Equipment Rental	132.92	89.92	43.00	0.00
590.0 · Property Taxes	4.05	4.05	0.00	0.00
591.0 · Licenses and Permits	60.00	60.00	0.00	0.00
595.0 · Depreciation Expense	900.00	0.00	0.00	900.00
Total Expense	249,440.55	175,549.00	70,616.44	3,275.11
NET	**1,097.54**	**0.00**	**0.00**	**1,097.54**

Subsection B4-a

FEMA 2012 Cooperative Agreement
August 1, 2012 - July 31, 2013

Western States Seismic Policy Council
FEMA 2012 Cooperative Agreement EMW-2012-RC-00002-S01
August 1, 2012 - July 31, 2013

TASKS / EXPENSES	Aug 2012	Sep 2012	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013	Jul 2013
SUMMARY												
Total Cooperative Agreement Amount	250,000.00											
Amt Budgeted Per Month	15,385.83	16,885.83	15,745.41	24,512.82	16,535.83	19,335.83	21,023.57	20,792.06	18,028.13	44,388.19	14,785.83	22,580.67
Cumulative Amount Budgeted	15,385.83	32,271.66	48,017.07	72,529.89	89,065.72	108,401.55	129,425.12	150,217.18	168,245.31	212,633.50	227,419.33	250,000.00
Cumulative Budget Remaining	234,614.17	217,728.34	201,982.93	177,470.11	160,934.28	141,598.45	120,574.88	99,782.82	81,754.69	37,366.50	22,580.67	0.00
Amt Expended Per Month	15,184.19	14,077.12	17,821.44	22,661.17	15,214.24	19,796.24	19,806.64	21,078.21	17,610.24	28,052.58	20,069.54	21,886.00
Amount Expended to Date	15,184.19	29,261.31	47,082.75	69,743.92	84,958.16	104,754.40	124,561.04	145,639.25	163,249.49	191,302.07	211,371.61	233,257.61
Cumulative Funds Remaining	234,815.81	220,738.69	202,917.25	180,256.08	165,041.84	145,245.60	125,438.96	104,360.75	86,750.51	58,697.93	38,628.39	16,742.39
PLANNED MONTHLY COST	15,385.83	16,885.83	15,745.41	24,512.82	16,535.83	19,335.83	21,023.57	20,792.06	18,028.13	44,388.19	14,785.83	22,580.67
TASK 1.0 MITIGATION SUPPORT	2,729.98	4,687.29	5,124.09	5,124.09	5,852.11	4,874.10	5,263.62	6,057.06	6,691.11	14,185.22	3,313.62	1,629.60
1.1 WSSPC 2013 Annual Meeting												
1.2 Joint WSSPC CREW Policy Workshop												
1.3 Awards in Excellence												
1.4 National EQ Program Managers Meeting												
1.5 Develop Earthquake Risk Reduction Policies												
TASK 2.0 OUTREACH	5,481.99	3,995.09	3,639.06	1,811.04	3,781.60	3,743.10	2,995.09	4,222.64	4,117.08	1,354.08	4,139.06	4,637.01
2.1 WSSPC Website												
2.2 WSSPC Quarterly Electronic Newsletter												
2.3 WSSPC Annual Report												
TASK 3.0 PARTNERSHIPS	970.20	690.71	1,350.79	2,184.04	1,456.02	1,019.22	2,969.56	873.61	726.01	291.21	291.21	2,079.55
3.1 Maintain Partnerships Similar Minded Orgs												
3.2 WSSPC Affiliate Member Program Outreach												
TASK 4.0 FINANCIAL	6,203.66	7,512.74	5,631.47	9,665.64	5,446.10	9,699.41	5,096.10	7,437.10	6,493.93	11,674.12	6,750.73	7,750.00
4.1 Manage WSSPC Finances												
4.2 Board Meetings 2/Yr												
4.3 Program/Financial Mgmt of Co-Op Agreement												
4.4 Maintain Office w/FT Exec Dir & Support Staff												
TASK 5.0 SUPPORT STATE TRAVEL	0.00	0.00	0.00	5,728.01	0.00	0.00	4,699.20	2,201.65	0.00	16,883.56	291.21	6,484.51
Support State Travel												
TOTALS	15,385.83	16,885.83	15,745.41	24,512.82	16,535.83	19,335.83	21,023.57	20,792.06	18,028.13	44,388.19	14,785.83	22,580.67

Western States Seismic Policy Council
FEMA 2012 Cooperative Agreement EMW-2012-RC-00002-S01
August 1, 2012 - July 31, 2013

TASKS / EXPENSES	Aug 2012	Sep 2012	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013	Jul 2013
ACTUAL MONTHLY COST	**15,184.19**	**14,077.12**	**17,821.44**	**22,661.17**	**15,214.24**	**19,796.24**	**19,806.64**	**21,078.21**	**17,610.24**	**28,052.58**	**20,069.54**	**21,886.00**
TASK 1.0 MITIGATION SUPPORT	**2,385.07**	**2,187.29**	**715.88**	**570.63**	**2,487.11**	**3,414.53**	**3,309.59**	**3,837.83**	**10,523.67**	**10,970.33**	**2,194.89**	**1,193.82**
1.1 WSSPC 2013 Annual Meeting	472.29	126.19	0.00	0.00	1,016.24	644.70	263.71	1,326.69	6,418.12	5,272.73	1,665.70	874.68
1.2 Joint WSSPC CREW Policy Workshop	377.83	0.00	0.00	0.00	294.17	155.21	382.38	385.67	1,685.98	1,459.72	29.48	0.00
1.3 Awards in Excellence	0.00	1,836.76	100.47	59.44	454.63	2,029.62	1,305.38	601.64	180.18	1,111.12	117.93	200.94
1.4 National EQ Program Managers Meeting	566.75	140.21	75.37	59.44	53.49	393.98	501.05	1,246.15	1,956.25	1,375.61	0.00	47.28
1.5 Develop Earthquake Risk Reduction Policies	968.20	84.13	540.04	451.75	668.58	191.02	857.07	277.68	283.14	1,751.15	381.78	70.92
TASK 2.0 OUTREACH	**7,391.37**	**6,659.99**	**10,524.57**	**3,233.59**	**5,495.69**	**5,790.38**	**5,340.18**	**11,261.47**	**2,440.49**	**5,108.52**	**4,643.32**	**7,683.04**
2.1 WSSPC Website	5,856.42	4,388.58	3,730.07	0.00	2,928.36	620.82	2,953.58	1,573.52	154.45	410.61	206.37	1,879.39
2.2 WSSPC Quarterly Electronic Newsletter	1,440.49	2,159.24	6,179.10	1,973.44	1,778.41	5,157.62	1,199.89	1,064.44	875.16	4,697.91	4,377.99	5,709.09
2.3 WSSPC Annual Report	94.46	112.17	615.40	1,260.15	788.92	11.94	1,186.71	8,623.51	1,410.88	0.00	58.96	94.56
TASK 3.0 PARTNERSHIPS	**543.14**	**448.68**	**1,996.90**	**1,843.15**	**882.52**	**859.85**	**3,876.89**	**1,196.65**	**244.53**	**24.15**	**2,558.67**	**3,333.10**
3.1 Maintain Partnerships Similar Minded Orgs	543.14	364.55	1,908.99	690.00	213.94	800.16	2,716.56	1,181.22	167.31	24.15	1,364.67	3,285.82
3.2 WSSPC Affiliate Member Program Outreach	0.00	84.13	87.91	1,153.15	668.58	59.69	1,160.33	15.43	77.22	0.00	1,194.00	47.28
TASK 4.0 FINANCIAL	**4,864.61**	**4,781.16**	**4,508.74**	**9,651.37**	**6,592.15**	**9,697.60**	**3,019.50**	**4,782.26**	**4,401.55**	**8,048.35**	**6,559.62**	**4,030.65**
4.1 Manage WSSPC Finances	850.13	981.47	1,544.78	784.62	2,620.82	5,650.30	1,318.56	1,434.68	604.89	1,352.61	1,680.44	1,146.55
4.2 Board Meetings 2/Yr	613.98	518.78	904.26	4,872.32	160.46	71.63	0.00	493.65	218.79	4,232.06	383.26	354.60
4.3 Program/Financial Mgmt of Co-Op Agreement	566.75	1,177.77	540.04	95.11	641.83	453.69	501.05	401.09	978.12	700.46	574.89	1,122.91
4.4 Maintain Office w/FT Exec Dir & Support Staff	2,833.75	2,103.14	1,519.66	3,899.32	3,169.04	3,521.98	1,199.89	2,452.84	2,599.75	1,763.22	3,921.03	1,406.59
TASK 5.0 SUPPORT STATE TRAVEL	**0.00**	**0.00**	**75.35**	**7,362.43**	**-243.23**	**33.88**	**4,260.48**	**0.00**	**0.00**	**3,901.23**	**4,113.04**	**5,645.39**
Support State Travel												
5.1 California	0.00	0.00	0.00	0.00	0.00	33.88	13.19	0.00	0.00	1,795.29	0.00	3,861.12
5.2 Hawaii	0.00	0.00	75.35	7,362.43	-243.23	0.00	4,247.29	0.00	0.00	2,105.94	4,113.04	1,784.27
5.3 Guam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Subsection B4-b

FEMA 2012 Cooperative Agreement
Modification 001
August 1, 2013 - December 31, 2013

Western States Seismic Policy Council
FEMA 2012 Cooperative Agreement EMW-2012-RC-00002-S01 Modification 001
August 1, 2013 - December 31, 2013

TASKS / EXPENSES	BROUGHT FORWARD	Aug 2013	Sep 2013	Oct 2013	Nov 2013	Dec 2013
SUMMARY						
Total Cooperative Agreement Amount	250,000.00					
Amt Budgeted Per Month		200.00	200.00	3,000.00	3,342.29	10,000.00
Cumulative Amount Budgeted		200.00	400.00	3,400.00	6,742.39	16,742.39
Cumulative Budget Remaining		16,542.29	16,342.29	13,342.29	10,000.00	0.00
Amt Expended Per Month		185.34	123.71	1,876.42	9,849.84	4,707.08
Amount Expended to Date	233,257.61	233,442.95	233,566.66	235,443.08	245,292.92	250,000.00
Cumulative Funds Remaining	16,742.39	16,557.05	16,433.34	14,556.92	4,707.08	0.00
PLANNED MONTHLY COST		200.00	200.00	3,000.00	3,342.29	10,000.00
TASK 1.0 MITIGATION SUPPORT		0.00	0.00	0.00	0.00	0.00
1.1 WSSPC 2013 Annual Meeting						
1.2 Joint WSSPC CREW Policy Workshop						
1.3 Awards in Excellence						
1.4 National EQ Program Managers Meeting						
1.5 Develop Earthquake Risk Reduction Policies						
TASK 2.0 OUTREACH		0.00	0.00	0.00	0.00	0.00
2.1 WSSPC Website						
2.2 WSSPC Quarterly Electronic Newsletter						
2.3 WSSPC Annual Report						
TASK 3.0 PARTNERSHIPS		0.00	0.00	0.00	0.00	0.00
3.1 Maintain Partnerships Similar Minded Orgs						
3.2 WSSPC Affiliate Member Program Outreach						
TASK 4.0 FINANCIAL		0.00	0.00	0.00	0.00	5,446.10
4.1 Manage WSSPC Finances						
4.2 Board Meetings 2/Yr						
4.3 Program/Financial Mgmt of Co-Op Agreement						
4.4 Maintain Office w/FT Exec Dir & Support Staff						
TASK 5.0 SUPPORT STATE TRAVEL		200.00	200.00	3,000.00	3,342.29	10,000.00
Support State Travel						
TOTALS		200.00	200.00	3,000.00	3,342.29	10,000.00

Western States Seismic Policy Council
FEMA 2012 Cooperative Agreement EMW-2012-RC-00002-S01 Modification 001
August 1, 2013 - December 31, 2013

TASKS / EXPENSES	Aug 2013	Sep 2013	Oct 2013	Nov 2013	Dec 2013	TOTAL FEMA GRANT 2012
ACTUAL MONTHLY COST	**185.34**	**123.71**	**1,876.42**	**9,849.84**	**4,707.08**	
TASK 1.0 MITIGATION SUPPORT	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**43,790.64**
1.1 WSSPC 2013 Annual Meeting						
1.2 Joint WSSPC CREW Policy Workshop						
1.3 Awards in Excellence						
1.4 National EQ Program Managers Meeting						
1.5 Develop Earthquake Risk Reduction Policies						
TASK 2.0 OUTREACH	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**75,572.61**
2.1 WSSPC Website						
2.2 WSSPC Quarterly Electronic Newsletter						
2.3 WSSPC Annual Report						
TASK 3.0 PARTNERSHIPS	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**17,808.23**
3.1 Maintain Partnerships Similar Minded Orgs						
3.2 WSSPC Affiliate Member Program Outreach						
TASK 4.0 FINANCIAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**70,937.56**
4.1 Manage WSSPC Finances						
4.2 Board Meetings 2/Yr						
4.3 Program/Financial Mgmt of Co-Op Agreement						
4.4 Maintain Office w/FT Exec Dir & Support Staff						
TASK 5.0 SUPPORT STATE TRAVEL	**185.34**	**123.71**	**1,876.42**	**9,849.84**	**4,707.08**	**41,890.96**
Support State Travel						
5.1 California	137.38	123.71	1,876.42	575.90	4,468.13	12,885.02
5.2 Hawaii	23.98	0.00	0.00	0.00	0.00	19,469.07
5.3 Guam	23.98	0.00	0.00	9,273.94	238.95	9,536.87

Subsection B5

FEMA 2013 Cooperative Agreement
August 1, 2013 - July 31, 2014

Western States Seismic Policy Council
FEMA 2013 Cooperative Agreement EMW-2013-CAK00130
August 1, 2013 - July 31, 2014

TASKS / EXPENSES	Aug 2013	Sep 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014	Jun 2014	Jul 2014
SUMMARY												
Total Cooperative Agreement Amount	250,000.00											
Amt Budgeted Per Month	15,523.95	17,193.95	17,193.95	21,626.34	18,963.95	22,387.47	16,848.95	17,945.95	17,601.38	28,926.29	25,873.97	29,913.85
Cumulative Amount Budgeted	15,523.95	32,717.90	49,911.85	71,538.19	90,502.14	112,889.61	129,738.56	147,684.51	165,285.89	194,212.18	220,086.15	250,000.00
Cumulative Budget Remaining	234,476.05	217,282.10	200,088.15	178,461.81	159,497.86	137,110.39	120,261.44	102,315.49	84,714.11	55,787.82	29,913.85	0.00
Amt Expended Per Month	14,867.24	14,720.26	19,231.36	21,797.58								
Amount Expended to Date	14,867.24	29,587.50	48,818.86	70,616.44								
Cumulative Funds Remaining	235,132.76	220,412.50	201,181.14	179,383.56								
PLANNED MONTHLY COST	15,523.95	17,193.95	17,193.95	21,626.34	18,963.95	22,387.47	16,848.95	17,945.95	17,601.38	28,926.29	25,873.97	29,913.85
TASK 1.0 POLICY DEVELOPMENT	2,329.11	2,329.11	2,329.11	5,140.68	2,329.11	2,329.11	2,329.11	2,329.11	4,406.54	2,829.11	2,779.11	10,849.88
1.1 Develop Earthquake Risk Reduction Policies												
1.2 WSSPC Annual Meeting												
1.3 WSSPC Board Meetings 2/Yr												
TASK 2.0 FORUMS FOR INFO EXCHANGE	1,482.17	1,482.17	1,482.17	1,482.17	1,482.17	1,482.17	1,482.17	2,082.17	1,482.17	3,759.51	1,482.17	5,979.37
2.1 EEW Workshop												
2.2 Awards in Excellence												
2.3 EQ Program Managers (NEPM) Meeting												
TASK 3.0 OUTREACH AND EDUCATION	6,145.64	7,915.64	7,915.64	7,915.64	9,685.64	6,309.16	6,145.64	6,745.64	6,145.64	16,145.64	16,145.64	6,145.64
3.1 WSSPC Website												
3.2 WSSPC Quarterly Electronic Newsletter												
3.3 WSSPC Annual Report												
3.4 Support State Travel to NEPM meeting												
TASK 4.0 PARTNERSHIPS	1,105.27	1,105.27	1,105.27	2,101.09	1,105.27	1,105.27	1,905.27	1,105.27	1,105.27	1,105.27	1,105.27	1,952.18
4.1 Maintain Partnerships Similar Orgs												
4.2 WSSPC Affiliate Member Program Outreach												
TASK 5.0 FINANCIAL AND GRANTS MANAGEMENT	4,461.76	4,361.76	4,361.76	4,986.76	4,361.76	11,161.76	4,986.76	5,683.76	4,461.76	5,086.76	4,361.78	4,986.78
5.1 Coop Agreement Management												
5.2 WSSPC Finances												
5.3 WSSPC Office												
TOTALS	15,523.95	17,193.95	17,193.95	21,626.34	18,963.95	22,387.47	16,848.95	17,945.95	17,601.38	28,926.29	25,873.97	29,913.85

Western States Seismic Policy Council
FEMA 2013 Cooperative Agreement EMW-2013-CAK00130
August 1, 2013 - July 31, 2014

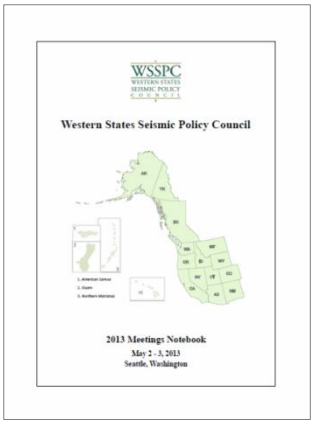
TASKS / EXPENSES	Aug 2013	Sep 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014	Jun 2014	Jul 2014
ACTUAL MONTHLY COST	**14,867.24**	**14,720.26**	**19,231.36**	**21,797.58**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
TASK 1.0 POLICY DEVELOPMENT	**215.82**	**673.48**	**2,550.82**	**7,832.82**								
1.1 Develop Earthquake Risk Reduction Policies												
1.2 WSSPC Annual Meeting												
1.3 WSSPC Board Meetings 2/Yr												
TASK 2.0 FORUMS FOR INFO EXCHANGE	**359.69**	**0.00**	**71.86**	**110.58**								
2.1 EEW Workshop/Webinar												
2.2 Awards in Excellence												
2.3 EQ Program Managers (NEPM) Meeting												
TASK 3.0 OUTREACH AND EDUCATION	**7,385.66**	**8,054.23**	**12,237.56**	**6,956.88**								
3.1 WSSPC Website												
3.2 WSSPC Quarterly Electronic Newsletter												
3.3 WSSPC Annual Report												
3.4 Support State Travel to NEPM meeting												
TASK 4.0 PARTNERSHIPS	**347.70**	**412.33**	**263.46**	**331.74**								
4.1 Maintain Partnerships Similar Orgs												
4.2 WSSPC Affiliate Member Program Outreach												
TASK 5.0 FINANCIAL AND GRANTS MANAGEMENT	**6,558.37**	**5,580.22**	**4,107.66**	**6,565.56**								
5.1 Coop Agreement Management												
5.2 WSSPC Finances												
5.3 WSSPC Office												
TOTALS	**14,867.24**	**14,720.26**	**19,231.36**	**21,797.58**								

SECTION C

Activities

ANNUAL MEETING

WSSPC holds an annual meeting to review proposed earthquake and tsunami risk reduction policies, and provide additional networking and educational opportunities for its members and affiliates. The 2013 meeting was held in conjunction with the 2013 National Earthquake Program Managers meeting in Seattle, Washington; WSSPC's portion took place May 2-3, 2013.

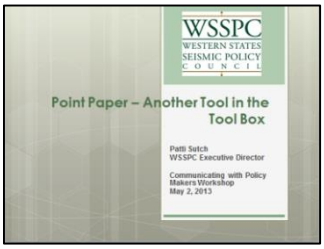


The event kicked off on Thursday, May 2nd, with the year's Annual Awards Luncheon to recognize the Lifetime Achievement and Awards in Excellence winners.

The awards ceremony was followed on Thursday afternoon by a communications workshop – *Communicating with Policy Makers* – that was jointly sponsored with the Cascadia Region Earthquake Workgroup, and included the following:

- *Communicating with Policy Makers: Is it Advocacy or Lobbying?* and *Point Paper – Another Tool in the Tool Box*, presented by Patti Sutch, Executive Director, WSSPC.
- *Overcoming Obstacles to Actionable Policy*, presented by Jim Mullen, Former Director, Washington Emergency Management Division and Past President of the National Emergency Management Association.
- *Effectively Engaging Policy Makers and Staff,* presented by John Bwarie, Strategy & Communications Officer, SAFRR Project: Science Application for Risk Reduction, Natural Hazards Mission Area, U.S. Geological Survey.
- *Keys to More Effective Verbal Communication*, presented by Kristan Uhlenbrock, Public Affairs Coordinator, American Geophysical Union.
- *Hearings: Providing Written and Oral Testimony,* presented by Matt Cowles, Government Relations Director, National Emergency Management Association; and John Madden, Director, Alaska Division of Homeland Security and Emergency Management, and President of the National Emergency Management Association.
- *From The Trenches: Impacting Policy, A Panel Discussion*, presented by Kristan Uhlenbrock, AGU; Matt Cowles, NEMA; and John Madden, ADHS&EM; facilitated by John Bwarrie, USGS.

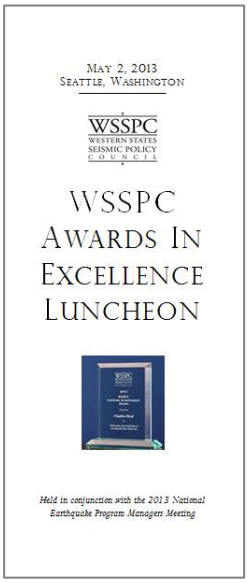
WSSPC's three policy committees met separately on Thursday evening to review policies and discuss new business. On Friday morning, May 3rd, the WSSPC Board of Directors met to discuss officer nominations, policy recommendations and new business. The Annual Business Meeting followed the Board meeting and included representation from 33 members – 22 in-person attendees and 11 proxies. The members elected the biennial Board of Directors; heard committee reports; discussed the venue for the 2014 Annual Meeting; and voted on 12 draft policy recommendations relating to earthquake and tsunami risk reduction. Board Chair John Parrish also presented a certificate of appreciation to outgoing Basin & Range Province Committee Chair Bill Lund of the Utah Geological Survey for his 8 years of service as committee chair.



WSSPC AWARDS PROGRAM

WSSPC implemented an awards program to support its mission to develop seismic policies and share information to promote programs intended to reduce earthquake-related losses. Since 1996, WSSPC awards have been effective in recognizing the hard-working, creative and innovative efforts of those within the earthquake hazards reduction community; brought greater visibility to exemplary programs, projects and products; and facilitated the transfer of successful experiences to other agencies.

Awards in Excellence are awarded annually to honor exemplary programs, projects, and products that have significantly contributed to addressing earthquake risk reduction through demonstrated achievements in earthquake mitigation, preparedness, response and recovery. One winner is selected to receive the Overall Award in Excellence.



National Awards in Excellence are awarded every four years in partnership with the Northeast States Emergency Consortium (NESEC), the Central U.S. Earthquake Consortium (CUSEC), and the Cascadia Region Earthquake Workgroup (CREW). These awards recognize persons, organizations and agencies in acknowledgement of their achievements, leadership and dedication in earthquake hazards reduction, as demonstrated through exemplary programs, projects, and products that address earthquake risk reduction with the United States.

Lifetime Achievement Awards are awarded periodically to honor outstanding leaders who are currently practicing and have demonstrated an extraordinary commitment, level of service, and contribution to earthquake risk reduction throughout their careers.

WSSPC Leadership Awards are awarded periodically to honor individuals within the WSSPC membership who have demonstrated sustained leadership benefitting the WSSPC community.

This year's award ceremony was held in conjunction with the WSSPC-NEPM annual meeting in Seattle, Washington. There were 5 Awards in Excellence winners, and 1 Lifetime Achievement award winner.

Left: Dave Norman and Robert Ezelle accepted an award from WSSPC Chair John Parrish on behalf of the Washington State Seismic Safety Committee. Center: Attendees at the 2013 WSSPC Award Banquet in Seattle, Washington. Right: Vicky McConnell accepts the Use of New Technology Award in Excellence for Oregon's Department of Geology and Mineral Industries. Images: Stephanie Moreno, WSSPC

2013 Lifetime Achievement Award

Charles Real

Charles "Chuck" Real received the 2013 Lifetime Achievement Award in Earthquake Risk Reduction. Mr. Real's distinguished and pioneering service in the field of seismic and tsunami hazard reduction resulted in significant improvements to protecting the public from future events. Until his retirement in late 2013, Mr. Real built an impressive 40-year career and reputation as a dedicated leader and respected scientist with the California Geological Survey (CGS). Mr. Real's passion for improving the public's understanding of and preparedness for natural hazards made him a sought-after collaborator on a number of national and international projects.

Mr. Real established and managed California's Seismic Hazard Zonation Program (SHZ), an internationally renowned earthquake hazard mitigation program for local land-use planning. He led the original feasibility study that identified seismic hazard information needs of homeowners, local government and the insurance industry; which resulted in the California Legislature passing the Seismic Hazards Mapping Act of 1990 and establishing SHZP. Since its inception, the program has completed over 118 maps identifying "zones of required investigation" for liquefaction and seismically induced landslides hazards for nearly 200 incorporated cities in California. Under Mr. Real's development and leadership, SHZP received the WSSPC Award of Excellence in Innovation in 1998. Since 2005, Mr. Real also has supervised the management of the Alquist-Priolo Earthquake Fault Zoning Program (AP). Established in 1972 and the source of many of the principles used to establish the Seismic Hazard Mapping Act, AP identifies Holocene-active faults in order to prevent construction for human occupation across their traces. In combination, these earthquake-hazard zone maps are used throughout California by local land-use planning agencies to mitigate earthquake ground failure hazards and make their communities more resilient to seismic hazards.

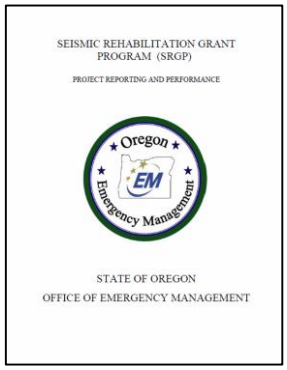
As an applied research scientist, Mr. Real demonstrated his prowess to develop and maintain a number of important earthquake hazard analysis projects. He conducted a number of post-earthquake field investigations where he utilized his experience as an applied geophysicist to note where improvements in earthquake hazard analysis and mitigation could be implemented. Mr. Real managed the Turkey Flat Project, a long-term international project to determine the effects of surface geology on earthquake shaking, and worked with academic and other governmental scientists on applying new and innovative methods for determining liquefaction and seismically induced landslide susceptibility. He was a Principal Investigator of a NEHRP-funded project that developed the procedure for preparing earthquake-induced landslide zones in the early 1990's, and more recently was a Principal Investigator in a NEHRP-funded project aimed at improving the liquefaction zoning methodology by moving to a deformation-based criteria. Mr. Real authored and co-authored numerous peer-reviewed scientific journal articles covering natural hazards policy, topographic amplification, liquefaction and landslide hazard zoning, remote sensing for hazard mapping, and geotechnical site response, and prepared a long list of CGS special reports and publications. Over the past several years, Mr. Real extended his expertise and leadership into tsunami hazard reduction; under his leadership, CGS expanded its role in tsunami hazard analysis for emergency response, maritime, and land-use planning purposes. In partnership with the California Emergency Management Agency, the state tsunami program is helping to lead the way nationally with new and innovative tsunami hazard mitigation efforts. Mr. Real established the California Tsunami Policy Work Group to develop an action plan to implement first-of-a-kind probabilistic tsunami hazard mapping products, as well as establish a long-term vision for tsunami resiliency planning.

2013 Overall Award in Excellence for Mitigation Efforts

The Overall Award in Excellence – awarded in the category of Mitigation Efforts – went to Oregon Emergency Management, a division within the Oregon Military Department, for the Oregon Seismic Rehabilitation Grant Program.

Program Summary

The major purpose of the Seismic Rehabilitation Grant Program is to help manage the high earthquake risk in the state of Oregon by using a seismic vulnerability assessment, rigorous cost benefit analysis and leveraged state bond funds to assist public schools and emergency response facilities in mitigating the seismic risk. Sustained efforts by long-time seismic safety champions such as former WSSPC Award winner Senator Peter Courtney, have helped make the program a reality.



The program provides grant funds to eligible applicants that have been selected by a grants review committee; awards, which range up to a maximum of $1.5 million, are used to seismically upgrade eligible high risk schools and emergency response facilities. The program also is designed to encourage leverage of other related pre-disaster mitigation activities, and includes outreach efforts to businesses, government, the general public, schools and non-profits to inform others about seismic risks and the grant program itself.

Because grant applications require a cost-benefit analysis, a relatively simple-to-use Oregon benefit-cost analysis tool was developed using the state's Department of Geology and Mineral Industries' enhanced rapid visual screening (E-RVS) method, and made available to applicants.

The program has issued three limited but successful rounds of grant awards: the first in 2010 and subsequent awards in 2011 and 2012. The grant program was established with the intent to help all Oregon communities meet life safety in emergency response facilities by 2022 and schools by 2032, as stipulated in Oregon Revised Statute 455.400. In order to assist Oregon communities meet the seismic safety laws, the grant program would need to expand its capacity and operate through 2032.

Contact Information

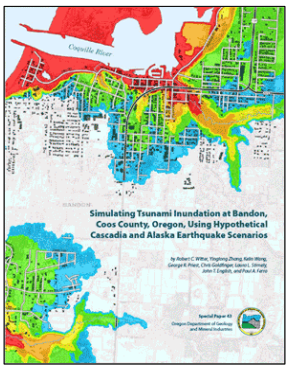
Program Name	Oregon Seismic Rehabilitation Grant Program
Administering Agency	Oregon Emergency Management
Address	P.O. Box 14370, Salem, OR 97309-5062 3225 State Street, Salem OR 97301
Telephone	503-378-2911
Website	*http://www.oregon.gov/OMD/OEM/Pages/plans_train/SRGP.aspx*

2013 Award in Excellence for Use of New Technology

The Oregon Department of Geology and Mineral Industries (DOGAMI) won the Award in Excellence for Use of New Technology for its publication *DOGAMI Special Paper 43 Simulating tsunami inundation at Bandon, Coos County, Oregon, using hypothetical Cascadia and Alaska earthquake scenarios.*

Project Summary

In July 2011, DOGAMI published DOGAMI Special Paper 43 Simulating tsunami inundation at Bandon, Coos County, Oregon, using hypothetical Cascadia and Alaska earthquake scenarios, providing a new method for modeling Cascadia subduction zone earthquakes for use in tsunami inundation modeling. The new method incorporates multiple source characterization for the Cascadia subduction zone with many possible earthquake scenarios using a logic tree framework. DOGAMI is currently using this method – which includes modeling fault slip ranging from 9 to 44 m and earthquakes with moment magnitude ranging from M8.7 to M9.2 – to develop tsunami inundation maps for the Oregon coast.



Funded by the National Oceanic and Atmospheric Agency's National Tsunami Hazard Mitigation Program, the method was developed by a group of scientific experts on the Cascadia subduction zone who developed a consensus on how to model the fault source with rupture parameters for use in tsunami hazard modeling. The method could be used to model Cascadia subduction zone-related tsunami hazards in northern California, Washington, and British Columbia as well as specific locations in Oregon. Although it is considered a state-of-the-art method, a future advancement might be to develop probabilistic tsunami hazard assessments and maps, perhaps to complement the USGS's probabilistic seismic hazard maps.

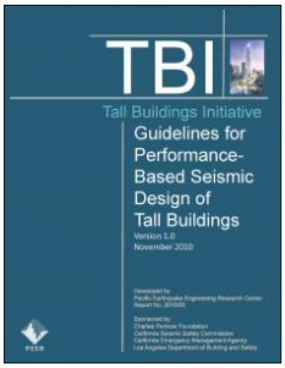
Contact Information

Project Name	*DOGAMI Special Paper 43: Simulating tsunami inundation at Bandon, Coos County, Oregon, using hypothetical Cascadia and Alaska earthquake scenarios*
Administering Agency	Oregon Department of Geology and Mineral Industries (DOGAMI)
Address	800 NE Oregon Street, #28, Portland, OR 97232
Telephone	971-673-1550
Website	*www.oregon.gov/OMD/OEM*
Download	*http://www.oregongeology.org/tsuclearinghouse/resources/sp-43/SP-43_onscreen144dpi.pdf*

2013 Award in Excellence for Innovation

Project Summary

In response to the surge of new and proposed tall buildings in regions of high seismicity and the lack of specific building code requirements that apply to them, the Tall Buildings Initiative coordinated funds and volunteer resources from several organizations to develop recommended design criteria that will help ensure that future, new tall buildings are safe and usable following earthquakes. The initiative was an extraordinary undertaking during particularly challenging economic times in both the building industry and academia, and involved collaboration across multiple disciplines including seismologists, geotechnical engineers, structural engineers, sociologists, architects, cost estimators, government regulators, building owners and occupants; Pacific Earthquake Engineering Center provided team management.



Many new tall buildings use innovative structural and architectural systems and high performance materials to meet earthquake performance criteria. However, prior to the Tall Buildings Initiative Guidelines published in November 2010, there were significant differences in alternatives to the Building Code that were published by the City and County of San Francisco and the Los Angeles Tall Buildings Structural Design Council. Before the Tall Buildings Initiative, there were no studies that systematically evaluated the different approaches to Performance-Based Earthquake Engineering, nor did comparisons with minimal code-based analysis and design approaches exist. The Tall Buildings Initiative generated key parametric studies and applied many earthquake simulations that now serve as the basis for its Guidelines for Performance-based Seismic Design.

Contact Information

Project Name	Tall Buildings Initiative
Administering Agency	Pacific Earthquake Engineering Research Center (PEER)
Address	325 Davis Hall MC 1792, Berkeley, CA 94720
Telephone	510-642-3437
Website	*http://peer.berkeley.edu/tbi/*
Downloads	*http://peer.berkeley.edu/tbi/publications-reports/*

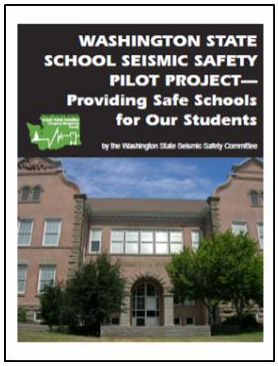
2013 Award in Excellence for Mitigation Efforts

The Washington School Seismic Safety Assessment Pilot Project – a project of the Washington State Seismic Safety Committee (SSC) – was the recipient of the 2013 WSSPC Award in Excellence for Mitigation Efforts.

Project Summary

A goal that had been on the horizon for several Washington State agencies, including but not limited to the Emergency Management Division (EMD), Department of Natural Resources (DNR), the Office of Superintendent of Public Instruction (OSPI), and Washington State's Seismic Safety Committee, was to systematically evaluate all public school buildings and critical facilities within Washington in order to establish the seismic risk for each. While a few individual school districts had completed such assessments, there had been no consistent, comprehensive statewide approach.

In late 2009, the aforementioned agencies, with funding support from FEMA through the National Earthquake Hazard Reduction Program (NEHRP), initiated a pilot project to evaluate school buildings in two school districts, Walla Walla Public Schools and the Aberdeen School District. Local emergency managers from Grays Harbor County and Walla Walla County participated in the process and included the school districts in their hazard mitigation plan update process, thus enabling the districts to be eligible for FEMA grant funding. ASCE 31-Tier 1 assessments were completed by volunteer structural engineers from the Structural Engineering



Association of Washington (SEAW) and volunteers from the Washington Association of Building Officials (WABO) provided further examination of non-structural elements. To get a true picture of risk for a particular site, staff from the Department of Natural Resources, used non-invasive methods that assessed the physical site characteristics by measuring how seismic waves travel through the upper 30 meters of soil. DNR Staff then input the identified building and soil characteristics in to FEMA's loss estimation modeling program, Hazards United States (HAZUS). Upon completion of the pilot project, participating districts were provided with a study report that they are using to strongly justify applications for FEMA grant funding through the Pre-Disaster Mitigation Grant Program (PDM) and the Hazard Mitigation Grant Programs (HMGP) to seismically retrofit deficient structures, thus alleviating some of the future costs that could be incurred.

Contact Information

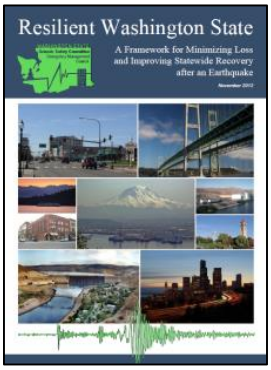
Project Name	Washington School Seismic Safety Assessment Pilot Project
Administering Agency	Washington State Seismic Safety Committee (SSC)
Address	Building 20, Camp Murray, WA 98430
Telephone	253-512-7001
Website	*http://www.emd.wa.gov/hazards/haz_earthquakes.shtml#Seismic*
Download	*http://www.dnr.wa.gov/Publications/ger_ofr2011-7_school_pilot_project.pdf*

2013 Award in Excellence for Multijurisdictional Planning

Washington State Seismic Safety Committee (SSC) won two WSSPC Award in Excellence Awards in 2013 – the second one was for The Resilient Washington State Initiative in the category of Multijurisdictional Planning.

Project Summary

Washington's SSC initiated a project in early 2010 to prepare a policy paper with the purpose of creating a framework for improving the state's resilience when earthquakes occur. Such a framework includes more effective seismic mitigation policies and recommendations for legislation and policy changes to improve and enhance statewide seismic safety. The report will be used to facilitate long-term implementation of seismic risk reduction policies across the state with the goal of making the state resilient in a 50-year time frame.



To complete this effort, the SSC formed a subcommittee called the Resilient Washington State (RWS) Subcommittee. Beginning with a one-day workshop on September 17, 2010, to introduce the project, the RWS Subcommittee brought together more than 100 key experts and stakeholders to coordinate with each other in facilitated subgroups that would complete an assessment of recovery timeframes and recommend policy changes to meet transparent performance measures.

To guide the project, the RWS Subcommittee defined a resilient state as "One that maintains services and livelihoods after an earthquake. In the event that services and livelihoods are disrupted, recovery occurs rapidly, with minimal social disruption, and results in a new and better condition." A number of values were also developed to include: Life Safety and Human Health, Property Protection, Economic Security, Environmental Quality, and Community Continuity. The participants in the sector groups worked within their areas of expertise to evaluate—relative to earthquake resilience—the current condition of infrastructure or service located throughout the State of Washington. Participants used a two-pronged approach to assessing how long certain critical infrastructure and services may be down after an earthquake, which enabled the first holistic and comprehensive assessment of how long it would currently take for Washington State to recover from a serious earthquake, and identified realistic target timeframes for recovery. To fill the identified gaps between existing recovery capacity and the suggested performance measure, the RWS Subcommittee, with input from the project stakeholders, identified recommended policy and programmatic changes to in effect 'buy down' future recovery times by investing in smart mitigation efforts today.

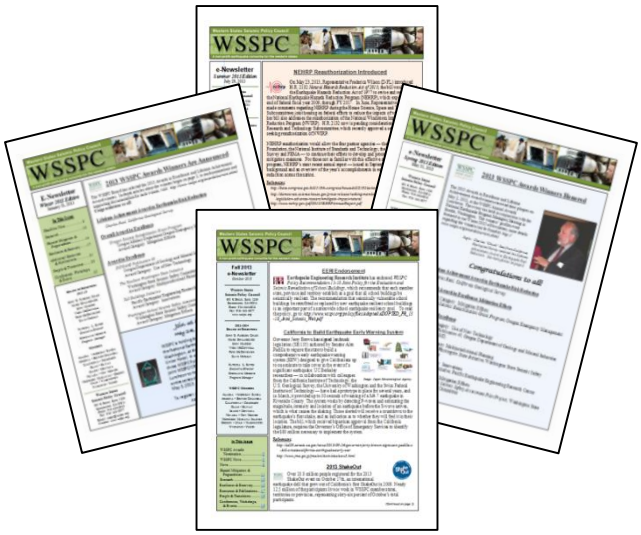
Contact Information

Project Name	Washington State Seismic Safety Committee (SSC)
Administering Agency	The Resilient Washington State Initiative
Address	Building 20, Camp Murray, WA 98430
Telephone	253-512-7001
Website	*http://www.emd.wa.gov/hazards/haz_earthquakes.shtml#Seismic*
Download	*http://www.emd.wa.gov/about/documents/haz_FinalRWSReport.pdf*

OUTREACH

e-Newsletter

Western States Seismic Policy Council has published a quarterly newsletter highlighting WSSPC member news since 1995; in 2008, the newsletter became an electronic "e-Newsletter" to provide easier access. Sections include summaries of WSSPC member news; hazard mitigation and preparedness activities; research findings; updates on the recovery and resiliency of previous earthquake and tsunami-impacted areas; earthquake and tsunami publications and resources; and updates on WSSPC members.

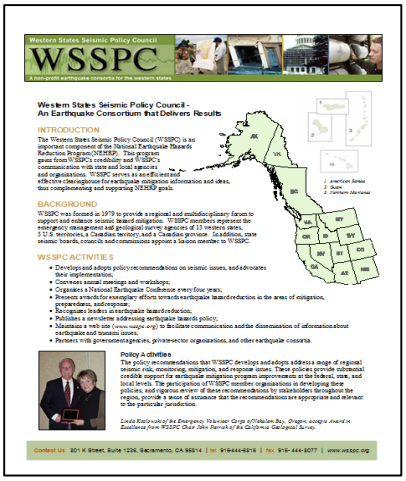


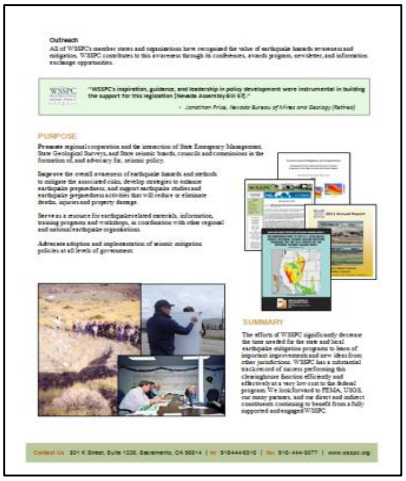
The e-Newsletter is distributed to hundreds of WSSPC members and affiliates, other earthquake consortia members, earthquake organizations, Federal Emergency Management Agency (FEMA) representatives, and United States Geological Survey (USGS) contacts. Current and previous e-Newsletters are available for download from the WSSPC website at *http://wsspc.org/news/newsletters.shtml*

WSSPC encourages member agencies – as well as other earthquake and tsunami organizations – to forward their information and news items for inclusion in upcoming editions. To subscribe to the WSSPC e-Newsletter, send an email to *smoreno@wsspc.org*.

WSSPC White Paper

WSSPC developed a white paper for its members to use to provide information to others about our non-profit organization. The publication is a useful tool for members to use for affiliate outreach and activity reporting, and is available on our website at *www.wsspc.org*





WSSPC.org

The WSSPC website – *www.wsspc.org* – showcases our official documents and publications, and provides links to WSSPC members' agencies, WSSPC technical committee activities, annual *Awards in Excellence* profiles, and earthquake and tsunami resources. To gauge the website's effectiveness, WSSPC has been using *www.web-stat.net* since February 2010 to monitor visitor statistics to the website. This web-based tool provides us with a comprehensive overview of website visits, including the number of new and repeat visitors; visitors' geographical locations; pages viewed; keywords and third-party links used to find our site; and how quickly visitors leave the site.

2013 Summary

After a significant earthquake or tsunami event, or when we release our quarterly e-newsletter, we may note an increase in visitors to the website, and a corresponding decrease in our bounce rate, which monitors how quickly a visitor leaves the website after accessing it. For example, after a M6.8 earthquake in the Northern Mariana Islands on May 13, 2013, there was a short spike in visitors and number of pages viewed on *www.wsspc.org*. The *WSSPC Website Visitors* chart on page C-12 contains the number of monthly site visits during FY 12-13.

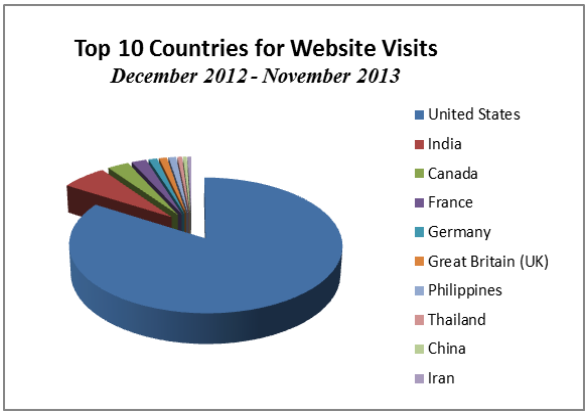
Pages Viewed by Visitors
December 2012 – November 2013

Home Page	6,145
Mitigation	2,343
Awards	1,726
About Us	1,271
Public Policy	1,106
Resources & Reports	1,042
Programs & Events	1,013
Other Earthquake Organizations	487
News	473
Tsunami Center	206
Calendar	87
Members	53
Total Page View	**15,952**

Lower bounce rate percentages indicate more visitors are continuing to one or more additional pages after initialing entering our site. Although bounce rates vary significantly during the course of a year, the *Monthly Bounce Rates and 2-Year Trendline* chart on page C-12 shows that visitors are staying longer, implying we are garnering greater interest in the content displayed on WSSPC pages.

The *Pages Viewed by Visitors* (left) lists the number of page views recorded for each main tab or link on the *www.wsspc.org* site. The 2012-2013 fiscal year yielded nearly 16,000 page views.

A number of third party websites refer visitors to our pages through links posted on their websites, as shown in the table on page C-11 and the charts – *Referrals from Member and Partner Agency* and *Referrals to wsspc.org* – on page C-13. With the exception of FEMA and USGS, most of the top referrers are from the western states, reflecting the continued visibility of the WSSPC website link on our members' and partners' websites.



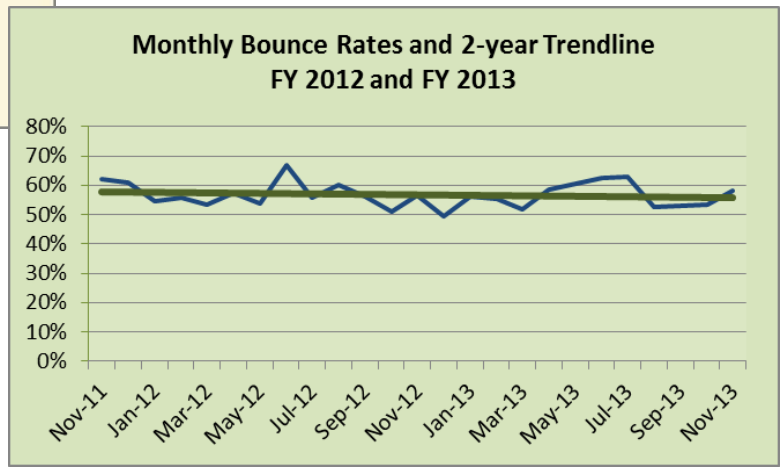
This year, Google searches led visitors to our pages from 76 countries around the world; the top ten appear in the pie chart at right. The most popular keywords and phrases leading search engines to our pages are "WSSPC" and "mitigation", as shown in the *Top Keywords Used in Searches* chart included on page C-13.

Third Party Links to WSSPC

The following WSSPC members and partner organizations have added a *www.wsspc.org* hyperlink to their agency's website to facilitate easy visitor access.

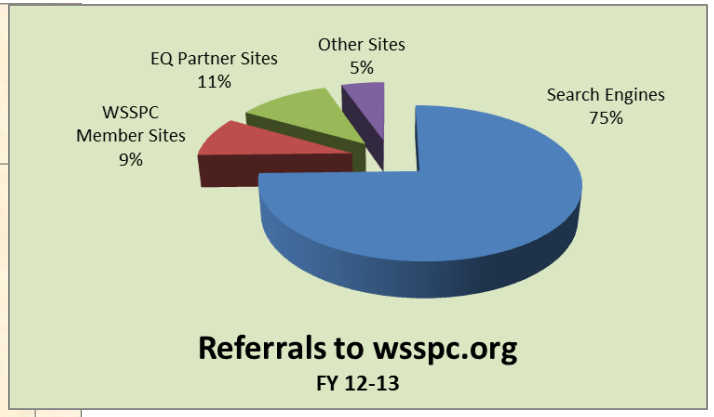
Organization	Link Location
Alaska Division Homeland Security and Emergency Management	http://ready.alaska.gov/links.htm
Alaska Division of Geological and Geophysical Surveys	http://www.dggs.dnr.state.ak.us/links/geology-links.php
Arizona Division of Emergency Management	http://www.dem.azdema.gov/operations/links.html
California Earthquake Clearinghouse	http://www.californiaeqclearinghouse.org/about/
California Governor's Office of Emergency Services	http://www.calema.ca.gov/PlanningandPreparedness/Pages/Earthquake-and-Tsunami-Partners.aspx
California Geological Survey	http://www.conservation.ca.gov/cgs/shzp/Pages/SHMPmorelinks.aspx
California Seismic Safety Commission	http://www.seismic.ca.gov/links.html
Cascadia Region Earthquake Workgroup	http://www.crew.org/news-events/blog/wsspc-releases-tsunami-report
Central U.S. Earthquake Consortium	http://cusec.org/earthquake-information/resources-a-links.html
Colorado Division of Emergency Management	http://www.coemergency.com/search/label/earthquake
Colorado Earthquake Hazard Mitigation Council	http://geosurvey.state.co.us/hazards/Earthquakes/Pages/ColoradoEarthquakeHazardMitigationCouncil.aspx
Colorado Geological Survey	http://geosurvey.state.co.us/hazards/Earthquakes/Pages/Earthquakes.aspx
Emergency Management British Columbia	http://www.embc.gov.bc.ca/em/em_links/em_links.html
Federal Emergency Management Agency	http://www.fema.gov/earthquake-contacts/regional-earthquake-consortia
Idaho Bureau of Homeland Security	http://www.bhs.idaho.gov/Pages/Preparedness/Hazards/NaturalHazards/Earthquake.aspx
Idaho Geological Survey	http://129.101.67.129/DrawOnePage.asp?PageID=179
Montana Bureau of Mines and Geology	http://mbmgquake.mtech.edu/news.html
Nevada Bureau of Mines and Geology	http://www.nbmg.unr.edu/Links.html
Nevada Division of Emergency Management	http://dem.nv.gov/links/
Nevada Earthquake Safety Council	http://www.nbmg.unr.edu/nesc/
New Mexico Bureau of Geology and Mineral Resources	http://geoinfo.nmt.edu/links/home.html
New Mexico Dept. of Homeland Security and Emergency Management	http://www.nmdhsem.org/Preparedness_Links.aspx
NOAA Center for Tsunami Research	http://nctr.pmel.noaa.gov/tsu_links.html
Northridge 20 Symposium	http://www.northridge20.org/
Oregon Dept. of Geology and Mineral Industries	http://www.oregongeology.org/sub/links/EQlinks.HTM
Oregon Emergency Management	http://www.oregon.gov/OMD/OEM/plans_train/earthquake.shtml
Oregon Seismic Safety Policy Advisory Commission	http://www.oregon.gov/OMD/OEM/osspac/osspac.shtml
Southern California Earthquake Center	http://www.scec.org/aboutscec/partnerships/
State Earthquake Program Managers	http://eqprogram.net/regional-consortia/
United States Geological Survey	http://earthquake.usgs.gov/other_eqsites.php
Utah Division of Emergency Management	http://publicsafety.utah.gov/emergencymanagement/mainlinks.html
Utah Geological Survey	http://geology.utah.gov/ghp/workgroups/brpshs.htm
Utah Seismic Safety Commission	http://ussc.utah.gov/threat.html
Washington DNR, Earth Sciences Division	http://www.dnr.wa.gov/ResearchScience/Topics/GeologicHazardsMapping/Pages/eqlinks.aspx
Washington Emergency Management Division	http://www.emd.wa.gov/hazards/haz_earthquakes.shtml
Yukon Emergency Measures Organization	http://www.community.gov.yk.ca/emo/links.html

Left: The WSSPC Website Visitors chart demonstrates how our monthly site visits increase after distribution of our quarterly e-Newsletter; in 2013, these were distributed in late January, May, July and October. Occasionally, daily rates also spike – leading to an increase in the monthly numbers – after a major earthquake event, such as the M8.0 earthquake in the Solomon Islands on 2/5/2013.



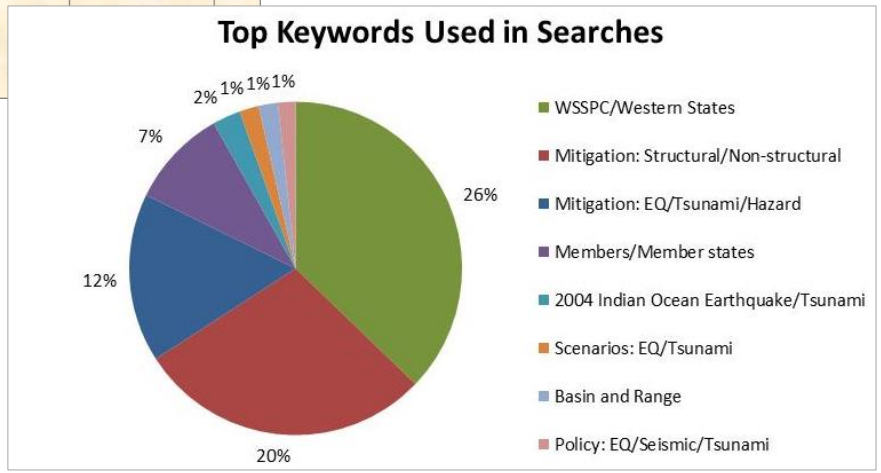
Right: The website's bounce rates – which monitor how quickly a visitor leaves our site after accessing it – shows evidence of a downward trend over the course of the last two years, indicating visitors are staying on our pages longer.

Above: Visitors often find wsspc.org after clicking on a link provided by the Federal Emergency Management Agency (FEMA) or the U.S. Geological Survey (USGS).



Above: The majority of visitors find us through search engines.

Below: In 2013, a significant percentage of searches leading to WSSPC included the phrases "structural mitigation" or "non-structural mitigation".



COLLABORATION

National Earthquake Program Managers Meeting

The National Earthquake Hazards Reduction Program (NEHRP) – implemented through the joint efforts of the Federal Emergency Management Agency (FEMA), the National Institute of Standards and Technology, the National Science Foundation, and the U.S. Geological Survey – was established by Congress in 1977 to lead the federal government's efforts to reduce the fatalities, injuries, and property losses caused by earthquakes.

As a component of NEHRP, many U.S. state and territorial governments have designated an earthquake program manager or coordinator to work on statewide earthquake risk reduction activities in order to reduce earthquake-related losses; the position is typically housed within the emergency management agency. Each year, a group of these representatives participate in the "National Earthquake Program Managers" (NEPM) meeting to develop programs and best practices, and foster relationships.

WSSPC helped plan and coordinate the 2013 meeting, which was held at the Marriott Courtyard Seattle Downtown/Lake Union in Seattle, Washington on April 30 to May 1, 2013. Per NEPM's website, the goal of the meeting was to "continue dialogue and relationship building between State Earthquake Program Managers and key stakeholders as well as to carry forward momentum from the 2012 National Earthquake Conference in Memphis, Tennessee."

Above: FEMA NEHRP Program Manager Ed Laatsch (on left) with planning committee members for the 2013 NEPM meeting. Image: Jennifer Lynette, FEMA

This year's meeting included a variety of sessions for earthquake program managers and partners, including:

- Earthquake program manager presentations and updates.
- FEMA/NEHRP earthquake program updates.
- Lessons on recovery from New Zealand's Canterbury/Christchurch earthquakes.
- Cross-boundary operations.
- Lessons learned from the August 2011 Virginia earthquake from a school district's perspective.
- Building mission-ready *Emergency Management Assistance Compact* requests for post-earthquake building inspections.
- National Earthquake Prediction Evaluation Council & state models.
- FEMA P909 training.

More information on the 2013 NEPM meeting can be found at: *http://eqprogram.net*

State Assistance

Additional FY12 funding was provided to WSSPC to support assigned state and territory emergency management travel and meetings for California, Guam, and Hawaii. The support provided was the following:

California

- Travel to National Earthquake Program Managers meeting in Seattle (1 person).
- Travel to Natural Hazards Center Workshop in Broomfield, Colorado (2 people).
- Travel to North Coast for Cascadia Catastrophic Earthquake Planning roll out and ShakeOut meeting (1 person).
- Travel within state to conduct an Earthquake Early Warning briefing (1 person).
- Travel to the annual American Geophysical Union meeting, Earthquake Country Alliance, and Earthquake Early Warning stakeholder meetings (2 people).
- Earthquake and Tsunami Program educational publication supplies.

Guam

- ShakeOut educational materials – posters, brochures, and stickers.

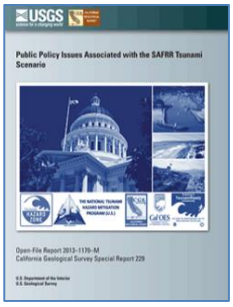
Hawaii

- Meeting costs and travel for 3 Hawaii State Earthquake Advisory Committee (HSEAC) meetings in Honolulu, Oahu

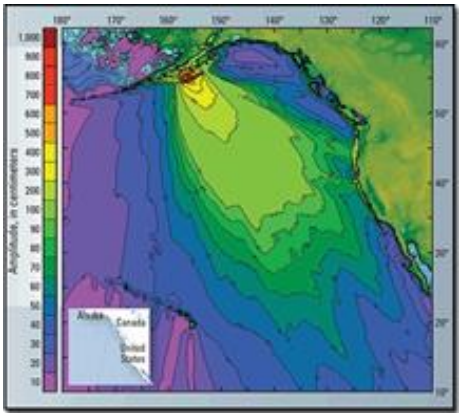
California Tsunami Policy Working Group

WSSPC Executive Director Patti Sutch is a member of the California Tsunami Policy Working Group, an ad hoc group formed in 2011 consisting of volunteer experts in earth science, flood hazard, structural and coastal engineering, local and regional planning, and natural hazard policy. The group has collectively considered the latest science on the tsunami threat to California and proposed a threefold framework to reduce tsunami risk – by taking mitigation actions, practicing risk-based land use and construction, and enhancing capabilities of emergency management. The group's report recommending policy actions will be published in 2014 during March's Tsunami Awareness Week.

The group also collaborated with the U.S. Geological Survey's Science Application for Risk Reduction (SAFRR) Tsunami Scenario project for California – a comprehensive impact analysis of a large credible tsunami originating from a M9.1 earthquake in the Aleutian Islands Subduction Zone striking California's coastline.



Above: The SAFFR Tsunami Scenario includes a chapter dedicated to public policy issues. Image: USGS/SAFRR



Left: This image from the SAFRR Tsunami Scenario Project shows travel times to California from the occurrence of the simulated SAFRR earthquake to the arrival of the first tsunami waves in California. Image: USGS/SAFRR

SECTION D

Policy

WSSPC POLICY COMMITTEES

WSSPC uses policy committees – consisting of members, members' agency representatives, and affiliate members – to develop and provide initial review of WSSPC's earthquake and tsunami policy recommendations. There are three standing policy committees: Basin and Range Province Committee, Engineering, Construction, and Building Codes Committee, and Tsunami Hazard Mitigation Committee.

Basin and Range Province Committee

The Basin and Range Province Committee (BRPC) seeks to promote the understanding and study of seismic hazards in the Basin and Range Province (BRP) of the western U.S., and to provide advice and recommendations to policy-making bodies regarding seismic hazards and risk in that region.

Basin and Range Province
Image: USGS

The BRPC consists of geoscientists and emergency managers from Basin-and-Range Province states (Arizona, Idaho, Nevada, New Mexico, and Utah). The BRPC states share common concerns regarding earthquake hazards and risk in the Basin and Range Province (BRP). Among those concerns are the large number of poorly studied or unstudied potentially active normal-slip faults in the BRP; the close proximity of known active faults to BRP urban centers; long recurrence intervals between damaging BRP earthquakes, leading to complacency on the part of both citizens and policy makers; unknowns regarding BRP fault behavior (earthquake clustering and triggering, multi-segment rupture, stress drops, BRP-specific attenuation relations); and the difficulty of preparing for damaging earthquakes in rural areas lacking adequate resources for planning and emergency response.

Goals pursued by the BRPC include promoting scientific research and emergency management functions in the BRP, establishing post-earthquake technical information clearinghouses, establishing informal cooperative agreements between states for technical assistance in the event of a damaging earthquake anywhere within the BRP, and facilitating information dissemination regarding the latest technical research and emergency response issues in the BRP.

Members:

EM = Emergency management representative
GS = Geologic survey representative
SSC = State seismic commission representative

2013 Chair: Bill Phillips, Idaho Geological Survey

Rick Allis, Utah GS
Lee Allison, Arizona GS
Kent Atwood, Montana EM
Elizabeth Ashby, Nevada EM
Wendy Blackwell, New Mexico EM
Bob Carey, Utah EM
Michael Conway, Arizona GS
Anthony Cox, Arizona EM
Craig dePolo, Nevada GS
Jim Faulds, Nevada GS
Melinda Gibson, Wyoming GS
Rob Jackson, Colorado SSC
Dave Love, New Mexico GS
Bill Lund, Utah GS (Past Chair)
Ian Madin, Oregon GS
John Metesh, Montana GS
Phil Pearthree, Arizona GS
L. Greer Price, Nevada GS
Mark Stephensen, Idaho EM
Mike Stickney, Montana GS
Seth Wittke, Wyoming GS
Jeri Young, Arizona GS

Engineering, Construction, and Building Codes Committee

The Engineering, Construction, and Building Codes Committee considers the need for and requirements of seismic building codes and incentives for building owners to retrofit older buildings.

Members:

2013 Chair: Ron Lynn, Nevada SSC

Rob Jackson, CO SSC
Mike Mahoney, Federal Emergency Management Agency
Pete McDonough, Utah SSC
Patrick Otellini, City and County of San Francisco
Woody Savage, U.S. Geological Survey, Emeritus
Mark Stephensen, Idaho EM
Yumei Wang, Oregon SSC
Barry Welliver, Utah SSC

Tsunami Hazard Mitigation Committee

The Tsunami Hazard Mitigation Committee coordinates and implements tsunami hazards mitigation plans and focuses on developing policies based on the current technology and science.

Members:

2013 Chair: Vicki McConnell, Oregon GS

Pilar Carbullido, Guam EM
Ann Gravier, Alaska EM
Rich Koehler, Alaska GS
Paul Okubo, Hawaii SSC
John Madden, Alaska EM
Richard McCarthy, California SSC
Kevin Miller, California EM
Teron Moore, British Columbia EM
Dave Norman, Washington GS
Erv Petty, Alaska EM
George Priest, Oregon GS
Kevin Richards, Hawaii EM
Althea Rizzo, Oregon EM
John Schelling, Washington EM
Bob Swenson, Alaska GS
Tim Walsh, Washington GS
Rick Wilson, California GS
Kent Yu, Oregon SSC

HISTORY OF WSSPC POLICY RECOMMENDATIONS

Adopted	Title	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
PR 13-1	Rapid Tsunami Identification and Evacuation Notification					A 01-1 & 01-2	>>>>>	>>>>>	R 04-1 & 04-2	>>>>>	>>>>>	R 07-1 & 07-2	>>>>>	>>>>>	R 10-1 & 10-2	>>>>>	>>>>>	R 13-1
PR 13-3	Post-Earthquake Technical Clearinghouses					A 01-3	>>>>>	>>>>>	R 04-3	>>>>>	>>>>>	R 07-3	>>>>>	>>>>>	R 10-3	>>>>>	>>>>>	R 13-3
PR 13-4	Seismic Provisions in the 2012 International Building Code					A 01-4	>>>>>	>>>>>	R 04-4	>>>>>	>>>>>	R 07-4	>>>>>	>>>>>	R 10-4	>>>>>	>>>>>	R 13-4
PR 13-5	Basin and Range Province Earthquake Working Group(s)								A 04-5	>>>>>	>>>>>	R 07-5	>>>>>	>>>>>	R 10-5	>>>>>	>>>>>	W
PR 13-6	Post-Earthquake Information Management System											A 07-6	>>>>>	>>>>>	R 10-6	>>>>>	>>>>>	R 13-6
PR 13-7	Seismic Design of New Schools														A 10-7	>>>>>	>>>>>	R 13-7
PR 13-9	Earthquake Early Warning Systems														A 10-9	>>>>>	>>>>>	W
PR 13-10	Joint Policy for the Evaluation and Seismic Remediation of School Buildings																	A 13-10
PR 13-11	Reliability of Lifeline Infrastructure																	A 13-11
PR 13-12	Earthquake Actuated Automatic Gas Shutoff Devices																	A 13-12
PR 12-1	Earthquake Planning Scenarios													A 09-1	>>>>>	>>>>>	R 12-1	>>>>>
PR 12-2	Developing Earthquake Risk-Reduction Strategies							A 03-1	>>>>>	>>>>>	R 06-1	>>>>>	>>>>>	R 09-2	>>>>>	>>>>>	R 12-2	>>>>>

Key: A = Adopted R = Re-adopted D=Discontinued N=Not Adopted W= Withdrawn/Returned to Committee

Adopted	Title	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
PR 11-1	Improving Tsunami Public Education, Mitigation, and Warning Procedures for Distant and Local Sources			A 99-1	>>>>>	>>>>>	R 02-1	>>>>>	>>>>>	R 05-1	>>>>>	>>>>>	R 08-1	>>>>>	>>>>>	R 11-1	>>>>>	>>>>>
PR 11-2	Definitions of Fault Activity for the Basin and Range Province	A 97-1	>>>>>	>>>>>	>>>>>	>>>>>	R 02-3	>>>>>	>>>>>	R 05-2	>>>>>	>>>>>	R 08-2	>>>>>	>>>>>	R 11-2	>>>>>	>>>>>
PR 11-3	Earthquake Monitoring Networks	A 97-4	>>>>>	>>>>>	>>>>>	>>>>>	R 02-5	>>>>>	>>>>>	R 05-3	>>>>>	>>>>>	R 08-3	>>>>>	>>>>>	R 11-3	>>>>>	>>>>>
PR 11-4	Identification and Mitigation of Unreinforced Masonry Structures					>>>>>							A 08-4	>>>>>	>>>>>	R 11-4	>>>>>	>>>>>
PR 11-5	Earthquake Emergency Handbook for First Responders and Incident Commanders															A 11-5	>>>>>	>>>>>
D	Development of National Earthquake Hazard Risk Mitigation Priorities	A 97-3	>>>>>	>>>>>	>>>>>	>>>>>	D											
D	Developing Guidelines for Fault Trace Setbacks	A 97-2	>>>>>	>>>>>	>>>>>	>>>>>	R 02-4	>>>>>	>>>>>	D								
D	Building Safe and Strong to Reduce Vulnerability to Earthquakes through Partnerships and Code Adoption						A 02-2	>>>>>	>>>>>	D								
D	Priorities for Applied Research on Earthquake Hazards								A 04-6	>>>>>	>>>>>	D						
D	Supporting Non-technical Explanation of USGS Uncertainty Maps to Accompany Probabilistic Seismic Hazard Maps								A 04-7	>>>>>	>>>>>	D						
D	Identification and Potential Mitigation of Seismically Vulnerable School Buildings														A 10-8	>>>>>	>>>>>	N
Proposed	To Reduce the Earthquake Vulnerabiity of Existing Public Buildings and Schools								N									
Proposed	Generic State Executive Order for Earthquake Safety for Existing State-Owned Buildings									N								

Key: A = Adopted R = Re-adopted D=Discontinued N=Not Adopted W= Withdrawn/Returned to Committee

POLICY RECOMMENDATIONS ADOPTED IN 2013

WSSPC Policy Recommendation 13-1

Rapid Tsunami Identification and Evacuation Notification

Policy Recommendation 13-1

WSSPC recommends that each coastal state, province, and territory emergency management agency work with coastal jurisdictions to develop evacuation plans for both local- and distant-source tsunamis, which have in place evacuation and re-entry notification systems, and supplement these emergency plans with a preparedness education campaign focusing on instructions to evacuate based on ground shaking, 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.

Executive Summary

Coastal jurisdictions should develop emergency response plans which incorporate both local-source tsunamis, where there may be only minutes to evacuate, and distant-source tsunamis, where there may be hours to evacuate. For local-source tsunamis, a robust education and preparedness campaign should focus on the importance of "natural" warnings, such as earthquake ground shaking felt at the coast as precursor to an incoming tsunami. For distant source tsunamis, emergency response plans should utilize redundant warning and communication systems and use nationally standardized systems which, in addition to standard evacuation and re-entry protocols, could include evacuation instructions via EAS to television and radio broadcast participants, automated telephone notification systems (e.g. reverse-911) and implementation of cell phone notification capabilities. The use of social media, phone trees, NOAA weather radios, satellite and cable television, and possibly beach-front sirens, if sirens are deemed effective and within a community's budget could further augment rapid dissemination of time sensitive tsunami alerts. Portions of this could be accomplished through adherence to planned implementation of the Integrated Public Alert and Warning System (IPAWS). These warning and notification systems should be tested on a consistent basis for confirmation of performance and improved efficiency during an event. WSSPC will work with its federal partners and the National Tsunami Hazard Mitigation Program to help maintain a consistent and effective, top-to-bottom warning system and public preparedness strategy.

Background

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

For distant source events, tsunami preparedness and response plans should include response to tsunamis, whether in "Warning" or "Advisory," in order to help reduce over or under evacuation of coastal areas.

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 would increase the immediacy and the coverage of the evacuation notification. These warning systems could include evacuation alerts and instructions through radio broadcasts, NOAA weather radios, focused reverse-911 cell phone calls, social media, or sirens focused on beach areas, if sirens are cost-effective and beneficial for a community. Portions of this could be accomplished through adherence to planned implementation of the Integrated Public Alert and Warning System (IPAWS). 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.

Placement of tsunami warning signs is an important aspect of educating the public about how to reach safety upon receipt of a warning. Signs are a proven education tool in recent tsunamis and should be implemented as determined appropriate by local authorities, with possible assistance from NTHMP in order to maintain continuity between coastal jurisdictions and states. Coastal jurisdictions should be encouraged to adopt standardized tsunami signs.

(See Also: *http://www.dot.ca.gov/hq/traffops/signtech/signdel/tsunami.htm*)

Regular and frequent testing of warning systems is essential to identify mitigation strategies for a more resilient and effective system. It is important to know that the system will work as intended should public safety officials ever need to send an alert or warning to a large region of the United States. Only a complete, top-down test can provide an appropriate diagnosis of the system's performance.

In some instances, ground shaking may be a precursor, and an "early warning," to the occurrence of a tsunami. People in all coastal jurisdictions 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 social media, coastal 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.

Internal Section:

Facilitation and Communication

1. Encourage representatives from state agencies to use Policy Recommendation 13-1 with their legislative delegations to develop rapid, multiple tsunami education and notification systems in their respective states, territories and provinces. In addition, education and evacuation planning are the most critical components of overall tsunami risk reduction and, therefore, should be promoted along with tsunami notification systems.

2. Forward Policy Recommendation 13-1 to the National Oceanic and Atmospheric Administration (NOAA), United States Geological Survey, the Federal Emergency Management Agency, and other Federal and State organizations as appropriate, for their budget and technical support.

3. Work with the National Tsunami Hazard Mitigation Program to support development of guidance on various rapid identification and notification systems to help supplement on-going, essential tsunami preparedness and awareness efforts.

Assessment

The assessment of this policy 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) regular tests of operational capability of notification 4) reauthorization and continued implementation of Public Law 109-424 (the Tsunami Warning and Education Act) that requires improvement in tsunami detection, forecasting, warning, notification, outreach, and mitigation in tsunami jurisdictions; 5) communities being designated by NOAA/National Weather Service (with state assistance) as a TsunamiReady™ Community; and 6) number of public education workshops and surveys completed in at-risk tsunami jurisdictions.

History

Policy Recommendation 13-1 is a synthesis of Policy Recommendations 10-1 and 10-2. PR 13-1 was adopted by voice vote of the WSSPC membership at the Annual Business Meeting May 3, 2013. Montana Emergency Management abstained from voting. Policy Recommendation 13-1 was 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.

WSSPC Policy Recommendation 13-3

Post-Earthquake Technical Clearinghouses

Policy Recommendation 13-3

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.

Executive Summary

Post-earthquake technical clearinghouses have been an important component of emergency response, recovery, and mitigation following large earthquakes. A technical clearinghouse, either established in a physical location or web based (virtual), can serve to coordinate post-earthquake investigations to provide timely hazards observations for state and federal emergency managers, scientific communities, and the public. This information is then used to improve our assessments of earthquake hazards, earthquake engineering, mitigation strategies, economic losses, and emergency response to damaging earthquakes. The clearinghouse also serves to integrate, manage, disseminate and archive information so that it is available to decision makers.

Multijurisdictional cooperation is especially important in the event of a large earthquake that affects multiple states. 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.

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 event 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.

Internal Section:

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. An Executive Summary was added to Policy Recommendation 10-3 and the policy was re-adopted as Policy Recommendation 13-3 by unanimous vote of the WSSPC membership at the Annual Business Meeting May 3, 2013.

WSSPC Policy Recommendation 13-4

Seismic Provisions in the 2012 International Building Codes

Policy Recommendation 13-4

WSSPC endorses the prompt adoption and enforcement of the seismic provisions of the 2012 *International Existing Building Code*, the 2012 *International Building Code*, and the 2012 *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.

Executive Summary

The *International Existing Building Code*, the *International Building Code* and the *International Residential Code* identify the minimum standards for the protection of life, limb and property. These consensus documents, which are supported by every major construction organization in the United States, provide the means for local jurisdictions, states and territories to protect their citizens, safeguard the economic vitality of their communities and provide for a sustainable environment. Amending seismic provisions out of the Code which are essential to the structural integrity of buildings compromises the effectiveness of the document and the safety of the community. Coinciding with Code adoptions is the need for appropriate training so the seismic resistant provisions may be consistently enforced and maintained. It is only through the unamended adoption of the seismic provisions of the International Code that a community has a legitimate expectation to be resilient in the event of disaster for its citizens, businesses and homes.

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.

Internal Section:

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 2012 editions of the International Existing Building Code, the International Building Code, and the International Residential Code.

History

Policy Recommendation 13-4 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. Policy Recommendation 10-4 was updated and re-adopted as Policy Recommendation 13-4 by a unanimous vote of the WSSPC membership at the Annual Business Meeting May 3, 2013.

WSSPC Policy Recommendation 13-6

Post-Earthquake Information Management System

Policy Recommendation 13-6

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

Executive Summary

Data collected after a major earthquake by both the public and private sectors is often lost because there is no systematic way to archive it, and thus the knowledge that could benefit society in the future is also lost. A national archive repository of post-earthquake information would allow practitioners to document, preserve, and access data on the natural, built and socioeconomic environments and to use this information to improve our understanding of earthquakes and reduce earthquake losses.

A national Post-earthquake Information Management System is supported by the Strategic Plan of the National Earthquake Hazards Reduction Program as a mechanism to achieve national risk reduction and mitigation goals. A scoping study for an information management system conducted by the American Lifelines Alliance (2008) states that "any national effort to reduce earthquake losses and social disruption resulting from severe natural hazard events requires a mechanism to capture and preserve engineering, scientific, and social performance data in a comprehensive and coherent system that will contribute to our learning from each disaster. Such a resource can play a vital role in efforts to enhance infrastructure and building design and to optimize mitigation, disaster planning, and response and recovery activities."

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 13-3) 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, authorized $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.

References

American Lifelines Alliance, 2008, Post-Earthquake Information Systems (PIMS) Scoping Study, 107 p.

http://www.nehrp.gov/pdf/alapimsreport.pdf

NEHRP, 2008, Strategic Plan for the National Earthquake Hazards Reduction Program, Fiscal Years 2009-2013 Strategic Plan, 66 p.

http://www.nehrp.gov/pdf/strategic_plan_2008.pdf

U.S. Geological Survey. 2003, The Plan to Coordinate NEHRP Post-Earthquake Investigations: USGS Circular 1242, 27 p.

http://geopubs.wr.usgs.gov/circular/c1242/c1242.pdf

Internal Section:

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 13-6 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. An Executive Summary and References were added to Policy Recommendation 10-6 and it was re-adopted as PR 13-6 by unanimous vote of the WSSPC membership at the Annual Business Meeting May 3, 2013.

WSSPC Policy Recommendation 13-7

Seismic Design of New Schools

Policy Recommendation 13-7

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 appropriate responsible local, state, and federal entities provide dedicated financial support for the establishment of a program that improves the seismic safety of new schools.

Executive Summary

School facilities, in addition to caring for our children, are often used as public assembly areas as well 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 risk category. School facilities that are designed and built under this set of assumptions are 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, and HVAC (Heating Ventilation and Air Conditioning). This presents an obvious problem where school facilities are used as emergency shelters or command centers. Increasing the school's design category to that of an essential facility would be more in conformance with its actual use, assure the safety of our children, and enhance the resiliency of the community.

Background

Currently schools are designed using the International Building Code Risk Category III. Design standards and professional practices of care are consistent with the code's guidance. WSSPC encourages increasing the Risk Category to a Level IV, while employing a minimum of Seismic Design Category C for school facilities with an occupancy load of greater than 250 persons, to be more consistent with the construction of essential facilities.

Individual School Districts and private operators should also be made aware of FEMA 241 which addresses mitigating non-structural hazards from building contents, its use and occupancy. 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.

Reference

FEMA 241, *Identification and Reduction of Nonstructural Earthquake Hazards in Schools*: Federal Emergency Management Agency, 18 p., July 1993.

Internal Section:

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 re-adopted as Policy Recommendation 13-7 by a voice vote of the WSSPC membership at the Annual Business Meeting May 3, 2013. Montana and Hawaii Emergency Management were opposed. Policy Recommendation 10-7 was first adopted by majority voice vote of WSSPC members July 9, 2010 at the Annual Business Meeting in Broomfield, Colorado. Hawaii was opposed.

WSSPC Policy Recommendation 13-10

Joint Policy for the Evaluation and Seismic Remediation of School Buildings

Policy Recommendation 13-10

The Western States Seismic Policy Council, with the support of the Earthquake Engineering Research Institute, recommends that each member state, province and territory establish as a goal that all school buildings be seismically resilient. This recommendation that seismically vulnerable school buildings be retrofitted or replaced by new earthquake resilient school buildings is an important part of a nationwide school earthquake resiliency goal.

Executive Summary

Our elementary and secondary school buildings contain the future of our country. Parents send their children to school every day with the belief that their children will be safe. However, many of the schools located in WSSPC's states, provinces and territories are older structures vulnerable to severe damage and even collapse in future earthquakes.

This WSSPC Policy Recommendation is enacted in recognition that WSSPC member states and territories are attempting to undertake the process of increasing the seismic resilience of schools. The Policy Recommendation provides needed support for these efforts.

Background

The 1933 Long Beach, California M6.4 earthquake is best known for collapsing or severely damaging thousands of unreinforced masonry (URM) buildings, including over 230 school buildings. Fortunately, schools were not in session at the time of the earthquake. Had that been the case, thousands of children would have been injured or killed.

The outcry from this poor performance of school buildings directly led to the State of California passing the Field Act which mandated earthquake resistant construction requirements for future school buildings, and the Garrison Act which established the requirements for the seismic safety of existing school buildings.

Schools are increasingly used to shelter students in place during all hazards, including flood and hurricane as well as earthquakes. In addition, schools are often used as refuge zones for citizens within their communities. Thus school building resilience is a key to protecting the local population under diverse hazardous conditions.

There have been notable efforts by some WSSPC member states, including Idaho, Washington, Oregon and Utah, to identify at-risk school buildings and to begin the process of addressing the risk they present.

Internal Section:

Facilitation and Communication

This policy recommendation will be sent to WSSPC representatives in the member states, who will then be able to distribute it to policy and decision makers, elected officials, school districts, parent/teacher associations, teacher unions, school administrators, building departments and elected leaders.

Assessment

A measure of the acceptance and implementation of this policy recommendation is the number of states, provinces and territories as well as individual school districts that adopt a seismic retrofit evaluation and remediation plan for their school buildings.

History

Policy Recommendation 13-10 was adopted by unanimous vote of the WSSPC membership at the Annual Business Meeting May 3, 2013.

WSSPC Policy Recommendation 13-11

Reliability of Lifeline Infrastructure

Policy Recommendation 13-11

WSSPC encourages improving the reliability and survivability of lifeline infrastructure and hereby supports the development of seismic design and performance guidelines for both new and existing infrastructure.

Executive Summary

Lifelines form a critical segment of the nation's infrastructure. Disruption can significantly affect the well-being of a community. Guidelines can serve as an effective method of identifying and reducing risk.

Background

Lifeline infrastructure including, but not limited to, electricity, gas, telecommunications, water, and waste water are critical to a community's wellbeing. Lifelines are being constructed without adequate seismic design and/or performance guidelines. Many existing lifelines have been constructed using old methods and technologies that are known to be inadequate by seismic experts.

Much of the nation's existing infrastructure has not been designed to tolerate extreme conditions exerted by major earthquakes, or earthquake-induced tsunamis, fault rupture, large landslides and liquefaction. Lifelines should have reliable performance to ensure that the region can withstand future earthquake damage without crippling consequences. Critical infrastructure requires vulnerability studies in order to understand potential damages and consequences. Mitigation of infrastructure with a high likelihood of failure with extreme consequences should be addressed. This policy recommendation is a reinvigorated effort to follow through on resolving infrastructure liabilities originally identified in FEMA 271 "Plan for Developing and Adopting Seismic Design Guidelines and Standards for Lifelines" (1995).

Internal Section:

Facilitation and Communication

Implementation

WSSPC recommends that the American Society of Civil Engineers (ASCE) develop guidelines addressing the seismic resilience of critical infrastructure. This process should involve a wide variety of stakeholders, potentially including FEMA, ANSI and DHS. A consideration in the development of these new guidelines should be their potential use in ongoing maintenance, rehabilitation and risk mitigation to existing lifelines to decrease infrastructure seismic vulnerability. Implementation can be accomplished by working with state agencies and regulators, such as public works, energy and water resource departments. Additional stakeholders include public and private utility commissions and drinking water programs.

Assessment

The effectiveness of this policy can be determined by completing the development and working towards implementation of industry recognized guidelines.

History

Policy Recommendation 13-11 was approved unanimously by vote of the WSSPC membership at the Annual Business Meeting May 3, 2013.

WSSPC Policy Recommendation 13-12

Earthquake Actuated Automatic Gas Shutoff Devices

Policy Recommendation 13-12

WSSPC recommends that each state, province or territory which is considering implementing requirements for installing automatic gas shutoff devices in industrial, commercial and/or residential applications assure that shutoff valves meet the provisions of the most currently available revision of ANSI/ASCE/SEI Standard 25 (Earthquake-Actuated Automatic Gas Shutoff Devices) and be installed in conformance with the manufacturer's installation instructions. The cost versus benefit of turning gas on after an event or the analysis of false activation is left to the jurisdiction. The policy only advocates that if a decision is made to proceed with earthquake actuated automatic gas shutoff devices that the current state-of-the-art provisions be utilized.

Executive Summary

Natural gas piping and appliances may be damaged during earthquakes, causing gas leaks. These leaks, if ignited, can result in fires and explosions which may jeopardize personal safety as well as resulting in significant damage to structures.

Fires and explosions may be more destructive to buildings than the earthquake itself. The ability to manually shut off a gas valve after an earthquake may be difficult or impossible due to debris or ground movement. Risk of gas related damage is further exacerbated if structures are unoccupied, thus placing the burden of shutting off gas service upon utilities or government agencies. The reliability of automatic gas shutoff valves has been greatly improved with the adoption of ANSI/ASCE/SEI Standard 25.

Background

A survey after the 1994 Northridge earthquake indicated automatic shutoff valves prevented "numerous gas related fires or explosions which reduced the need for water, firefighters and other emergency services" (Strand, 1998). Earthquake activated automatic gas shutoff devices are relatively inexpensive and a proven method to prevent the loss of gas, resultant fires and possible community conflagrations which might result from an errant spark.

While the installation of excess flow valves is currently mandated by Federal Code on new or replacement natural gas service lines serving single family residences, these valves may not detect leakage within structures caused by damaged or overturned appliances or equipment. The value of these may be enhanced by the addition of an automatic gas shutoff valve.

The suitability and conditions of the use of earthquake-actuated automatic gas shutoff devices should be reviewed and approved by the local jurisdiction having authority and such devices should comply with ANSI/ASCE/SEI Standard 25. Use of automatic gas shutoff valves can save lives and reduce the risk of property damage in areas of significant earthquake hazard.

Reference

Strand, Carl L., 1998, *Performance of Seismic Gas Shutoff Valves and the Occurrence of Gas-Related Fires and Gas Leaks During the 1994 Northridge Earthquake, with an Update on Legislation*, p. III-813, in: Proceedings of the NEHRP Conference and Workshop on Research on the Northridge, California Earthquake of January 17, 1994, Sponsored by the National Earthquake Hazards Reduction Program (NEHRP), Published by California Universities for Research in Earthquake Engineering, Richmond, California.

Internal Section:

Facilitation and Communication

- Encourage communication of the California Standards currently adopted by various jurisdictions.
- Commence an ongoing education program demonstrating both the value and reliability of the automatic gas shutoff valves.
- Target utility companies, homeowners, and policy makers.

Assessment

The success of the policy may be measured by voluntary use of automatic shutoff valves as well as mandatory requirements established in states, provinces, territories and local jurisdictions.

History

Policy Recommendation 13-12 was adopted by unanimous vote of the WSSPC membership at the Annual Business Meeting May 3, 2013.

POLICY RECOMMENDATIONS ADOPTED IN 2012

WSSPC Policy Recommendation 12-1

Earthquake Planning Scenarios

Policy Recommendation 12-1

WSSPC recommends that each member state, province, and territory establish an active program to produce Earthquake Planning Scenarios for areas with high risk of earthquake losses. WSSPC also recommends that FEMA support the production of these Earthquake Planning Scenarios through its funding resources and in-kind services.

Executive Summary

Earthquake planning scenarios provide policy makers and emergency preparedness personnel with realistic assessments of the areas and types of structures and lifelines that are at most risk of damage, and estimated human casualties. Equally important, scenarios identify areas and infrastructure that are most likely to sustain little or no damage and remain functional following an earthquake, thereby minimizing the placement of valuable response assets in areas where they may not be needed.

The cost to prepare planning scenarios, and to update them regularly, is insignificant compared to the future savings from reduced losses to infrastructure, business economics, and human life when the information is used to develop effective seismic-safety policies. Minimizing future earthquake damage through prior planning, loss-reduction measures, and providing information to facilitate quick recovery is critical for maintaining earthquake-resilient communities.

Background

The U.S. Geological Survey indicates that losses to the U.S. built environment and to the U.S. economy from natural geologic hazards amount to tens of billions of dollars every year, and the cost of these losses continues to increase. A fundamental reason for this increase is the continued development of population centers and infrastructure in areas known to have significant natural hazards. Policy makers and public agencies at all levels of government must balance the desired needs for community growth and development with concerns for ensuring the safety of the citizenry. Knowledgeable professionals must provide government decision makers, community planners, and developers with factual, timely, and unbiased scientific and engineering assessments of a community's vulnerability to geologic hazards. Planning scenarios have proven to be an effective means for communicating these risks.

Earthquake Planning Scenarios have been prepared for several areas in the western U.S. over the past two decades and have resulted in numerous initiatives to reduce future earthquake losses (see Appendix 1). A planning scenario describes a realistic earthquake and the estimated resulting damage and casualties in the affected areas. It may describe the fault rupture that initiates the earthquake, expected ground motion and acceleration, secondary effects triggered by the earthquake (landslides, liquefaction, surface rupture, tsunamis, fires), expected structural losses to the building stock and lifelines (major pipelines, power transmission lines, highways, bridges, airports, harbors, hospitals, etc.), and human casualties, as well as areas and types of infrastructure least likely to be damaged or destroyed. The purpose of a scenario is to provide accurate information that can assist governments and developers in engineering, planning, and protecting vulnerable facilities from the destructive effects of a future earthquake; prioritizing emergency relief operations in areas likely to suffer the greatest damage; or planning and conducting emergency response training exercises.

Appendix 1: Completed earthquake planning scenarios

Following the devastating eruption of Mount St. Helens in 1980, President Carter requested the National Security Council to consider the implications of the occurrence of a large damaging earthquake in California. The results of this analysis were presented by FEMA in 1981. One of the major conclusions was that it was unlikely that the collective emergency response capabilities of all levels of government and the private sector would be adequate to cope with a major destructive earthquake in metropolitan areas of California.

In response, the California Governor's Emergency Task Force on Earthquake Preparedness was established in February, 1981. Some 30 committees were formed to deal with improvement of the many emergency response functions that would be needed in such an earthquake emergency: e.g., communications, search and rescue, fire services, medical services, air transport, etc. Working with the Task Force, the California Geological Survey (CGS) developed the first two earthquake planning scenarios for the San Francisco Bay Area and the Greater Los Angeles Area. These two scenarios, funded by FEMA, were readily accepted, and a demand for additional scenarios covering other California metropolitan areas resulted in the production of five more scenarios over the following decade.

The State of Washington, through its Emergency Management Division of the Military Department, and the Earthquake Engineering Research Institute, recently prepared an earthquake disaster scenario for the Seattle-Tacoma metropolitan area. This scenario describes potential damage from the Seattle Fault, and predicts 1,600 deaths, 24,000 injured, police and fire departments overwhelmed, inadequate emergency and shelter services, nearly 40,000 buildings destroyed or rendered uninhabitable, $33 billion in damages and loss, more than 130 fires, and years of rebuilding and recovery.

In 1996, the Nevada Bureau of Mines and Geology (NBMG) produced a detailed scenario for a Reno-Sparks-Carson City earthquake. That scenario, published as NBMG Special Report 20, has been used numerous times in emergency response and recovery exercises, most recently in June 2008.

Most recently, the USGS, in collaboration with the California Geological Survey and many community agencies and organizations, has published *The ShakeOut Scenario – Effects of a Potential M7.8 Earthquake on the San Andreas Fault in Southern California* (USGS Open File Report 2008-1150; CGS Preliminary Report 25). Under this scenario, if no additional preparedness and mitigation actions are taken, the resulting damage will cause 2,000 deaths, 50,000 injuries, and $200 billion in damage along with severe, long-lasting disruptions.

Other states with earthquake potential have also prepared these types of scenarios on a formal basis. Washington, in collaboration with the USGS, universities, and others, is undertaking studies of the potential damage from a very large earthquake along the Cascadia Subduction Zone. The California Geological Survey has considered this in one of its original scenarios. In 2007, Oregon completed an initial step in quantifying structures in the state that would be susceptible to damage from an earthquake in its publication *Statewide Seismic Needs Assessment Using Rapid Visual Screening.*

In Alaska, an earthquake planning scenario is in the initial stages of development for the Kodiak area. This scenario is a cooperative effort involving the Alaska Seismic Hazards Safety Commission, Alaska Division of Homeland Security & Emergency Management, city and borough government, FEMA, and U.S. Coast Guard.

Appendix 2: Resources for scenario development

Valuable analytical tools are available for incorporation into Earthquake Planning and Mitigation Scenarios. HAZUS is a powerful risk assessment software program developed by FEMA for analyzing potential losses from earthquakes (as well as from other types of natural hazards). HAZUS combines current scientific and engineering knowledge with geographic information systems (GIS) technology to produce estimates of hazard-related damage before or after an earthquake. For HAZUS to be most effective, users should employ the latest census information and a current inventory of the built environment, including transportation and lifeline infrastructure.

Two other analytical tools are available from the USGS; these are ShakeMap and PAGER. ShakeMap combines measurements of ground shaking (actual or modeled) with information about local geology and earthquake location and magnitude to estimate shaking variations within a geographic region. Produced maps are a valuable tool for emergency response, public information, loss estimation, earthquake planning and modeling, and post-earthquake engineering and scientific analyses.

PAGER (Prompt Assessment of Global Earthquakes for Response) is an automated system designed to rapidly estimate the number of people, cities, and regions that have been exposed to severe ground shaking by an earthquake. PAGER products can be sent automatically to affected emergency responders, government agencies, and others with information as to the estimated scope of a potential disaster.

Internal Section:

Facilitation and Communication

Geological surveys are uniquely qualified to provide scientific and engineering information and guidance to the communities they serve regarding geologic and seismic hazards. Emergency management agencies facilitate and manage available resources to lessen the impacts of a damaging earthquake through mitigation and to hasten a community's response and recovery. Seismic safety advisory boards provide important state and local earthquake policy guidance. These WSSPC member organizations, in cooperation with other federal, state, and regional experts, are uniquely suited to combine their talents and spearhead the development and production of Earthquake Planning Scenarios for their affected populations. In addition, public-private organizations such as the not-for-profit Cascadia Region Earthquake Workgroup (CREW), which provides services to Washington, Oregon, California, and British Columbia, can assist in preparing earthquake and tsunami scenarios. Resources such as these should be examined and leveraged, where practicable.

Scenario-development activities are most effectively implemented by involving and coordinating with federal and state geoscience and emergency management agencies and owners and operators of critical infrastructure and key resources. This policy recommendation recognizes that FEMA is in an ideal position to support the development of earthquake planning scenarios.

Assessment

The effectiveness of this policy recommendation will be evaluated by identifying future earthquake planning scenario efforts that culminate in production of a published scenario report. Ultimately, the effectiveness of a planning scenario will be evaluated by identifying earthquake loss-reduction actions or policies that are developed in response to the published scenario.

History

Policy Recommendation 09-1 was first adopted in 2009 by unanimous vote of the WSSPC membership at the Annual Business Meeting February 11, 2009. It was reviewed, reformatted, and re-adopted as WSSPC Policy Recommendation 12-1 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 10, 2012.

WSSPC Policy Recommendation 12-2

Developing Earthquake Risk-Reduction Strategies

Policy Recommendation 12-2

WSSPC strongly encourages states and local governments to form public-private partnerships to develop and continually update long-term, comprehensive statewide and community-level earthquake risk-reduction strategies as part of an all-hazards plan to reduce injury, loss of life, property damage and economic disruption from earthquakes.

Executive Summary

Given the high seismic activity in the western states, provinces and territories, and the high risk of loss of life, property damage and economic loss due to earthquakes, state and local governments are encouraged to form partnerships that will develop earthquake risk-mitigation plans and risk-reduction strategies that will benefit local communities. Mitigation policies and activities are long-term, multifaceted processes where effective coordination, collaboration and communication among partners are critical. For example, partnerships with the many Seismic Safety Boards and Commissions that have been created in WSSPC states are critical in the effort to educate state and local policymakers about the importance of sound seismic hazard policy.

Background

Given the high seismic activity in the western United States, Pacific territories, and Canada, mitigation of earthquake risks is a common interest among all the western states, territories, and provinces. FEMA's Report 366b, (April 2008), *HAZUS-MH Estimated Annualized Earthquake Losses for the United States*, clearly shows that the western states are most at risk, with 84% of the nation's estimated annual dollar losses from earthquakes. WSSPC, as a consortium of 13 western states, 3 Pacific territories, and a Canadian territory and province, is the ideal organization to promote the benefits of earthquake risk-mitigation policies, to promote collaboration among its members and the federal government, and to share mitigation successes between WSSPC and other organizations. From its inception, WSSPC has strongly supported reduction of losses from seismic events through policy recommendations and annual conferences.

The benefits of proper mitigation and planning is highlighted by cost/ benefit studies that show for every FEMA dollar spent on mitigation, four dollars are saved in reduced disaster relief. In addition, FEMA grants to mitigate natural-hazard risks are expected to save lives and injuries in future events (Multihazard Mitigation Council, 2005, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*).

It is the responsibility and duty of the geological and emergency management community to organize and disseminate key information concerning proper earthquake-risk mitigation. WSSPC encourages its partners to seek potential mitigation outreach activities, mitigation plan development, or construction projects, some of which may be eligible for funding through FEMA's various mitigation program grants. These efforts complement FEMA's Pre-Disaster Mitigation initiatives.

Comprehensive statewide and local earthquake mitigation plans and strategies should include the following elements:

- Assessment of all seismic hazards to quantify and define the risk to communities;
- Assessment of infrastructure risks;

- Implementation of land-use and development policies to reduce exposure to earthquake hazards;
- Adoption and enforcement of the International Building Codes for the seismic design, inspection, and construction of new buildings and structures;
- Adoption of the International Existing Building Code for the maintenance and retrofit of seismically "at risk" structures;
- Development and implementation of retrofit, redevelopment, grant, and abatement programs to help strengthen existing structures, where necessary;
- Support of continuing public-education efforts and public/private partnerships to raise awareness of seismically induced threats and build constituent support for earthquake hazard reduction programs.

Safety of communities and infrastructure can only be accomplished though diligent, informed, and coordinated efforts of regulators and stakeholders. WSSPC will continue to play a key role in that organization and communication effort.

Appendix A: WSSPC Member State Implementation of Policy Recommendation 12-2

Washington: The Resilient Washington State Initiative is a strategic planning process for achieving state-level resilience with respect to earthquake hazards. The intent of the process is to identify actions and policies before, during, and after an earthquake that can leverage existing policies, plans and initiatives to realize disaster resilience to earthquakes within a 50-year life cycle.

Facilitation and Communication

WSSPC members, including seismic safety commission liaisons, will send this policy recommendation to all identified policy and decision makers (elected officials, heads of key departments, such as emergency managers, building officials and planners, and chairs of the State Seismic Safety Commissions and Boards). Policymakers' decision to support earthquake risk mitigation and foster partnerships is the key to effective mitigation in each state.

Assessment

Successes in policy implementation are occasions when the mitigation actions or requirements stated above are incorporated into public policies and decisions, and subsequently integrated into important public or private projects.

This statement of earthquake risk-reduction strategies should be adopted by all WSSPC partners. Successes should be submitted in a timely manner to WSSPC for posting on its website and in Appendix A.

History

Policy Recommendation 09-2 was first adopted as Policy Recommendation 03-1 by unanimous vote of the WSSPC membership at the Annual Business Meeting September 24, 2003. It was reviewed, revised, and re-adopted as WSSPC Policy Recommendation 06-1 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 17, 2006. It was reviewed, revised, and re-adopted as WSSPC Policy Recommendation 09-2 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting February 11, 2009. It was reviewed, reformatted, and re-adopted as WSSPC Policy Recommendation 12-2 by unanimous vote of the WSSPC membership at the Annual Business Meeting April 10, 2012.

POLICY RECOMMENDATIONS ADOPTED IN 2011

WSSPC Policy Recommendation 11-1

Improving Tsunami Public Education, Mitigation, and Warning Procedures for Distant and Local Sources

Policy Recommendation 11-1

WSSPC supports strong, immediate and positive action from federal and state agencies to reduce the potential loss of life caused by tsunamis.

Specifically, WSSPC recommends robust, effective, and fully maintained implementation of the deep-sea tsunami detection system by NOAA, and expanding the efforts by NOAA and the USGS and WSSPC members to enhance public education programs about the potential for local tsunami impacts and the need to evacuate threatened areas immediately after strong or sustained ground shaking.

WSSPC recommends full and timely appropriation of specified funds to the National Tsunami Hazard Mitigation Program (NTHMP) as described in the Tsunami Warning and Education Act of 2006.

Background

Tsunamis can be the most destructive and deadly hazard that results from an earthquake, not only to nearby coastal areas, but occasionally to regions thousands of miles from the source. The 1946 and 1964 Alaskan earthquakes produced tsunamis that caused damage and/or loss of life in Hawaii, American Samoa and along the coasts of British Columbia, Washington, Oregon and California. The Pacific Tsunami Warning Center at Ewa Beach, Hawaii, and the West Coast and Alaska Tsunami Warning Center at Palmer, Alaska, were established as a result of these destructive tsunamis and because of the need to warn coastal populations of tsunamis from distant sources.

Alarms triggered by earthquakes that failed to produce tsunamis have been a major concern associated with past warning systems and continue to be a concern even as warning systems improve. Unnecessary evacuations not only create financial burdens on coastal communities, but may cause people to ignore a real threat in the future. Additionally, unnecessary evacuations are risky to public safety. Programs to reduce unnecessary evacuations have been developed and implemented through the NTHMP. These programs are designed to ensure that the messages from the tsunami warning centers are accurate and timely, and that they significantly reduce the number of unnecessary evacuations.

Nevertheless, Pacific States, Provinces and Territories still must plan for local coastal earthquakes that provide little or no time to issue a general public warning of a destructive tsunami. Subduction zone earthquakes, like the December 2004 Sumatra Earthquake (M 9.1) and subsequent tsunami, can cause the largest loss of life in tsunami-at-risk coastal communities, particularly those close to the source. The recently released 2008 Uniform California Earthquake Rupture Forecast (UCERF) estimates a ten percent probability of a M 8.0 or greater earthquake somewhere along the Cascadia Subduction Zone (Cascadia Megathrust) in the next 30 years. During the past century, the Alaska-Aleutian subduction zone had a M 8.0 or greater earthquake on the average of every 16 years, four of which produced destructive tsunamis.

Therefore, it is vitally important to educate coastal residents, businesses, and visitors about the importance of immediate evacuation to high ground upon cessation of strong or sustained ground shaking. In areas where no high ground is nearby, vertical evacuation in approved engineered structures may be the only option to survive a tsunami impact. Through the use of scientifically researched and developed

tsunami inundation models and maps, community evacuation plans must be developed showing evacuation routing and safe zones.

Tsunami Outreach

WSSPC supports the vital efforts to reduce loss of life caused by tsunamis through concentrated public education. Public education must be institutionalized and consist of continuous instructional programs that are reinforced by exercises and training, and subsequently measured using social science surveys to determine programmatic effectiveness. In the case of many locally sourced tsunamis, the time before impact is so brief that the most effective means for protecting the public is not through warning systems, but through community outreach and education. Buoys, sirens, and loudspeakers, etc., are meaningless if the general public does not know what to do in the critical few minutes following an earthquake that generates a damaging tsunami.

Distant Source Tsunamis

WSSPC supports the efforts of the U.S. Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA) to expand the deployment, maintenance, and improvement of the nation's seismic monitoring system and the deep-ocean tsunami detection system for the purposes of rapidly and accurately detecting distant-source tsunamis, and reducing false warnings and watches that result in unnecessary evacuations. WSSPC further supports NOAA's effort to develop tsunami forecasting tools for coastal communities.

Local Source Tsunamis

WSSPC supports expanding the efforts of NOAA, the USGS, and the coastal members of WSSPC through the National Tsunami Hazard Mitigation Program (NTHMP) for: (1) research and identifying all forms of local tsunami sources (such as submarine landslides); (2) mapping and modeling of the tsunami inundation zone; (3) developing tsunami evacuation maps and routes; (4) implementing a public rapid warning system; and, (5) maintaining a sustained public education program about the potential for local tsunamis and the need to evacuate immediately after strong or sustained ground shaking stops.

Facilitation and Communication

WSSPC will write letters to NOAA, the USGS, and FEMA offering continued support for increased deployment of deep-ocean tsunami detection systems, the development of a tsunami forecasting model, improvement of seismic monitoring to better detect tsunami-generating earthquakes, public education, and other long-term risk reduction efforts. While WSSPC supports these Federal activities, the activities should not be funded at the expense of continued and required support of State and local tsunami mitigation and education activities.

WSSPC will write letters to key Congressional representatives and to NOAA urging their support and funding for the Tsunami Warning and Education Act (2006), and for the full and timely appropriation of specified funds to the state programs as described in the Act.

Assessment

The effectiveness of the support letters will be measured in part by the continued financial support for the seismic monitoring system, the open ocean tsunami detection system, inundation mapping and mitigation by the NTHMP, and the full funding of the Tsunami Warning and Education Act.

In turn, the effectiveness of the seismic monitoring and tsunami detection systems will be measured by the successful and timely identification of destructive tsunamis from local and distant sources and the continued reduction of unnecessary evacuations.

The effectiveness of the evacuation route maps and educational campaigns can be measured in the short term by public awareness polling funded through the National Tsunami Hazard Mitigation Program, and in the long term by the minimal loss of life from a local tsunami because people responded appropriately.

History

WSSPC Policy Recommendation 08-1 was first adopted in 1999 as WSSPC Policy Recommendation 99-1. It was reviewed, revised and re-adopted as WSSPC Policy Recommendation 02-1 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting September 18, 2002. It was reviewed, revised and re-adopted as WSSPC Policy Recommendation 05-1 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting September 14, 2005. It was reviewed, revised and re-adopted as WSSPC Policy Recommendation 08-1 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 22, 2008. It was reviewed and re-adopted as WSSPC Policy Recommendation 11-1 by unanimous voice vote of the WSSPC membership at the WSSPC Annual Business Meeting April 4, 2011.

WSSPC Policy Recommendation 11-2

Definitions of Fault Activity for the Basin and Range Province

Policy Recommendation 11-2

WSSPC recommends that the following definitions of fault activity be used to categorize potentially hazardous faults in the Basin and Range physiographic province:

Holocene fault – a fault whose movement in the past 11,700 calibrated years B.P.; (Cohen and Gibbard, 2010) has been large enough to break the ground surface.

Late Quaternary fault – a fault whose movement in the past 130,000 years has been large enough to break the ground surface.

Quaternary fault – a fault whose movement in the past 2,600,000 (Cohen and Gibbard, 2010) years has been large enough to break the ground surface.

It should be emphasized that some historical magnitude 6.5 or greater earthquakes that produced surface faulting in the Basin and Range Province occurred on faults that have not been previously active in the Holocene; furthermore, earthquakes in the Province may occur on faults in all three categories. It is the responsibility of the user to decide what level of earthquake hazard (surface fault rupture and ground shaking) is acceptable for a specific structure or application.

Background

Future large, surface-rupturing earthquakes in the Basin and Range Province most likely will occur on faults that display evidence of prior large surface displacements during Quaternary time. The date when the last major earthquake occurred on a fault and the time interval between the most recent earthquake and earlier earthquakes are factors that influence the probability of when a similar-size earthquake might occur within a given time period. For example, a fault that has a major earthquake on average every 1000 years is more hazardous than one that has a major earthquake on average every 100,000 years. It is up to the user to decide what degree of fault activity is considered "hazardous" and what level of hazard is acceptable. Depending on the intended use of the land (critical facilities, fire stations, hospitals, schools, residences, picnic grounds, etc.), different levels of seismic hazard and risk may be acceptable. In addition, understanding the frequency and size of earthquakes on a fault is critical when deciding whether to build across the fault, and when estimating the probabilities of ground shaking at varying distances from the fault. It should be noted that historical, damaging, moderate to large (< M 6.5) earthquakes have occurred on faults in the Basin and Range Province that do not have any obvious expression at the ground surface.

A **Holocene** criterion, 11,700 calibrated years B.P., to characterize potential fault activity has significant precedence, principally from its past usage and application in California. For purposes of implementing the Alquist-Priolo Earthquake Fault Zoning Act, the California Code of Regulations defines an active fault as *Holocene Active*, that is, there is evidence of surface rupture within approximately the past 11,000 years, although local governments may use a broader definition. The *Holocene Active* definition also has a practical applicability because climate change following the most recent major glaciation has resulted in many recognizable soil horizons and geomorphic surfaces that are used to help date fault activity. Because major historical earthquakes have occurred in the Basin and Range Province on faults that do not show surficial evidence of previous Holocene activity, the Holocene Epoch is too short to span the range of average earthquake recurrence intervals (average earthquake repeat times) on faults in the Province.

A **late Quaternary** criterion (130,000 years) uses the onset of the Sangamon interglacial period as a datum and spans many of the average fault recurrence intervals in the Basin and Range Province. All but one of the major historical earthquakes in the Province occurred on faults that show evidence of late Quaternary activity.

The **Quaternary** Period (2,600,000 years) represents the onset of a major climatic change to the current cycle of glacial/interglacial intervals, during which most of the surficial alluvial deposits and much of the present landscape in the Basin and Range Province formed. All the major historical earthquakes in the Province have occurred on faults that show evidence of Quaternary-age movement at the surface. A Quaternary criterion encompasses an average recurrence interval for essentially all the faults that might produce future earthquakes.

The Basin and Range Province is a large extensional tectonic domain that contains thousands of normal-slip and strike-slip Quaternary faults involved in contemporary deformation. Large earthquakes in the Province, especially those that are associated with surface rupture, commonly involve multiple, distributed faults, and have occurred on faults that have a wide range in the time since their most recent surface-faulting earthquakes. This tectonic behavior in the Province differs from the more localized, higher slip-rate tectonics of the plate boundary system in western California. These different characteristics may warrant different considerations, such as the activity criterion used when establishing fault setbacks and identifying potential earthquake sources.

The identification of faults that pose an earthquake hazard requires application of a fault-activity criterion to exclude ancient faults that are unlikely to rupture during future earthquakes. This criterion allows society to develop guidelines for identifying potential surface-rupture and ground-motion sources. Two fundamental parameters are needed to characterize fault activity for the purposes of hazard assessments: the amount of displacement that occurred during large, surface-faulting earthquakes and the time interval over which the earthquakes occurred, which in some cases can be expressed as an average recurrence interval between earthquakes. These data are used to calculate the fault's geologic slip rate, which is net displacement divided by the time interval over which the strain accumulated that resulted in displacement. Fault slip rates, typically expressed in mm/yr or m/kyr, provide a quantifiable measure of fault activity; the higher the slip rate, the more active the fault.

There are several examples of Basin and Range Province faults that have had major historic movement, but lacked evidence of Holocene or late Quaternary activity. The most dramatic example of the latter is the 1887 Sonoran earthquake in northern Mexico. Different lines of reasoning suggest that prehistoric surface rupture occurred at least 100,000 to 200,000 years ago (Bull and Pearthree, 1988). The 1954 Fairview Peak, Nevada, earthquake (Bell and others, 2004) is another example of a major historic earthquake on a fault that lacked evidence of Holocene displacement (Pearthree, 1990; Caskey and others, 2004). The 1954 Dixie Valley, Nevada, earthquake occurred on a fault zone that has evidence of Holocene activity, but also ruptured major portions of fault traces that lacked Holocene displacement (Bell and Katzer, 1990). Major earthquakes have occurred on faults that had Holocene displacement as well, such as the 1983 Borah Peak, Idaho, earthquake (Hanks and Schwartz, 1987). More than one-half of the major historical earthquakes in the Province produced surface faulting on faults that appear to lack Holocene activity. Thus, the Holocene criterion is a useful but not a complete indicator of where future large earthquakes may occur in the Basin and Range Province.

Prehistoric earthquakes that produced surface ruptures on faults within the Basin and Range Province have a range of recurrence intervals that span from hundreds of years to hundreds of thousands of years. Recurrence intervals of a few thousand to tens of thousands of years are typical. One of the most comprehensive and detailed paleoseismic studies in the Province was undertaken as part of the site characterization of the proposed high-level nuclear waste repository at Yucca Mountain, Nevada. That

study revealed that average recurrence intervals for many of the faults at and near Yucca Mountain are between 20,000 and 100,000 years (e.g., Wong and others, 1995). A range of earthquake recurrence intervals can be estimated by considering the typical range of vertical slip rates for faults in the Basin and Range Province (0.01 to 1.0 mm/yr) and typical surface displacements during major earthquakes (1 to 3 m). This yields a range of potential recurrence intervals of 1,000 to 300,000 years.

Elapsed time since the most recent large earthquake and average earthquake recurrence intervals are important parameters needed when determining fault activity levels and earthquake hazard. They should be evaluated along with other considerations related to levels of acceptable hazard and cost/benefit ratios when evaluating earthquake risk for a specific purpose.

Facilitation and Communication

WSSPC recommends that government agencies, regulators, and owners consider these fault-activity definitions when determining which faults are hazardous for specific facilities or purposes. For some facility types, active fault definitions are contained in state and federal regulations. Such regulations commonly use different definitions of fault activity based on the societal importance of the facility being built. Definitions that include less active faults or require more restrictive mitigation measures are typically used for critical facilities where the effect of the facility's failure has grave consequences.

When assessing the impact of future earthquakes, factors to consider are the type of facility and its societal importance; level of acceptable risk; goals, costs, and benefits of risk reduction; and geologic practicality of applying the definition. An example of the latter is found in areas of the Basin and Range Province where widespread latest Pleistocene pluvial lake or glacial deposits facilitate the use of a Holocene criterion, but where the use of a late Quaternary criterion may be impractical because the evidence of activity on some faults of that age is buried by younger deposits. The expense of risk-reduction measures must be balanced against the probability of earthquake occurrence and the resulting risk to society in terms of public safety and potential economic loss. Use of these three broad fault-activity definitions (Holocene, late Quaternary, Quaternary) are an aid to choosing the appropriate activity class for a proposed facility. It is ultimately up to the regulator and owner to decide how the hazard should be categorized and addressed, although uniform treatment among Basin and Range Province states is desirable.

Assessment

The success of this Policy Recommendation can be assessed based on the use of the definitions by states and local governments in regulations and ordinances. Utah, Colorado, and Clark County, Nevada have adopted these definitions in an earlier version of this WSSPC Policy Recommendation. A periodic re-evaluation of these and other federal, state, and local entities should be made to determine the extent to which these definitions are being incorporated into future seismic-hazard rules, regulations, and guidelines.

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History

WSSPC Policy Recommendation 08-2 was first adopted in 1997 as WSSPC Policy Recommendation 97-1. It was reviewed and re-adopted as WSSPC Policy Recommendation 02-3 by unanimous vote of the WSSPC membership at the Annual Business Meeting September 18, 2002. It was reviewed, revised, and re-adopted as WSSPC Policy Recommendation 05-2 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting September 12, 2005. It was reviewed, revised, and re-adopted as WSSPC Policy Recommendation 08-2 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 22, 2008. Policy Recommendation 08-2 was updated and re-adopted as WSSPC Policy Recommendation 11-2 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 4, 2011.

WSSPC Policy Recommendation 11-3

Earthquake Monitoring Networks

Policy Recommendation 11-3

WSSPC advocates the continuation and expansion of earthquake monitoring networks as envisioned and supported by the Advanced National Seismic System (ANSS). ANSS emphasizes strong-motion instrumentation of urban ground-motion monitoring sites and selected engineered structures as well as increased broadband seismograph instrumentation. The resulting data provide better understanding of future ground shaking potential, rapid information for emergency response, and insights for the design of more earthquake-resistant new and retrofitted construction.

WSSPC calls upon all parties committed to earthquake loss reduction to advocate greater support of the U.S. Geological Survey's efforts to expand ANSS monitoring and to standardize data collection, processing, and storage. To further these efforts, WSSPC encourages the USGS to strengthen partnerships with emergency managers, engineers, and corporate response and business interruption planners, as well as State and local agencies.

Background

Earthquake monitoring networks are vital both to respond to earthquakes and to characterize earthquake hazards. The earthquake parameters produced by modern seismic networks, when combined with historic earthquake catalogs and the paleoseismic record, are essential input for developing the Nation's probabilistic seismic hazard maps and analyses. Automated processing of earthquake information by seismic networks in the United States provides near-real time information on earthquake locations, magnitudes, and patterns of moderate and damaging ground shaking. In the last decade, seismologists have expanded the capabilities of the seismic network system in some areas to routinely produce ShakeMaps, fault orientations and slip distributions, and aftershock probabilities. In California, ShakeMap has become a valuable tool to assist emergency responders in identifying the possible extent of earthquake damage. Strong-motion data (now increasingly available in real-time) are essential to evaluate the engineering relationship of structural damage to severity of ground shaking.

During the 1960s, the U.S. Geological Survey (USGS) began to operate, support and coordinate local seismic networks that were sensitive enough to detect microearthquakes, including aftershocks of larger earthquakes. Data from these early seismograph networks were used to delineate the spatial relationships between earthquake hypocenters and active faults. Earthquake networks provide fundamental earthquake data in the form of catalogs specifying hypocenter location, time of occurrence, and magnitude. These data find uses in diverse applications ranging from earthquake hazard analysis to disaster response. Seismic networks throughout the U.S. have provided fundamental data for the U.S. Geological Survey's National Seismic Hazard Mapping Project, which is generating ever-advancing state-of-the-art earthquake hazard maps for the U.S. The availability of earthquake monitoring network data has led to new and innovative research that has advanced the field of seismology through an improved understanding of the physics of earthquake occurrence.

Despite the importance of its products, earthquake monitoring in the United States faces many problems and challenges, the most notable of which are:

- Outdated, inadequate instrumentation
- Separation of functions between strong- and weak-motion monitoring systems
- Lack of sufficient and uniform geographic coverage in areas at risk
- Lack of uniform operational standards

- Well-established independent networks with non-standardized and even incompatible equipment, operations, products, and funding sources.

Many of the currently deployed instruments record only high frequency (1-25 Hz), vertical motions over a very limited dynamic range. Known as "short-period" seismographs, these analog instruments are extremely sensitive, recording even tiny microearthquakes. However, moderate and larger magnitude earthquakes drive short-period seismograph signals off-scale. The full amplitudes of shaking cannot be recorded and the resulting waveforms are highly distorted.

For the western states, modern monitoring of earthquakes is crucial. The largest proportion of the Nation's seismic risk is in the western states. However, large and damaging earthquakes are not limited to California. Two of the largest earthquakes in the lower 48 states during the past four decades have occurred in the Northern Rocky Mountain region (magnitude 7.3 1959 Hebgen Lake, MT; and magnitude 6.9 1983 Borah Peak, ID). Yet, the Northern Rocky Mountain region remains the largest seismically active region of the lower 48 states without sufficient modern instrumentation.

The recent advent of digital instrumentation has revolutionized seismology. High-fidelity earthquake data transmitted in real-time via terrestrial and satellite communication links and analyzed with modern techniques rapidly provide data and results essential for all aspects of seismology. Modern dataloggers coupled with broadband and strong-motion sensors have the capability to record the full spectrum of earthquake-related ground motions—everything from the high frequencies of nearby earthquakes to the low-frequency, rolling motion of distant earthquakes. Most importantly, digital instruments have dynamic range sufficient to detect tiny earthquakes and yet able to remain on-scale for a major, nearby earthquake. Additionally, all three axes of ground motion (up-down, north-south, and east-west) are recorded (as opposed to only the vertical direction of ground motion recorded by many current network seismographs). High-quality recordings by even a few broadband seismographs from earthquakes with magnitudes as small as 3.5 allow computations that uniquely characterize the type of faulting, amount of energy released, and the stress field responsible for the quake. Likewise, high-quality strong-motion recordings in the urban environment are necessary to understand how seismic shaking can cause damage to buildings and other structures. All this information is now immediately posted to the Internet, and datacenters provide ready access to the information for rapid response and recovery as well as long-term research.

The vision of the next generation of national earthquake monitoring, the Advanced National Seismic System (ANSS), was issued in 1999 by the U.S. Geological Survey, which has now begun its implementation. Its design has been developed in consultation with earthquake specialists in academia and the States together with the engineering community. The mission of the Advanced National Seismic System is to provide accurate and timely data and information on earthquakes and their effects on buildings and structures, employing modern monitoring methods and technologies.

Since the ANSS was established by Congress in 2000, the USGS has fostered the organization of seven regional networks developed through incorporation of local efforts into regional systems. The seven networks are in California, the Pacific Northwest, Alaska, Hawaii, the Intermountain region, the Central U.S. (including the Southeast), and the Northeast. With USGS support, the newly established ANSS regional networks have installed almost 800 new and upgraded monitoring stations in 24 states since its inception. The largest numbers of new stations are in Alaska, California, Nevada, Utah and Washington, and most have been installed in urban areas where seismic risk is high.

Automated processing of earthquake information by seismic networks provides near-real-time information on the Internet about earthquake location, magnitude, fault orientation, slip distribution, and aftershock probabilities. Together with other parties, the USGS has developed ShakeMap, an analytical

methodology that creates maps of the severity of ground shaking developed from ground-motion data recorded by the newly installed ANSS instrumentation and other modern stations. ShakeMaps are posted to the Internet within minutes following earthquakes and also are distributed through technologies like CISN Display and ShakeCast. The initial maps are automatically revised as new seismic data become available. In areas of California with a relatively dense distribution of strong-motion seismometers, ShakeMap can help emergency managers immediately identify areas that have been exposed to strong shaking before damage reports are available. ShakeMap is being used in conjunction with earthquake loss modeling to make preliminary estimates of earthquake damage costs.

The planned ANSS instrumentation of engineered structures to monitor their responses to earthquake ground motion is just beginning. Because of limited funding, only a small number of buildings have been instrumented so far. This type of monitoring is very important to the establishment of better building code requirements and design practices to achieve improved earthquake resistance in both new construction and retrofitted structures. Following damaging earthquakes, real-time monitoring of the response of lifelines and buildings will also be valuable in emergency response.

Facilitation and Communication

WSSPC recommends expansion of the regional free-field real-time earthquake monitoring in the western states and throughout the Nation. WSSPC also endorses the expansion of monitoring of engineered structures in order to use insights from investigation of their earthquake performances in the creation of better design procedures and construction standards. To accomplish such expansion, WSSPC encourages the USGS to form partnerships to further these efforts with the emergency managers, engineers, and corporate response and business interruption planners, as well as State and local agencies. In addition, recognizing the synergistic aspects of the National Science Foundation's EarthScope Program, which is deploying temporary seismic and GPS instruments, WSSPC encourages the USGS to take full advantage of EarthScope instruments in fulfilling the mission of ANSS. WSSPC commends those states that are partnering with ANSS to fund modernizing and increasing the numbers of seismic monitoring stations.

The ANSS funding to date is a small fraction of the planned and requested capitalization needed to build out ANSS, although there has been some incremental growth. There are more than 6,000 stations needed to meet the ANSS requirements.

Assessment

The success of this policy can be assessed by the increase in the number of engineered structures with strong motion instruments, the level of funding available for maintaining and enhancing networks, and the evidence of partnerships implementing seismic networks among the USGS, state and local agencies, and the private sector.

History

WSSPC Policy Recommendation 08-3 was first adopted in 1997 as WSSPC Policy Recommendation 97-4. It was reviewed, revised, and re-adopted as WSSPC Policy Recommendation 02-5 by unanimous vote of the WSSPC membership at the Annual Business Meeting September 18, 2002. It was reviewed, revised, and re-adopted as WSSPC Policy Recommendation 05-3 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting September 12, 2005. It was reviewed, revised, and re-adopted as WSSPC Policy Recommendation 08-3 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 22, 2008. Policy Recommendation 08-3 was reviewed, revised and re-adopted as WSSPC Policy Recommendation 11-3 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 4, 2011.

WSSPC Policy Recommendation 11-4

Identification and Mitigation of Unreinforced Masonry Structures

Policy Recommendation 11-4

Unreinforced masonry bearing-wall structures represent one of the greatest life safety threats and economic burdens to the public during a damaging earthquake. WSSPC recommends that each state, province or territory adopt a program to identify the extent of risk that unreinforced masonry structures represent in their communities and develop recommendations that will effectively address the reduction of this risk.

Background

During earthquakes, unreinforced masonry (URM) structures are vulnerable to catastrophic collapse and represent a significant life safety threat, as occurred in the 2008 Wells, Nevada earthquake. Unreinforced masonry structures are made from brick, hollow clay tile, stone, concrete block, or adobe materials that are not strengthened by the addition of steel or other reinforcement. Common building examples include older industrial complexes, schools, mercantile establishments, and private residences.

Also of concern are components of these structures such as walls, unsupported parapets, and fireplace chimneys, which can fall on pedestrians or other people trying to exit a building. The masonry usually is held together with weak mortar and is unable to resist lateral forces. Wall and roof anchorage tends to be inadequate, allowing floors and roofs to separate from the walls and collapse. Historically, this type of building damage has been a major contributing factor to loss of life in earthquakes throughout the world.

Unreinforced masonry is recognized by the Federal Emergency Management Agency as one of the structural types most prone to failure during an earthquake. A review of the USGS Hazards Program listing earthquakes that generated 1,000 or more deaths since 1900 shows that unreinforced walls are a significant contributing factor in losses to both the financial sector and in human lives.

WSSPC strongly believes that jurisdictions must be proactive to address this threat to their citizens. Legislatively mandated programs and/or local municipally adopted ordinances have proved effective at addressing this risk.

WSSPC recognizes that there is a societal cost to the inventory and remediation of unreinforced masonry buildings, but in those areas of high seismicity, failure to address this issue will have expensive and lethal consequences. In order to minimize the cost and make programs more politically acceptable, the three-stage approach of identifying the population of hazardous buildings, analyzing the risk presented by these buildings, and retrofitting those buildings deemed to be a hazard is recommended.

It is realized that resistance is to be expected when dealing with retroactive ordinances. However, as can be seen by those areas that have adopted fire sprinklers retroactively, versus those that have not, even minimal remediation can yield discernable life-saving results. Standardized retrofit concepts for unreinforced masonry structures are available through FEMA publications; however, this in no way negates the need for local engineering analysis and design.

Facilitation and Communication

Voluntary Implementation Plan

WSSPC recommends that States adopt a voluntary program to identify the extent of risk that unreinforced masonry structures represent in their communities.

The first phase involves creating an inventory of unreinforced masonry structures and is a relatively low-cost process. State and local entities, including school districts, should be responsible for identifying their own URM structures. A review of the locally adopted codes is necessary. All structures built under the Uniform Building Code of 1961 or later[1] should have been reinforced, although this should be verified by field inspections.

Private owners of structures erected prior to the effective date of the 1961 Uniform Building Code should be notified that their buildings may be a potential threat to human health and safety and require professional structural inspection with submittal of the inspection findings to an appropriate agency. This inventory process may take several years, but upon completion a more accurate assessment of a community's risk will be evident.

As a second step, the development of a plan to mitigate this risk will need to be addressed.

Using a multi-pronged approach, including obtaining grant funding when possible, incentives to reduce taxes, possible adjustment of permit application fees, or the providing of design and construction assistance, may make mitigation a more workable option. Neither litigation nor forced abandonment of these structures is desirable. The reduction in occupancy or limitations on use may be an acceptable risk-reduction option. Permits issued for the sole purpose of seismic retrofitting should not affect or trigger additional jurisdictional requirements or property tax increases.

Alternate Mandatory Implementation Plan

WSSPC recommends that each State, province or territory implement a three-phase approach to reducing the risk presented by unreinforced masonry buildings by doing the following:

1. Adopt a legislative initiative requiring the inventory of unreinforced structures within a jurisdiction ;
2. Develop, or cause to have developed, a mitigation plan that identifies hazardous structures and includes a cost-benefit analysis; and,
3. Implement a mandatory URM structures program through:
    a. Completing mitigation design and retrofit,
    b. Abandoning use of the structure, or
    c. Controlling use and occupancy to minimize the potential risk.

Assessment

The effectiveness of this policy can be determined by maintaining an inventory of states, provinces and territories with active programs to mitigate the dangers of unreinforced masonry bearing wall structures.

[1] The actual UBC Code date should be subject to local research to more clearly identify when the code was adopted and, perhaps more importantly, enforced. It is only through this analysis that a more appropriate date may be established for survey purposes.

By collecting and identifying these individual efforts, WSSPC will provide a clearinghouse of information which can be used to help promote the policy and advocate its use.

The clearinghouse inventory should be administered annually and contain sufficient detail to help identify the types of programs instituted and their effect in the affected regions.

History

WSSPC Policy Recommendation 08-4 was adopted by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 22, 2008. Policy Recommendation 08-4 was reviewed, revised and re-adopted as Policy Recommendation 11-4 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 4, 2011.

WSSPC Policy Recommendation 11-5

Earthquake Emergency Handbook for First Responders and Incident Commanders

Policy Recommendation 11-5

The Western States Seismic Policy Council (WSSPC) recommends that an Earthquake Emergency Handbook for first responders and incident commanders be developed, preferably by an interagency task force.

Background

The Fireline Handbook is a valuable tool for first responders and incident commanders dealing with wildfires. The Fireline Handbook was developed by the Incident Operations Standards Working Team, which was sponsored by the United States Department of Agriculture, the United States Department of Interior, the National Association of State Foresters, the United States Fire Administration, and the Intertribal Timber Council. This handy document is used at essentially all major wildfires, and the importance and utility of the handbook is underscored by the variety of organizations that joined together to produce and subsequently adopt it. Among other things, following the handbook can avoid putting fire responders at undo risk and avoid potential injuries because the handbook incorporates the hard won lessons learned and accumulated wisdom from fighting many fires, and compiles that information into an easy and quick to use format.

Most emergency first responders and incident commanders have not experienced an earthquake, and therefore are unfamiliar with the nature of earthquake hazards and how to properly respond to an earthquake emergency and its aftermath. This is because the repeat time between large, damaging earthquakes is relatively long compared to many other natural hazards such as wildfires. Unfortunately, the consequences of an earthquake and related hazards in its aftermath can be catastrophic. The incident commander for the 2008 Wells, Nevada earthquake was unfamiliar with earthquake hazards and had to learn the basics of earthquake emergency response while responding to the event. He expressed the need for an earthquake emergency guide similar to the Fireline Handbook. Developing an Earthquake Emergency Handbook was also the number one "lesson learned' in the emergency response section of the Wells earthquake disaster review (dePolo and LaPointe, 2011).

Facilitation and Communication

WSSPC encourages the Federal Emergency Management Agency of the U.S. Department of Homeland Security to take the lead, in cooperation with relevant Federal, state, and local agencies and private industry, in developing a comprehensive Earthquake Emergency Handbook. The handbook should then be rapidly distributed to potential first responders and incident commanders in earthquake-prone states.

The document should alert first responders and incident commanders to issues specific to damaging earthquakes, and to issues that arise during the emergency response following an earthquake, including:

- Seismic safety considerations for Incident Command Centers, Emergency Operating Centers, and emergency shelters;
- Scoping earthquake damage and gaining situational awareness – earthquakes typically have a unique damage profile with the worst damage (often very widespread) occurring at the beginning of the event followed by sometimes strong and damaging aftershocks;
- Deploying teams with appropriate training and strategies to safely reconnoiter for earthquake-affected individuals and to rapidly assess building safety;

- Guidance for the size of aftershocks that would trigger re-inspection of buildings for safety;
- Important resources, such as earthquake response plans, and contact information for building inspectors, earthquake scientists, and community leaders;
- Communicating and properly qualifying/quantifying issues during earthquake emergencies between responders, responding agencies, and the affected public;
- Guidelines for establishing safety perimeters and barricades following an earthquake, to protect people from building collapse, parapet or chimney collapse, etc. during an aftershock; and
- Collateral damage considerations such as inspecting dams, canals, bridges, over/under passes, communication links, radio repeaters, cell tower sites, hazardous material storage sites, and other infrastructure that if damaged can inhibit emergency response or cause greater damage.

WSSPC members can help review the handbook and encourage its distribution and use in earthquake-prone areas.

Assessment

Measures of the success of this policy recommendation will be: 1) the development of an Earthquake Emergency Handbook, and 2) the distribution of the handbook to first responders and incident commanders in areas at risk from a damaging earthquake. Following the use of the handbook in an earthquake response, an evaluation should be made regarding the effectiveness of the handbook to determine what should be added, and what can be improved. The handbook should be widely available, possibly on the WSSPC website, so new first responders to earthquake emergencies and incident commanders will know of its availability and how to obtain it.

Key insights and experienced approaches to earthquake emergency response can ultimately save the lives of responders and the affected public, so it is with a sense of urgency that the Earthquake Emergency Handbook is requested to be developed.

References

dePolo, C.M. and LaPointe, D.D., editors, The 21 February 2008 Mw 6.0 Wells, Nevada earthquake - A compendium of earthquake-related investigations prepared by the University of Nevada, Reno: Nevada Bureau of Mines and Geology Special Publication 36, variously paginated. (*http://www.nbmg.unr.edu/Pubs/sp/sp36*)

Incident Operations Standards Working Team, 2004, NWCG Fireline Handbook: National Wildfire Coordinating Group Handbook 3, variously paginated. (*http://www.nwcg.gov/pms/pubs/410-1/410-1.pdf*)

History

Policy Recommendation 11-5 was unanimously adopted by email vote of the WSSPC members June 30, 2011.

SECTION E

2013 Earthquake Program Reports

ALASKA
EARTHQUAKE PROGRAM REPORT

Alaska Division of Geological & Geophysical Surveys

The Alaska Division of Geological & Geophysical Surveys (DGGS) continued progress on a phased, systematic geologic hazards investigation along a proposed intrastate natural gas pipeline corridor from Prudhoe Bay to the southern end of the proposed alignment north of Anchorage. This effort was funded by the Alaska Gasline Development Corporation and utilized pipeline corridor LiDAR surveys published in 2011. At least six Quaternary-active faults are crossed by the proposed intrastate pipeline alignment. Rupture parameters associated with these faults have been evaluated and are being disseminated to pipeline design engineers and planners. DGGS has prepared preliminary data summaries of the 2011 and 2012 field programs and is preparing a comprehensive final technical report including results of the 2013 field investigations. Significant new findings include a re-classification of the Castle Mountain fault as a reverse fault and an estimate of the age of the penultimate earthquake along the Denali fault west of the 2002 rupture. As part of this investigation, previously-mapped faults on the southern flank of the Brooks Range were evaluated for relative tectonic activity, including the Kobuk fault and several unnamed faults north of Wiseman.

The *Quaternary faults and folds in Alaska: A digital database* was published in 2012 as a downloadable shapefile that includes paleoseismic parameters for each fault. In 2013, DGGS expanded this project and published an on-line interactive map that displays the locations and relative activity of Alaska's Quaternary faults on a map with various zoom, scroll, and base map options. Fault parameters from the Quaternary fault and fold database, including name, age, slip rate, slip sense, and others, can be viewed by clicking individual faults. DGGS staff also digitized the legacy *Neotectonic Map of Alaska* (Plafker and others, 1994) and published the shapefile to ensure that users have full accessibility to digital versions of legacy and new fault compilations.

DGGS geologist Rich Koehler conducted collaborative tsunami research with the U.S. Geological Survey along the Aleutian subduction zone on Umnak Island south of the town of Nikolski. This work was focused on documenting the number and age of past tsunami events and estimating possible inundation during the most recent tsunami (1957?) based on mapping driftwood logs deposited on the hillside. Koehler also continued collaborative efforts with the Alaska Earthquake Information Center at the University of Alaska Geophysical Institute to characterize tsunami hazards for priority communities in Alaska. This work is funded by the Alaska Division of Homeland Security & Emergency Management (ADHSEM). Final inundation maps and reports for the communities of Sitka and Valdez were published by DGGS and products for the communities of Chenega Bay, northern Sawmill Bay, Cordova, and Tatitlek are currently in review. Initial seismic source assessment and preliminary modeling has begun for Dutch Harbor and Cold Bay in the Aleutians. Results for these studies were presented at the 26th International Tsunami Symposium and the annual meeting of the American Geophysical Union.

With support from the Alaska Department of Transportation & Public Facilities, DGGS staff conducted fault and fracture surveys along the Yukon River bluffs in the vicinity of the E.L. Patton Bridge to evaluate possible causative mechanisms (including seismic activity) for a landslide that occurred in fall 2012. The results of this investigation were published as a Preliminary Interpretive Report. DGGS staff continued to be involved with technical review of seismic hazard studies related to the Susitna-Watana Hydroelectric Project's probabilistic seismic hazards assessment, including review of draft reports and field review of fault lineament mapping with geohazard contractors. Additionally, with support from the Alaska Office of Project Management and Permitting and the State Pipeline Coordinators Office, DGGS geologist Rich Koehler continued to assess fault hazards in the vicinity of the proposed Pebble mine in

southwest Alaska and performed field review of seismic hazard investigations in the Salcha Seismic Zone in the vicinity of the trans-Alaska pipeline in the Interior.

Results from a paleoseismic trench investigation along the Cathedral Rapids fault was published as a DGGS Report of Investigations. In association with the Alaska Seismic Hazards Safety Commission (ASHSC), DGGS published the ASHSC annual report, which contains eight white papers in support of policy recommendations in line with the goals of WSSPC. Additionally, DGGS field reconnaissance results were presented at several national meetings including the Geological Society of America and American Geophysical Union.

Alaska Division of Homeland Security and Emergency Management

Partnerships

The State of Alaska's Division of Homeland Security and Emergency Management (DHS&EM) coordinates the State Tsunami and Earthquake Programs through the Division's Planning Section (Mitigation Team) in a statewide effort to eliminate loss of life, reduce damage, and educate the public about short/no notice seismic hazards.

As in previous years, DHS&EM engaged multiple state, local, and federal agencies in partnership. These partners include University of Alaska Fairbanks Geophysical Institute Alaska Earthquake Information Center (AEIC); Alaska Department of Natural Resources Division of Geological and Geophysical Survey (DGGS); Alaska Seismic Hazards Safety Commission (ASHSC); Federal Emergency Management Agency (FEMA); the West Coast/Alaska Tsunami Warning Center (WC/ATWC); the National Oceanic and Atmospheric Administration/National Weather Service (NWS) warning coordination meteorologists; and Alaska's local, tribal, and borough governments. The DHS&EM State Hazard Mitigation Officer also serves as one of the eleven ASHSC board members appointed by the Governor.

Preparedness Education

DHS&EM's Fall Preparedness Conference in October 2013 focused on earthquake and tsunami preparedness. Two sessions of the National Disaster Preparedness Training Center *AWR 217, Tsunami Awareness* course were delivered to 58 student attendees at this forum. Additionally, three new Alaskan course instructors were trained and certified, broadening State and local tsunami education and outreach capabilities. FEMA sponsored the delivery of *Rapid Visual Screening of Buildings for Potential Seismic Hazards* and *Reducing Risk of Nonstructural Earthquake Damage* to over 70 local and state conference attendees from all over Alaska. The State Mitigation Team provided 35 attendees with information on how to develop grant applications for local hazard mitigation projects, including seismic studies, structural, and non-structural mitigation projects.

This year, DHS&EM purchased, received and deployed a new Earthquake Simulator. This tool, pulled on a trailer by an F-450 truck, enables audiences to directly experience the effects of an earthquake on the contents of a typical residence. The new Quake Simulator, accompanied by mitigation, earthquake, and tsunami-education materials, and Division Outreach personnel, made visits to the State Fair, schools, community fairs, and company safety days.

In partnership with FEMA, ASHSC, NWS, and WC/ATWC, DHS&EM launched the Great Alaska Shakeout website, and joined the National "Drop, Cover, and Hold" drill on October 17, 2013 with over 49,000 registered participants.

DHS&EM, NOAA, ADGGS, ASHSC, the United States Geological Survey (USGS), and the Anchorage Museum continued development of a statewide strategy for earthquake and tsunami awareness, education, and preparedness culminating in the 50th anniversary of the 1964 Good Friday Earthquake in 2014.

Improved Seismic Hazard Identification

This year, the State continued a major effort to provide funding and technical assistance for local community hazard mitigation planning. In 2012-2013, seventeen Alaskan communities throughout the state developed or updated their mitigation plans. Additionally, the State of Alaska updated the State Hazard Mitigation Plan for another three years. The hazard mitigation planning process includes conducting surveys and community meetings in which seismic and tsunami risk and mitigation were discussed and prioritized, among other hazards. These plans result in communities that have assessed seismic and tsunami hazards and their associated risks, and developed strategies to address them. This activity is consistent with *WSSPC Policy Recommendation 12-2: Developing Earthquake Risk-Reduction Strategies*. Each local community mitigation plan integrates with the State Hazard Mitigation Plan, enhancing Alaska's overall seismic resilience.

In 2012, DHS&EM added all-hazard vulnerability assessment to the Division's Homeland Security and Vulnerability Assessment teams to provide additional information to critical facility operations around the state. These initiatives also are consistent with *WSSPC Policy Recommendation 12-2: Developing Earthquake Risk-Reduction Strategies*.

Seismic Hazard Mitigation Retrofit Projects

Sub-grant applicants completed several DHS&EM-administered hazard mitigation grant program (HMGP) structural and non-structural seismic mitigation grant projects in 2012-2013. In 2012, the Anchorage School District (ASD) completed a project for seismic retrofit of 68 facilities.

Under the National Earthquake Hazard Reduction program's (NEHRP) Earthquake Hazard Reduction State Assistance Program (EHRSAP) grant, ASD also developed a pilot program to assess the seismic hazard safety of its facilities. ASD received seismic vulnerability assessments of two of its schools. These serve as benchmarks for 117 ASD schools. The 2013 NEHRP EHRSAP grant was awarded to the Matanuska-Susitna School District for a similar project. These activities are consistent with *WSSPC Policy Recommendation 12-10: Joint Policy for the Evaluation and Seismic Remediation of School Buildings*.

Tsunami Mapping, Warning Systems, and TsunamiReady™

DHS&EM continued to coordinate tsunami inundation mapping. The mapping is a cooperative effort between DHS&EM, AEIC, DGGS, and NOAA. The process includes data collection, computation, community input, peer review, and final publication. The tsunami inundation maps aid communities in developing evacuation maps, emergency response plans and mitigation objectives. Mapping progress this year includes publication of the Valdez report, final review of the Sitka report, first review for Tatitlek and Cordova reports, and draft report preparation for Akutan and Unalaska.

In cooperation with NOAA, DHS&EM funded and managed the installation of a tsunami/all-hazard warning siren system in Saint George. Coordination is underway for warning siren grants to Gustavus, Klawock, Craig, and Ketchikan. These systems give communities the ability to warn their citizens of an impending tsunami or other community emergencies.

TsunamiReady™ funds and coordinates installation of tsunami warning systems and evacuation signs, NOAA weather radios, and training in coastal tsunami-threatened communities. Tsunami evacuation signage was installed in Cordova and Whittier. Both communities are very near completion of

TsunamiReady™ requirements. The cities of Craig and Klawock are also working toward TsunamiReady™ recognition.

Education and Outreach

DHS&EM, along with NWS, continued community tsunami preparedness and education visits to numerous coastal communities in Southeast Alaska and the Kenai Peninsula. The visits included meetings and presentations for elected officials, emergency responders, schools, federal and private agencies, and the public. In addition to meetings, open public forums were presented in each community. Mitigation and Outreach staff also conducted earthquake and tsunami outreach in Homer, Alaska schools and at the Homer Preparedness Conference.

In November 2012, DHS&EM hosted a tsunami operations workshop in Cordova. The workshop brought together individuals from eleven South-central communities for training on tsunami alert and warning procedures, evacuation, sheltering and recovery. The workshop included earthquake and tsunami science, community-specific training, tabletop exercises and a field trip. Participants in the workshop included city leaders, emergency management personnel, emergency responders, harbormasters and health workers. The Mitigation Team prepared for the fourth workshop in an annual series for Kodiak in early 2014.

The Mitigation team coordinated with USGS and the State of Washington to develop earthquake and tsunami Public Service Announcements for K-12 schools. These were completed and delivered in September of 2013.

Alaska Seismic Hazards Safety Commission

The Alaska Seismic Hazards Safety Commission, established in 2002 and active since 2005, is an advisory body charged by statute to recommend goals, priorities, and policies for mitigating seismic hazards to the Governor and Legislature, as well as the public and private sectors. To this end the Commission's work in 2013 continued to focus towards long-term goals to establish legislation aimed at improving the safety of schools and public buildings at risk from earthquake damage; participate in local earthquake scenario planning studies; and near-term projects to educate State government and public entities about the Alaska seismic environment and strategies to mitigate the earthquake hazards.

During 2013, the Commission maintained a full roster of 11 members, made up entirely of volunteers representing the fields of civil engineering, geology, seismology, emergency response, government management, and insurance. Two new commissioners were appointed by Governor Parnell, including: Ann Gravier, Hazard Mitigation Officer with the Alaska Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management Services; and Dr. Michael West, State Seismologist with the Geophysical Institute at the University of Alaska Fairbanks. Through October the Commission held six half-day and two two-day meetings (with another half-day meeting scheduled in November). The Commission's principal efforts and accomplishments during the year have included:

- Initiated planning for and funding of a pilot program, using Rapid Visual Screening procedures, to demonstrate the need for a more complete statewide program to assess the seismic vulnerability of schools and public buildings (similar to the successful programs recently completed in Oregon and Utah).
- Continued work on a scenario earthquake study for eastern Kodiak Island (which has experienced several damaging earthquakes and tsunamis over the past few hundred years); in particular assisting FEMA complete a HAZUS risk assessment for the project.
- Continued work on an abbreviated summary of the known earthquake sources and seismicity across the state.

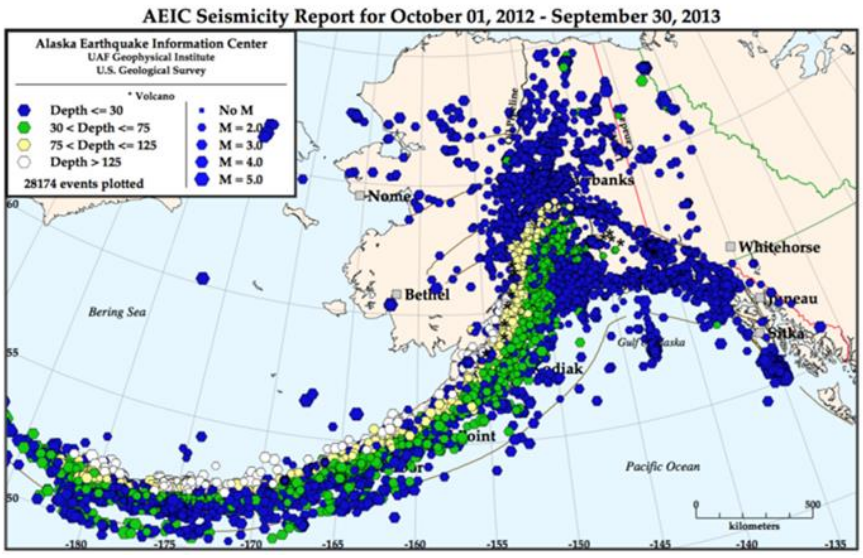
- Met with the Alaska State Board of Registration for Architects, Engineers, and Land Surveyors to discuss the Commission's 2012 recommendations for amendments to state licensing regulations intended to ensure civil and structural engineers possess a basic knowledge of seismic hazards and seismic engineering.
- Approved Policy Recommendation 2013-1; that State and local government jurisdictions and owners of important facilities incorporate and maintain seismic instrumentation as part of their routine operating systems. This recommendation includes preparation of an informational document outlining the value and potential near-term benefits of strong motion instrumentation to facility owners.

Additionally, individual commissioners:

- Participated in two one-day post-earthquake building safety assessment (following ATC-20) training courses for Municipality of Anchorage staff.
- Continued to participate on other groups involved with mitigation of seismic hazards (e.g. WSSPC committees, the Municipality of Anchorage Geotechnical Advisory Commission, and the ATC committee to update FEMA 154), and the local organizing committees for EERI's 10th National Conference on Earthquake Engineering, and an exhibit at the Anchorage Museum, both in 2014 to commemorate the 50th anniversary of the 1964 Mw9.2 Prince William Sound Earthquake.
- Facilitated a meeting between the USGS, the Alaska Earthquake Information Center, and the University of Alaska Anchorage to improve maintenance, operation and data distribution for the Alaska Strong Motion Network.
- Participated at WSSPC's 2013 annual meeting in Seattle.

University of Alaska Fairbanks Geophysical Institute (*www.aeic.alaska.edu)*

The University of Alaska Fairbanks Geophysical Institute (UAFGI) operates the Alaska Earthquake Information Center (AEIC) with primary support from the State of Alaska and USGS. Support from NOAA for seismic network operations has been reduced by 50% for 2013. AEIC monitors seismicity in the state and surrounding regions using a network of roughly 500 seismic stations. AEIC is charged by the Alaska legislature with recording and archiving Alaska earthquake data and disseminating earthquake information to the public.



Between October 1, 2012, and September 30, 2013, AEIC reported a total of 28,174 seismic events in the State of Alaska, with depths between 0 and 256 km and magnitudes between 0.4 and 7.5. Forty-four of the earthquakes had magnitudes of 5.0 or greater. About 20% of the earthquakes were located in the Aleutian Islands.

The largest earthquake, of magnitude 7.5, occurred on January 5, 2013, in Southeast Alaska. It ruptured a 140-km

long segment of the Queen Charlotte fault and was felt strongly throughout Southeast Alaska and the Yukon Territories. AEIC was able to locate about 350 aftershocks, 20 of which had magnitudes of 4.0 or greater.

Another major earthquake, of magnitude 7.0, occurred on August 31, 2013, in the Andreanof Islands. This earthquake ruptured the subduction interface between the Pacific and North American plates. More than 800 aftershocks were located, nearly 60 of which had magnitudes of 4.0 or greater.

The largest earthquake in mainland Alaska, with a magnitude of 5.8, occurred on December 4, 2012, in the Cook Inlet region, 44 km west of Anchorage. Its depth and focal mechanism are consistent with this event being an intraplate earthquake, meaning it occurred inside the subducting Pacific plate.

Field Work

During the summer 2013 field season, AEIC installed nine new broadband stations while improving reliability at existing stations. Many of these sites filled notable geographical gaps in the network including three new stations in the Kenai Peninsula and one on Chernabura in the Shumagin Islands. AEIC resolved longstanding problems at two of the most remote sites, on Chirikof and Atka Islands, both of which are critical because they are the only broadband stations in extremely active regions.

Three new seismic stations and one GPS station were added to the Susitna-Watana Hydroelectric Project monitoring network, which was initiated in 2012. The purpose of this sub-network is to measure background seismicity and, if the proposed dam is built, to monitor seismicity induced by its reservoir. Considerable effort went into improving the challenging telemetry for this network by installing a radio tower at a key repeater site. In addition to its role in the dam project, this seven-station network has significantly improved monitoring in the area between the Denali and Glenn Highways.

AEIC carried out significant maintenance network-wide, especially in Denali National Park and throughout the coastal region from Southcentral to Southeast Alaska. Efforts were concentrated on improving telemetry and upgrading solar power systems to include modern MPPT charge controllers.

USArray

In advance of the USArray project coming to Alaska in 2014, AEIC now has three IRIS-funded staff members working this project exclusively in the areas of permitting, outreach, and station installation and maintenance.

Inundation Mapping

As part of the National Tsunami Hazard Mitigation Program (NTHMP), UAFGI and ADGGS continue their collaboration on tsunami-inundation mapping projects with funding from NOAA through ADHSEM. A report for Valdez including tectonic and landslide sources was published in November 2012. AEIC staff traveled to Valdez to present the maps and report. The Sitka report is nearly finished and will be published before the end of 2013. AEIC staff were scheduled to present the report in Sitka on November 4, 2013. Reports for Cordova, Tatitlek, and Chenega have been submitted to ADGGS for publication. The modeling has been completed for Akutan, Unalaska, Elfin Cove, Gustavus, and Hoonah, and those reports are in progress.

Other Projects

Other current UAFGI earthquake-hazards research projects include:

- Development of an archive of ground-motion characteristics and spatial parameters for notable earthquakes and hypothetical scenarios.

- A collaborative project (TWEAK) to improve observation, modeling and mitigation of the effects of large earthquakes and tsunamis.
- A major new research-grade field experiment in the Cook Inlet region has been funded for the next several years. The principal investigator on this project is UAF professors Tape and Christensen.
- Collaborative research with the National Science Foundation (NSF), Incorporated Research Institutions for Seismology (IRIS), and the IRIS Program for Array Seismic Studies of the Continental Lithosphere (PASSCAL) to study the St. Elias Erosion/Tectonics Project (STEEP) is now in its last year.
- Development of catalog of moment tensors based on full waveform inversion.
- Testing of the MT-GRID algorithm for real time moment tensor inversion.
- ShakeMap production for all significant Alaska earthquakes.
- Seismic monitoring of the Trans Alaska Pipeline through strong-motion and broadband instruments at 11 sites along the pipeline corridor, including generation of threshold alarms and ShakeMaps.
- Collaboration with the USArray program in advance of its coming to Alaska in 2014.

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ARIZONA
EARTHQUAKE PROGRAM REPORT

Arizona Geological Survey

During 2013, the Arizona Geological Survey (AZGS) cataloged over 100 Arizona earthquakes, participated in multiple outreach activities, and acted as resource experts for the seismic source characterization project for the Palo Verde Nuclear Power Plant. With funding from FEMA, AZGS also completed its first online hazards mapping service called the Hazard Viewer. The Hazard Viewer contains locations of current and past earthquakes, active faults, earth fissures and fire hazard maps. It can be viewed at: http://data.azgs.az.gov/hazard-viewer

Seismicity

The largest quake recorded in the state was a Md = 3.5 which occurred near the North Rim Lodge at Grand Canyon. This area has been the site of several earthquake swarms, some of which include several quakes in the 3.0 range. Several active faults have been mapped in the general area of the swarms, including the West Kaibab fault, Sinyala and others.

The Great ShakeOut

On October 17th 2013, at 10:17 a.m., more than 116,400 Arizonans participated in the Great Arizona ShakeOut; across the U.S. and elsewhere more than 18.8 million people participated. In Arizona, we exceeded 2012 ShakeOut participation by ~ 54,000 participants, resulting in 86% growth in just our second statewide exercise.

More than 84,000 K-12 students and faculty in Arizona dropped, covered and held on as part of the drill, reflecting a renewed effort to reach the education community . Involvement in Yuma County surpassed that of other counties, but Maricopa and Coconino Counties are closing fast (Fig. 1).

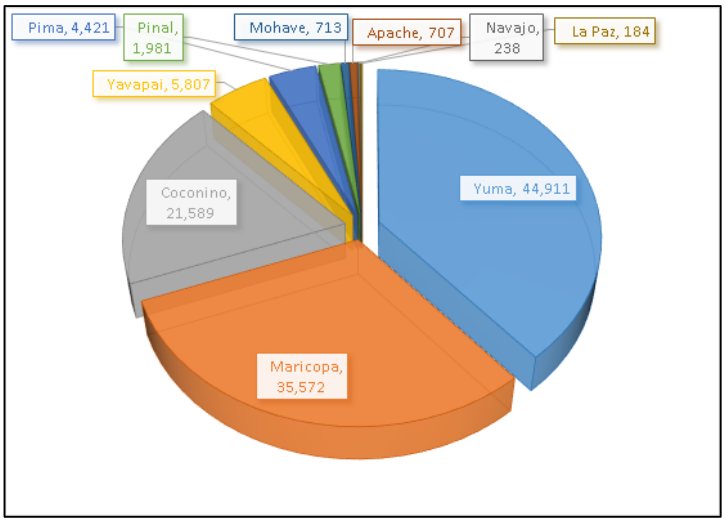

Figure 1. Enrollment by County for those counties with greater than 100 participants in 2013.

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BRITISH COLUMBIA
EARTHQUAKE PROGRAM REPORT

Emergency Management British Columbia

British Columbia has continued to focus on seismic planning as a major priority for 2013. Underlining the collective planning efforts of Emergency Management British Columbia (EMBC) and other agencies is the continued high profile of seismic hazards due to global events and the October 27th, 2012, Haida Gwaii M7.8 earthquake and tsunami.

ShakeOut

The BC Earthquake Alliance organized a province-wide earthquake drill held on October 17, 2013, at 10:17 a.m. to enhance awareness of the earthquake hazard in BC and encourage personal preparedness. During the Great British Columbia ShakeOut, participants were asked to "Drop, Cover and Hold On" for two minutes, in response to a simulated earthquake event. The ShakeOut BC drill coincided with ShakeOut drills across the globe.

According to the main ShakeOut registration site, over 690,000 participants registered to take part in the Great British Columbia ShakeOut drill in 2013. We are encouraged that we exceeded last drill's participation numbers of over 600,000.

BC Seismic Safety Council

Co-chaired by EMBC and Natural Resources Canada, this group of federal, provincial and academic representatives has been developed to integrate province-wide strategies that address seismic concerns in areas including: tsunami planning levels, education and outreach, earthquake early warning system and risk assessment tools.

Tsunami Notification Tests

Regular tests of the Provincial Emergency Notification System (PENS) are conducted to ensure readiness for a distant tsunami event that may impact the British Columbia coastline. During these tests, approximately 1100 phone calls are made via the Interactive Voice Response (IVR) system, as well as 300 faxes and 300 emails to local governments, local emergency officials, police and fire departments, federal and provincial ministries, First Nations, utilities, regional health authorities and the media.

Earthquake and Tsunami Outreach

Public education and outreach are an important aspect of EMBC seismic programming. In 2013, EMBC travelled to coastal communities to connect with local governments about tsunami notification and share enhancements to the tsunami notification process that were brought about from lessons learned from the October 2012 Haida Gwaii event. A public education campaign will follow in the fall of 2013 and spring of 2014 that will coincide with the commemoration of the 1964 Great Alaska earthquake and tsunami.

Social Media

The use of social media for emergency notification is an area of expansion this year, with EMBC using twitter and a website blog to detail information quickly to stakeholders. It has been successfully employed during flood and fire season and during tsunami alerts.

International Working Group Participation

In addition to being a member of WSSPC, EMBC continues to be an active participant in the Cascadia Region Earthquake Workgroup (CREW). Teron Moore acts as board member and secretary of the CREW executive committee.

EMBC continues to collaborate with colleagues throughout the US and internationally on earthquake, tsunami and volcano preparedness and response planning, as well as working closely with federal partners at Public Safety Canada and Natural Resources Canada.

Contributing Author:

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CALIFORNIA
EARTHQUAKE PROGRAM REPORT

California Geological Survey

Seismic Hazards Zonation

Under this program are three major projects. The first is authorized by the Alquist-Priolo Earthquake Fault Zoning Act, in which active faults (as defined by the State Mining and Geology Board as having movement in the Holocene – approximately the last 11,000 years in California – are zoned where they express surface rupture. Construction of structures for human habitation within these regulatory zones generally is prohibited. California Geological Survey (CGS) has zoned over 5,000 miles of active surface faults in the State, producing about 553 maps. It is estimated that approximately 1,800 miles of active surface rupture remains to be zoned.

The mapping of other seismic hazards is authorized by the Seismic Hazards Mapping Act. This project places zones around the extent and likelihood of secondary hazards following an earthquake, such as ground liquefaction and triggered landslides, in urbanized areas. Under this project, 115 maps have been produced covering over 7,000 square miles. These maps are regulatory in nature and enforced by local permitting agencies. CGS continues to map in several areas around the state.

Work continued on the joint CGS-California Governor's Office of Emergency Services (Cal OES) Tsunami Hazard Mitigation and Preparedness Program. Last year, preliminary probabilistic inundation maps for portions of the California coastline were evaluated and shared with representatives of two pilot study communities, Crescent City and Huntington Beach. Partnerships were formed with the University of Alaska and Humboldt State University to assist in tsunami inundation modeling and development of a tsunami deposit database. Progress continues on this modeling and map preparation. Eventual products will include tsunami hazard maps for land-use planning and construction in all coastal communities, and tsunami map products for the maritime community to help improve the resiliency of infrastructure and to provide guidance for evacuation to designated safety areas during tsunami events.

Seismic Hazards Assessments

The construction of new schools, or when structural modifications are made to existing schools, requires a permit from the Division of the State Architect. Prior to the issuance of a school construction permit, CGS reviews consulting reports describing the school site's geology and seismic hazards to ensure that those hazards, if any, are adequately described and taken into consideration in the construction of the school. Failure of a school district to thoroughly and adequately evaluate existing seismic hazards will prevent the school from receiving site approval from CGS and a construction permit from the State Architect. CGS reviews reports from approximately 400 school sites each year, and makes field checks of sites where fault-trenches are exposed. Also under this program, CGS evaluates the seismic hazards site conditions for hospital construction for the Office of Statewide Health Planning and Development Safety Board (OSHPD). Hospitals must be constructed in strict accordance with OSHPD standards. CGS reviews consulting reports from approximately 70 hospital sites each year. Earthquake risk and loss assessments also are conducted under this program, wherein local and regional damages to the infrastructure are calculated and analyzed for various earthquake scenarios along major fault systems.

Strong Motion Instrumentation Program (SMIP)

This earthquake engineering program commenced in 1971 and has evolved into the largest Strong Motion Network in the nation, with over 1,200 stations and more than 8,500 instruments installed in 64 bridges, 60 hospitals, 235 buildings, 38 geotechnical arrays, and 880 free-field stations throughout the State.

Strong Motion information gathered by this network is provided to the structural engineering and design communities to improve the earthquake resiliency of California's structures. Ultimately, this information is incorporated into the Building Code. The CGS SMIP network comprises the largest part of the California Integrated Seismic Network (CISN), along with networks and partnerships with the U.S. Geological Survey (USGS), Cal OES, California Institute of Technology (Caltech) and University of California, Berkeley (UC Berkeley). CISN is an integral part of the USGS Advanced National Seismic System (ANSS).

The SMIP is in partnership with the USGS in the operations of the Center for Engineering Strong Motion Data (CESMD). Strong Motion data from throughout the U. S. and from around the World are sent to the Center for processing, display, and archiving. Data arriving from the CISN system is automatically processed and offered on the Internet within minutes of an earthquake event. Earthquake data from different parts of the World may take several days to post because of some countries' data-holding policies. The Center's archives may be accessed at: *http://strongmotioncenter.org*.

This year, some of the SMIP projects included placing hundreds of instruments (accelerometers) on the East Bay extension of the San Francisco Bay Bridge, inside the Bay Area Rapid Transit System's (BART) tube (40 sensors over 3 ½ miles) that lies on the bottom of San Francisco Bay, on the Dumbarton Bridge crossing the southern San Francisco Bay, the Caldecott Tunnel, and numerous hospitals and other structures.

Earthquake Early Warning System

In late August 2013, the California Legislature passed Senate Bill 135 (Senator Padilla) that authorized the State of California to develop and implement an Earthquake Early Warning System. Under this Act, Cal OES, acting in cooperation with CGS, Caltech, UC Berkeley, Alfred E. Alquist Seismic Safety Commission (SSC), and the USGS, is to oversee the planning and implementation of the system. Several organizational meetings have been held, and the physical planning is to commence in January 2014, with the commencement of implementation by January 2016.

California Governor's Office of Emergency Services and California's Earthquake Country Alliance Partner Agencies

Program Background

In 2013, the California Governor's Office of Emergency Services (Cal OES) reacquired its former agency name (having been called the California Emergency Management Agency between 2009 and 2012). The Cal OES Earthquake and Tsunami Program dates back to the formation of the Southern California Earthquake Preparedness Project (SCEPP) in 1980 and the Bay Area Regional Earthquake Preparedness Project (BAREPP) in 1984.

Through its Earthquake and Tsunami Program, Cal OES leadership sustains efforts to develop plans for catastrophic earthquake and tsunami response and recovery, places emphasis on public earthquake and tsunami preparedness and education, provides guidance and leadership in promoting the implementation of new technologies, and continues to provide a voice for earthquake and tsunami-informed hazard mitigation and land-use planning.

To continue to accomplish its mission, Cal OES works closely with the CGS; USGS; SSC; California Earthquake Authority (CEA); Southern California Earthquake Center (SCEC) and Tsunami Research Center at USC; Caltech; UC Berkeley; American Red Cross; Earthquake Engineering Research Institute

(EERI); the Structural Engineers Association of California (SEAOC); local government, private industry, and non-profit entities; and California's Earthquake Country Alliance (ECA).

2013 Earthquake and Tsunami Program Staffing

Cal OES' Earthquake and Tsunami Program is currently budgeted for five full-time Cal OES employees: program manager, four research/program staff, and one grants specialist. Four of these five positions are currently filled; the incumbent in the earthquake program specialist position retired in August, and that position remains vacant. The tsunami program specialist position was filled in December after a 9-month vacancy. The position for the program manager was filled by Mark Johnson in mid-2013, following an 18-month vacancy. Additionally, NEHRP and NTHMP grant funds support part-time assistance from the former program manager, and contributions from contracted subject-matter experts: two from Humboldt State University and two from CGS. Other divisions of Cal OES involved in earthquake and tsunami mitigation and education include Mitigation Planning, Mitigation Grants, and Office of Communications.

Funding

In 2013, the Earthquake Program relied on two funding sources. First, an annual allocation of $1.7 million from California's State General Fund (GF) provides some of the support for the California Integrated Seismic Network (CISN). GF also supports two full-time positions, staffing Cal OES' outreach program efforts for emergency managers and the public. An additional earthquake position is funded through a FEMA Emergency Management Performance Grant (EMPG).

For 2012 and 13, California has no NEHRP State Cooperative Agreement. Rather, FEMA has directly funded Cal OES's NEHRP priority projects through direct cooperative agreements with EERI, the Southern California Earthquake Center (SCEC), and WSSPC; Cal OES is closely involved with those projects.

The Tsunami Program is funded through a multi-year grant administered through the National Weather Service (NWS). The NTHMP funding cycle, mandated by the Tsunami Warning and Education Act of 2006, sunset in September 2013, and funding is operating through July 2014 under a grant extension. Legislation authorizing continued funding is pending Congressional approval and funding is currently under consideration.

Program Activities

ShakeOut Public Earthquake Drill

California's public ShakeOut earthquake drill has become "national", spreading across the Country to forty-four U.S. states and territories in 2013. California's sixth annual drill numbered 9.6 million registered drill participants – an increase of 200,000 over California's 2012 drill participation. With our SCEC and EAC partners, Cal OES continues to work on California's ShakeOut. Further, Cal OES and its ECA partners provide common resources used in ShakeOuts nationally and internationally. Cal OES also continues to provide subject matter advice to states as they join ShakeOut. ShakeOut continues to spread and grow, and has become its own "phenomenon" over the past 6 years:

- 2008: 5.4 million Southern California
- 2009: 6.9 million California, New Zealand West Coast
- 2010: 7.9 million California, Nevada, Guam

- 2011: 12.5+ million California, Nevada, Guam, Oregon, Idaho, British Columbia, and Central United States (Alabama, Arkansas, Georgia, Indiana, Illinois, Kentucky, Minnesota, Missouri, Oklahoma, South Carolina and Tennessee.)
- 2012: 19.4 million All of the 2011 participants, plus: Alaska, Arizona, Southeast United States (Washington D.C., Maryland, North Carolina, Virginia, Utah, Washington, Puerto Rico, Japan (central Tokyo), New Zealand, Southern Italy (US naval bases and surrounding areas), and a new "Global" site for all other areas.
- 2013: 24.7 million All above except New Zealand, plus: Rocky Mountain region (Colorado, Wyoming, Montana), Hawaii, Ohio (now in the Central U.S.), West Virginia & Delaware (now in the Southeast region), Northeast region (Connecticut, Pennsylvania, Massachusetts, Maine, New Hampshire, New Jersey, New York, and Rhode Island), American Samoa, U.S. Virgin Islands, Commonwealth of Northern Marianas Islands, Charlevoix region of Quebec, and expansion across Japan.

Staying Safe Where the Earth Shakes

Cal OES used 2011 NEHRP funding to partner with the California Earthquake Authority (CEA) to co-fund a new earthquake education publication as part of California's *Putting Down Roots in Earthquake Country* "suite" of publications. The product was developed via a collaboration with a large group of Subject Matter Experts (SME) partners via ECA. *Staying Safe Where the Earth Shakes* intended to meet the needs of those who may have lower literacy levels (through use of simpler language); and to be easier/more economical to translate and keep translated into non-English languages. The NERHP 10-funded pilot version was completed in June, and 9 additional regional versions are nearing completion under CEA funding. With the exception of the outer and inner covers, this product was purposely created for "generic" use by the states and territories beyond California that have adopted ShakeOut campaigns.

Buildings at Risk Summits 2013

For the third year in a row and in support of ShakeOut, the Structural Engineers Association of Southern California (SEAOSC) hosted a risk reduction conference, *Buildings at Risk Summit*. New for 2013, a sister conference was hosted by The Structural Engineers Association of Northern California (SEAONC). Partnering with ECA, Cal OES, FEMA QuakeSmart, and private sector sponsors, SEAOC hosted some 500 attendees statewide. The event – now held annually - created a forum to spur action by stressing the benefit of mitigation and encouraging synergy among the structural engineering community, emergency managers, policy makers and other stakeholders.

California Vital Infrastructure Vulnerability Assessment Project (Cal VIVA)

Cal VIVA supports the 2010 State Multi-Hazard Mitigation Plan requirement of identifying state-owned buildings that house critical functions and are vulnerable to earthquakes. Covering three phases between 2010 and 2013, the project was led by Cal OES Hazard Mitigation Planning Division with technical support from architectural engineering and other faculty at California Polytechnic State University, San Luis Obispo. The project determined a standardized methodology to identify vulnerable buildings which are critical to response and recovery efforts after an earthquake; tested the selected methodology; and improve the methodology based on lessons learned. Once the methodology was completed, the most recent approach covered several high occupancy state-owned buildings, and also develop a conceptual methodology which can be used by individual departments and agencies. The final phase, completed in 2013, further tested the methodology with individual user departments, and then put forward a plan which can be used by department and agencies within state government to systematically address building vulnerability and potential retrofits on a long-term basis. This project is FEMA-NEHRP State Assistance funded; through the State of California initially and then directly through EERI in 2012/13. Although

FEMA has interrupted direct funding to states under NEHRP State Assistance, California remains intimately involved with its NEHRP-funded projects.

SAFRR Tsunami Scenario

The State Program participated in analysis leading to release of a major study in September via the USGS Science Application Risk Reduction team (the same team that produced ShakeOut and ArkStorm). SAFRR integrates physical science, social science and emergency management in creating detailed analysis to support officials and the public in reducing the risk of the future tsunamis that will impact California. The SAFRR Tsunami Scenario is created by an earthquake offshore from the Alaskan peninsula and extends to the California coast.

For this USGS-led project, the SAFRR Team included Cal OES Earthquake and Tsunami Program, CGS, the National Oceanographic and Atmospheric Agency (NOAA), and academic partners to develop new tools to offer more accurate insight into the likely impacts when tsunamis occur. This project was the third in a series of projects led by the USGS Science Application for Risk Reduction (SAFRR) since 2008. In this scenario, scientists specifically outline the likely inundation areas, current velocities in key ports and harbors; physical damage and repair costs; economic consequences; environmental impacts; social vulnerability; emergency management; and policy implications for California. Some of the issues highlighted in the scenario include public safety and economic loss. In this scenario approximately 750,000 people would need to be evacuated, with 90,000 of those being tourists and visitors. Additionally, one-third of the boats in California's marinas could be damaged or completely sunk, resulting in $700 million in losses. It was concluded that neither of California's nuclear power plants would likely be damaged by this particular event. Further information can be found at *http://pubs.usgs.gov/of/2013/1170/*. An additional study of community vulnerabilities within the state-mapped potential inundation zone was released in February at *http://pubs.usgs.gov/sir/2012/5222/*.

This scenario was the focus of discussion at a workshop series in September 2013 that convened in partnership with the California Tsunami Hazard Mitigation Program, USGS scientists and partners to explain the scenario and results to stakeholders in the coastal communities of California. The workshops aimed to establish a community of experts while fostering the use of science in decision-making. Workshops were hosted by the Cabrillo Marine Aquarium (September 4); Santa Barbara County Office of Emergency Management (September 5); San Diego County Office of Emergency Management (September 6); Santa Cruz County Office of Emergency Management (September 9); and the Port of San Francisco (September 10).

Tsunami Inundation Modeling

State tsunami modelers have completed all of the required modeling to validate second-generation tsunami inundation maps. Modeling and mapping tsunami inundation from a new large Aleutian Islands source developed by the USGS has been compared to the state inundation line. High resolution modeling (10m) in Orange and San Diego counties has been used to verify the inundation maps.

Tsunami Planning/Coordination

As a representation of planning and coordination activities, approximately 64 workshops, presentations, meetings, and community forums were completed from February through July, during which tsunami hazards, planning, policy, and/or maps & modeling were discussed.

Tsunami Preparedness Month

California continues to observe Tsunami Preparedness Week during the fourth week of March. The week is supported nationally by NOAA and proclaimed by the California Governor; it is an opportunity for focused outreach and education down to the community level.

In recognition and support of National Tsunami Preparedness week, the following statewide activities were conducted:

- Television broadcast on Tsunami Awareness, KGO-TV, San Francisco;
- Google Map interface for tsunami inundation maps;
- Cal OES/CGS recognition of Tsunami Preparedness Week, March 27;
- Newly developed brochure for boaters distributed to target audiences;
- Purchased and distributed additional 1,300 tsunami warning signs, decals, and multi-hazard signs.
- The following quantities of outreach materials were distributed to local jurisdictions during National Tsunami Preparedness Week/Month 2013:
    - *How to survive a tsunami* brochures (5000)
    - *How to survive a tsunami* brochures (Spanish) (2000)
    - *How to survive a tsunami* brochures (Chinese) (1000)
    - *Tsunamis know what to do* children's video in English (850)
    - *Tsunami preparedness in California* general audience video (1150)
    - *Tsunamis What Boaters Should Know* (25,000)
    - *Living on Shaky Ground* (500)

End-to-End Communications Test

During Tsunami week each year since 2008, the program has conducted a "Live Code" Tsunami Warning Communications Test which tests the operation and performance of the last critical link in the tsunami warning communications system – the Emergency Alert System (EAS) that provides tsunami warnings to the public. This test uses the actual tsunami event codes (TSW) that are used when a tsunami warning is issued by NOAA, a test few other states conduct due to the perceived risk that residents and visitors may mistake the test for an actual tsunami emergency. California has chosen to conduct this test to ensure that these EAS codes will function properly in an actual tsunami emergency. This "live" test is conducted for Del Norte, Humboldt, and Mendocino Counties. Tsunami Week also included required Monthly Test (RMT) Tsunami Code (all coastal areas except Del Norte, Humboldt, Eureka) conducted by National Weather Service forecast offices in Monterey, Oxnard, and San Diego.

Tsunami Modeling and Mapping for Maritime Community

The state continues to work closely on major initiatives which include: 1) analyzing risks to the maritime community; 2) providing planning data and assistance for multiple scenarios to the emergency management community; and 3) working to produce probabilistic tsunami hazard analysis maps for the coast of California. Work proceeded with delivery and presentation to several harbors in California of findings. This work is being completed via two subcontracts with the University of Southern California Tsunami Research Center to help achieve the goals of producing in-harbor maps of tsunami currents, producing offshore safety zone maps, and developing guidance on evacuation protocol planning for the maritime community. The NTHMP Mapping and Modeling Subcommittee is looking to the work in California as a demonstration project for the nation. Leveraged by our existing database of modeled tsunami current velocities, outside funding has been secured from FEMA.

A focused work group to provide feedback and guide product development met via a series of conference calls. Workshops to develop secondary evacuation areas and present a method incorporating variables influencing incoming tsunami wave height (tide, storm, modeling error, and topographic run up) were conducted in coastal jurisdictions of the members: Orange County, Humboldt County, San Diego County, and Monterey County. A guidance document for these tools has been developed and mechanisms for use protocols for incorporation into emergency management planning practice are under discussion.

Tsunami Hazards Analysis for California

In coordination with other state and federal agencies, progress is being made on both the development of viable Probabilistic Tsunami Hazards Analysis (PTHA) for California. Two communities were selected as appropriate coastal communities for pilot studies in 2012. The State Tsunami Policy Group held meetings in Sacramento (08/07/13) and Oakland (10/17/13) where the PTHA/land-use planning project was discussed. A comparison between two PTHA methods is being performed at Crescent City this year. Meetings with the two principal investigators in December and January helped develop and set a schedule for review by a CA-PTHA Work Group. Formal invitations were sent and the Work Group was established in January 2013. Preliminary PTHA maps have been completed and are being checked for accuracy in the field. A basecamp website has been established for the CA-PTHA Work Group. CGS participated in American Society of Civil Engineers meetings looking into tsunami loads on structures to determine construction guidance in California. The MMS and NTHMP continues to promote the CA-PTHA project as a national "pilot study" to help determine if the methodologies are sound and if national guidance can be developed.

CGS has held a dozen conference calls and one in-person workshop for the CA-PTHA Work Group. A draft report for the CA-PTHA has been completed and shared with MMS members for their feedback. Although some delays in contracts with the modelers occurred, the second phase of PTHA modeling of 10% of the coastline is underway and draft maps should follow. This work should be completed by the end of the extended contract (July 2014).

Concrete Coalition

A project of EERI and many partners, Phase I of this project was funded with HMGP funds, and used volunteers to begin to gather information on the stock of dangerous non-ductile concrete buildings in the state. Granted by FEMA to meet California's NEHRP 12 priorities, Phase II of the Concrete Coalition not only continues to gather data, but will work with pilot jurisdictions to develop strategies and products to make progress in fixing these types of buildings. This project is FEMA-NEHRP State Assistance funded directly through EERI in 2012/13. Although FEMA has interrupted direct funding to states under NEHRP State Assistance, California remains intimately involved with its NEHRP-funded projects, such as the Concrete Coalition.

California Residential Mitigation Program

A Joint Powers Authority partnering Cal OES and CEA continue work on an incentive program to help homeowners seismically retrofit their homes. The resources for this program – called the California Residential Mitigation Program (CRMP) – come from the CEA Earthquake Loss Mitigation Fund. By statute, 5% of CEA's insurance premiums are used to support mitigation. The program, called the *Bolt + Brace Program*, focuses on helping the retrofit of wood-frame family dwellings where those two specific elements are inadequate.

The program is currently being piloted in two California communities, the Los Angeles neighborhood of Eagle Rock and the Rockridge neighborhood of Oakland. A typical retrofit can cost between $2,000 and $10,000. *Earthquake Brace + Bolt* will pre-qualify homeowners whose homes meet certain criteria and

then select the recipients of the rebate (up to $3,000) using a database which will randomly select participants. The fill program is projected to roll out in fall 2014.

Public Education through ECA

Since 1980, the Cal OES Earthquake and Tsunami Program has promoted awareness and preparedness for earthquakes through targeted outreach to California communities. Governmental earthquake planning and preparedness have been much improved since the 1970s, but research data from 2008 (*The California Earthquake Preparedness Study, 2010 (CEPS)*) documented the challengingly low levels of pubic disaster preparedness, and preparedness rates were not significantly better in parts of the state with elevated risk. So, in spite of twenty-some years of earthquake education, stakeholders including Cal OES still found themselves confronted by the contrast between large populations at high earthquake risk and relatively low levels of public earthquake preparedness. However, in recent years, social science research has also presented evidence-based methods to create public behavior change (*Communicating Actionable Risk, Wood et al., 2011*). Wood et al.'s approach addresses the seemingly stubborn problem of public preparedness "resistance". Their research pointed to cross-stakeholder collaboration as one of the key variables in public communication, as a way to provide frequent, ongoing, and consistent messaging through a variety of trusted, local sources. From the late 90's through 2008, public earthquake education stakeholders were already collaborating regionally: California's north coast, which is part of the Cascadia Subduction Zone and at high risk for near-source tsunami, has hosted a successful regional stakeholder group for over 15 years; the Redwood Coast Tsunami Working Group (RCTWC) provides a template for cross-sector collaboration. In the San Francisco Bay Area, USGS organized partner organizations in successful education initiatives using earthquake anniversaries. SCEC, USGS, Caltech and other partners had coordinated on both preparedness and mitigation campaigns. Then, in response to the first Great Southern California ShakeOut earthquake drill in 2008, a statewide ECA was first convened as a multi-stakeholder coalition helping coordinate the efforts of many separate organizations. ECA is this network of stakeholders that make the annual Great California ShakeOut possible. Due to ShakeOut's success, it is ECA's key statewide event; however, ECA is intended to network and leverage earthquake preparedness efforts on an ongoing basis. As such, Cal OES began use of its NEHRP State Assistance funding for ECA in 2009. Since that time, by-laws have been developed; regional groups have elected statewide steering group representatives; a dozen state-wide sector-based committees have been established; and leaders use phone conferences to coordinate across the state. Current efforts focus on developing and strengthening regional stakeholder groups, and on continuing to attract non-traditional partners to expand the base of communicators. Both the Great California ShakeOut and ECA are made possible through NEHRP funding. ECA's administrative home is at SCEC. SCEC also organizes support for ShakeOut initiatives across the country, and is the key leader in ShakeOut's international success.

Earthquake Early Warning

For several years, the Cal OES Earthquake Program has been with the California State Geologist, the Directors of the Seismological Laboratories at UC Berkeley and Caltech, CGS and USGS, and the SSC to promote the development of an Earthquake Early Warning System in California. This effort has proceeded on several levels. The program continues to monitor on-going research at Caltech, UC Berkeley and SCEC to develop algorithms to rapidly identify and analyze an evolving seismic sequence. Currently, Cal OES is collaborating with USGS to coordinate implementation of an earthquake early warning system, and convene working groups to address the many organization and management issues inherent in building such a system.

In 2013, California OES Director Mark S. Ghilarducci convened a working group comprised of public and private sector stakeholders in the development and operation of an earthquake early warning system that could be implemented for California. During the meetings which took place between March and July of 2013, many aspects of earthquake early warning were discussed including possible roles to be played

by government agencies and private sector organizations, how the system would be organized and managed, how users would come to understand how to use early warnings and the costs associated with a start-up and for ongoing maintenance and operations. During this phase, California State Senator Alex Padilla introduced Senate Bill 135 mandating that an earthquake early warning system for California be implemented as a public/private partnership, and tasked Cal OES, in collaboration with several institutional stakeholders, in further articulating the details of a system and identifying funding sources that do not include the state's General Fund. The bill passed and was signed by the Governor, and the Working Group completed its work with a set of recommendations. SB135 was codified as California Government Code section 8687.8.

Cal OES has created a charter to carry out the mandate of the legislation by convening five committees that include those institutions identified in the Government Code and other stakeholders and subject matter experts as deemed appropriate by the Project Managers. These committees will focus on the following areas which address the mandate of the law: 1) Earthquake Early Warning Model Committee which will develop a model that represents a public/private partnership that will operate in a cost effective and reliable manner; 2) Management Committee which will formalize an organizational structure that incorporates existing roles and responsibilities for seismic monitoring in California; 3) Standards Committee will establish a mechanism to assure that the system operates in a timely, reliable and efficient manner; 4) Education and Training Committee will develop a comprehensive training and education program that addresses the needs of all potential users of an earthquake early warning system; and 5) Funding Committee which will identify costs and options for system funding that do not identify the state General Fund as one of those sources. An Oversight Committee will be made up of the chairs of the five committees and chaired by an executive level member of Cal OES.

In 2014 the established committees are tasked to research and prepare an implementation plan for an earthquake early warning system that is a public-private partnership with organizational responsibilities, a management structure, an associated training and education program, conforms to the highest scientific and technical standards of performance and has a rational and feasible funding strategy that is independent of the state General Fund.

Support for CISN

The Cal OES Earthquake and Tsunami Program has provided funding for the development and maintenance of CISN since 2002 at approximately $2-3 million per year. A GF funding cut in fiscal year 2011/12 reduced support for CISN to $1.7 million. The CISN includes the Northern and Southern California Seismic Networks (administrated by UC Berkeley and Caltech respectively) and the California Strong Motion Instrumentation Program (administered by CGS). Cal OES is a member of the CISN Steering Committee and manages the funding contracts with the three participating institutions.

Catastrophic Earthquake, Tsunami and Volcanic Hazards Planning

Cal OES's Earthquake and Tsunami Program coordinated with FEMA to develop the Cascadia Subduction Zone Earthquake and Tsunami Response Plan. This two-year project involved state agencies from California, Oregon and Washington; the Province of British Columbia, Canada; local jurisdictions; non-governmental organizations; USGS; and FEMA. Two previous catastrophic earthquake plans – one for Southern California and the other for Northern California – were completed in 2008 and 2010. Also under development is the state's first comprehensive Volcanic Hazards Identification, Risk Analysis, and Concept of Operations Annex to the State Emergency Plan. This plan is being developed with significant input from USGS California Volcano Observatory (CalVO). The Concept of Operations section is currently on hold due to staffing shortages, but the Hazard Identification and Risk Analysis sections were completed by March 2013.

Earthquake and Tsunami Boards and Associations

The Earthquake and Tsunami Program of Cal OES is an active participant on boards and committees as well as in professional associations. The program staff participates in Board of Directors meetings for the Western States Seismic Policy Council (representing the Cal OES Director); the Cascadia Region Earthquake Workgroup; the External Advisory Board of SCEC, and the External Advisory Board of the Federal Alliance for Safe Homes. In addition to board participation, program staff have held leadership positions in: the California Tsunami Steering Committee (Chair); the Coordinating Committee of the National Tsunami Hazard Mitigation Program; the Steering Committee of CISN, and the California Post-Earthquake Clearinghouse (Management Committee).

California Earthquake Authority (CEA)

Cal OES and its Earthquake Country Alliance partners have the unique opportunity to partner with CEA, California's publicly mandated but privately funded earthquake insurer. CEA continues to be instrumental in partnering with science, communicators and emergency managers to promote earthquake resiliency. In addition to their support of ECA and ShakeOut, their partnership in the *Staying Safe* booklets, and their participation with Cal OES in the Joint Powers Authority intended to dispense household mitigation grants, CEA continues to work closely with the American Red Cross (ACR) in the "Joined Forces" programming, which completed its second year in 2013. Designed to help consumers prepare to survive and recover from California's next damaging earthquake, through integration with MVP broadcast advertising and direct mail, the CEA and ACR worked together to promote the annual statewide auction in April and the Great California ShakeOut in October. As a partner in the ShakeOut earthquake drill, CEA supported the Traveling Red Table® Tour, placed a media buy, included the ShakeOut messaging in direct mail pieces, created bonus media opportunities and story pitches and actively worked to make this the biggest ShakeOut drill ever. CEA also independently continued its support of federal legislation that, if passed, would allow the CEA to lower rates and make earthquake insurance more affordable and accessible.

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COLORADO
EARTHQUAKE PROGRAM REPORT

Division of Homeland Security and Emergency Management
Colorado Office of Emergency Management

Local Hazard Mitigation Planning – Improving Earthquake Hazard Information

Using NEHRP funds, the local jurisdictions listed below have successfully developed enhanced earthquake risk analyses as part of their local multi-hazard mitigation plans. In order to receive the funding, the local jurisdiction agreed to complete a detailed scope of work developed by the Division of Homeland Security and Emergency Management Colorado Office of Emergency Management (DHSEM OEM). This scope requires a complete hazard analysis and risk assessment, vulnerability assessment, capability assessment, mitigation actions, and the use of best available date.

Jurisdiction	Start	End	Status
Summit County	Winter 2013	September 2013	State Review
Grand County	Winter 2013	September 2013	State Review
Park County	Winter 2013	September 2013	State Review
Ouray County	Winter 2013	September 2013	State Review

State Hazard Mitigation Planning

DHSEM COEM staff reviewed and updated earthquake related sections and items in the State of Colorado Natural Hazards Mitigation Plan. Revisions were made to the hazard analysis and risk assessment, vulnerability assessment, capability assessment, and mitigation actions. Updated $HAZUS_{MH}$ loss estimations were integrated in to the 2013 update to provide enhanced vulnerability and potential losses by jurisdiction. The plan was submitted to FEMA for formal review on December 13, 2013.

Colorado Earthquake Hazard Mitigation Council

DHSEM OEM staff attended and participated in regularly scheduled CEHMC meetings for the duration of the performance period. Earthquake program funding was used to update and print 15,000 copies of the Colorado Earthquake Hazards pamphlet/fault map originally developed by the CEHMC in 2008.

National Earthquake Program Managers Meeting

DHSEM OEM staff represented Colorado at the 2013 NEPM meeting in Seattle, Washington. Staff presented Colorado's accomplishments and challenges over the previous 12-month period to other state and territorial representatives. Staff networked with FEMA staff and other state program managers to share ideas and successes.

Western States Seismic Policy Council

In conjunction with the 2013 NEPM meeting, DHSEM OEM participated in the annual meeting of the Western States Seismic Policy Council (WSSPC). DHSEM OEM staff reviewed and provided comments on WSSPC policies and initiatives as appropriate.

Great Rocky Mountain Shakeout

DHSEM OEM was a partner state in the 2013 Great Rocky Mountain ShakeOut. DHSEM OEM mitigation staff coordinated with preparedness program staff to provide educational information collected at the 2013 NEPM for use at school assemblies and other events. Preparedness program staff received technical assistance from State of Washington earthquake program staff for educational information and other programmatic items. Preparedness program staff also coordinated with Radio Disney for assemblies, radio announcements, and other ShakeOut promotional activities (Radio Disney direct costs fall under FFY 2012 program funding).

Colorado Geological Survey

$HAZUS_{MH}$ Earthquake Loss Estimation – 2013 Update

In early 2013, staff from the Colorado Geological Survey finalized calibrating $HAZUS_{MH}$ to run updates of statewide (county by county) loss estimations. Maps showing the probability of damages for ten categories of loss (critical facilities and economic loss) were produced for each relevant fault by county. County and statewide summary reports were also produced for each fault scenario.

These loss estimations are used to inform planning process for both earthquake response and mitigation planning. This information will be made publicly available via the Colorado Geological survey earthquake hazard page or other means.

Colorado Earthquake Hazard Mitigation Council

The Colorado Earthquake Hazard Mitigation Council CEHMC) is a multi-disciplinary organization that is interested in developing a better understanding of earthquake hazards in Colorado. The council's members include civil engineers, emergency managers, geologists, geophysicists, geotechnical engineers, mechanical engineers, risk managers, seismologists, and structural engineers in the private sector, academia, and state and federal government. The group has been in existence in various forms for more than three decades. The ad hoc Colorado Earthquake Hazard Mitigation Council (CEHMC) continues to meet bi monthly on the campus of the Colorado School of Mines in Golden, Colorado.

Seismicity

Seismic activity has continued west of Trinidad in southern Colorado. A 2002 Colorado Geological Survey ROCKTALK publication stated that "the detailed studies of the fault under Segundo showed that the earthquakes are occurring on a 6 km long fault. A fault of this length is capable of generating a magnitude 5.8 earthquake (Wells and Coppersmith, 1994)." In fact, on August 23, 2011, the same day as the Mineral Virginia M5.8 earthquake, a M5.3 earthquake occurred near Segundo. Since the swarms of 2001 and 2011, additional research is in progress based on the possibility that at least some of the seismic activity in this area has been triggered by water injections from gas production. In the Raton Basin, the late Cretaceous Raton and Vermejo Formations host the coalbed methane. The late Cretaceous Trinidad Sandstone and Pierre Shale underlie the formations from which the methane is produced. Igneous dikes and sills associated with the Spanish Peaks intrusive complex locally intrude these formations. The Raton Basin is one of only a few sedimentary basins in the United States that has high geothermal heat flow. The Basin is located at the eastern edge of the Rio Grande Rift. There is a small volcanic anomaly just to the south of the seismic activity. Although widespread gas production is also present in the San Juan Basin in southwestern Colorado, there have been many more recent earthquakes in the Raton Basin than in the San Juan Basin. During gas production, water that is pumped from the sediments is re-injected under no pressure (gravity). Induced earthquakes usually involve pressurized injection into or near the basement. But the water from these injections is not under pressure and most of the events are in the basement, far below the wells. It is still to be determined whether a valid mechanism exists for the

triggering of these earthquakes. This is important since the seismicity of the Raton Basin is having a very significant effect on the National Seismic Hazard Maps (NSHM) for this area and for others where induced earthquakes have been identified or are being investigated. Since earthquakes that are determined to be non-tectonic events are usually removed from the hazard calculation, it is very important that the Trinidad events be properly evaluated for their contribution to the hazard. We understand that, as part of the development of the maps, USGS is evaluating what "b" value and maximum magnitude is appropriate for triggered earthquakes or if they should somehow be considered deterministically.

Two faults in central Colorado, the Gore Range Frontal Fault and the Williams Fork Mountains Fault, are being added to the NSHM for 2014, bringing the total in Colorado to six (6).

Seismic Safety of Schools

The CEHMC policy recommendation on seismic design of public schools that was originally submitted to Colorado Geological Survey in 2008 is consistent with the WSSPC Policy Recommendation 13-7 Seismic Design of New Schools. The CEHMC recommendation was resubmitted on January 3, 2011, to the State of Colorado, Colorado Division of Fire Safety, and again on November 1, 2012, to the Division of Fire Prevention and Control, for their use in issuing building permit applications for the construction of public schools. However, the recommendation has not yet been implemented by the State of Colorado.

CEHMC Co-Chair Rob Jackson is a member of the Earthquake Engineering Research Institute (EERI) Committee on the Seismic Safety of Schools. The American Clearinghouse on Educational Facilities (ACEF) is currently developing a resource publication which will provide best practices in school design as a proactive measure for natural hazards. Co-Chair Jackson wrote the seismic section of the publication, entitled Earthquake Safety Guidelines for Educational Facilities. The document is posted on both the EERI and ACEF websites. Links are provided below:

- *https://www.eeri.org/wp-content/uploads/Earthquake%20Safety%20Guidelines%20for%20Eduational%20Facilities.pdf*
- *http://online.tarleton.edu/ACEF/GuidelinesforEarthquakeSafetyinEducational/*

Earthquake Mitigation Activities

- On October 10, 2013, Co-Chair Jackson gave an earthquake talk to the ASCE/SEI Colorado Structural Group.
- On October 17, 2013, Colorado, along with Montana and Wyoming, participated in the first Great Rocky Mountain ShakeOut.
- The CEHMC was represented at the Western States Seismic Policy Council's 2013 Annual Meeting in Seattle and is participating in the WSSPC committees.

Contributing Authors:

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Rob Jackson, Co-Chair; Colorado Earthquake Hazard Mitigation Council

HAWAII
EARTHQUAKE PROGRAM REPORT

Hawaii State Civil Defense

Hawaii State Civil Defense (SCD) collaborated with several key working groups – including the Hawaii State Earthquake Advisory Committee (HSEAC), Hawaii State Hazard Mitigation Forum (HSMF) and the Tsunami Working Group (TWG) – during 2013. These committees continued to work with partners in the private sector, government agencies, the National Tsunami Hazard Mitigation Program (NTHMP-NOAA), the National Earthquake Hazard Reduction Program (NEHRP- FEMA), the Post Disaster Mitigation (PDM-FEMA), the Emergency Management Performance Grant (EMPG-FEMA), the University of Hawaii, and the Pacific Disaster Center (PDC) in an ongoing commitment and focus on earthquake and tsunami concerns, risks, and planning. The committees/groups have helped guide research and secured funding for mitigation projects for the State of Hawaii.

State and County Multi-Hazard Mitigation Plans include statewide risk and vulnerability assessments of seismic exposure, as well as proposed mitigation actions and capabilities in the State of Hawaii.

For twenty-three years (established September 1990), HSEAC has continued to serve as an advisory body to SCD. HSEAC meets quarterly to promote activities, including but not limited to research, project development and management, and mitigation. In collaboration with the other committees and agencies mentioned above, the list below reflects the seismic efforts in Hawaii.

Current Projects/Activities in 2013

- Hawaii participated for the first time in the Great Hawaii ShakeOut.
- SCD hosted:
  - Hawaii Emergency Preparedness & Homeland Security Workshop, October 21-23, 2013.
  - Three HSEAC meetings with WSSPC support and leadership.
  - FEMA training ATC-20 Postearthquake Safety Evaluation of Buildings and Rapid Observation of Vulnerabilities and Estimation of Risk (ROVER)
- Public Outreach:
  - Developed the Tsunami Awareness Program (TAP) to enhance the TsunamiReady™ outreach.
  - Developed the Hawaii Hazards Awareness & Resilience Program (HHARP) to enhance community resilience throughout Hawaii.
  - Completed the Post and Pier Expert System (Home Retrofit Project)
- Continued tsunami inundation mapping. Current focus is on a M9.2 event generating a large tsunami in the Aleutian Islands and the impact on the Hawaiian Islands.
- Completed Pacific Disaster Center HAZUS update, implementation of HAZUS MR-4, and revision of the Earthquake scenario Atlas.
- Developed 5-Year Plan for HSEAC.
- Mapping Projects:
  - Oahu
    - Mapped and modeled.
    - Tsunami inundation mapping – Review Panel Oahu.
    - State approved and released data to City and County.

        - City and County updated evacuation map.
        - Public information campaign and publishing.
    - Hawaii
        - Mapped and modeled.
        - Tsunami inundation mapping – Review Panel Hawaii.
        - State approved and released data to Hawaii County.
        - Hawaii County to develop evacuation maps.
        - Public information campaign and publishing.
    - Maui
        - Tsunami inundation mapping – Review Panel Maui.
        - Tsunami evacuation maps updated.
    - Kauai
        - Completed modeling.

- Other currently funded projects:
    - Tsunami Observer Program.
    - New and up-dated outreach material.
    - EEFI Radio.
    - Oahu Tsunami Signage.
    - Tsunami Awareness Kit – Hawai'i.
    - Hawaii Hazards Awareness & Resilience Program.

Current Outreach for TsunamiReady™, Hawaii Hazards Awareness & Resiliency Program (HHARP), and StormReady™

- Oahu
    - Kailua
    - Marine Corps Base Hawaii
    - Kaneohe
    - Ewa Beach
    - North Shore
    - Kapolei
    - U.S. Coast Guard
    - Pearl Harbor

- New effort on all four counties

Exercises

- This year's SCD exercise was entitled *Kai Mimiki* (literally translated from Hawaiian to mean a large wave from the sea). SCD conducts a Distant Tsunami exercise and a Local Tsunami exercise annually. Both exercises are coordinated with the monthly testing of the warning sirens. The participants included: Pacific Tsunami Warning Center; Hawaii County Civil Defense Agency; Maui County Civil Defense Agency; Kauai County Civil Defense Agency; and Honolulu City and County Department of Emergency Management; the State and County Warning Points, and the National Weather Service. The April exercise focused on how various federal, state, and county agencies would respond and warn the public of a large earthquake off the Big Island; in October, on a distant earthquake out of Alaska which produces a tsunami that will impact Hawaiian Islands.

- April is Tsunami Awareness Month in Hawaii due to the historical significance of the April 1, 1946 tsunami. This year SCD is working with Pacific Tsunami Museum, Hawaii (Big Island) Civil Defense and others to increase awareness.

- *Exercise Makani Pahili 2013* (MP13) was designed to provide an opportunity to exercise collectively with a common hurricane scenario, enhance disaster preparedness for government and private sector agencies statewide, and provide a forum to enable agencies to identify areas for improvement. Exercise participants responded to hurricane Watch and Warning messages as well as guidance received from Civil Defense Agencies. Participating organizations and their planners used the State Civil Defense ExPlan of published damage scenarios to allow their own participants to get the most benefit from the exercise.

Contributing Author:

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IDAHO
EARTHQUAKE PROGRAM REPORT

Idaho Geological Survey and the Idaho Bureau of Homeland Security

2013 Idaho Earthquakes

There were 186 earthquakes with magnitudes >1 in Idaho between 11/1/12 and 11/20/13 (Figure 1). Of these, 10 had magnitudes > than 3, and there were two earthquakes with magnitudes of 4 and 4.2. No damage was reported from the earthquakes.

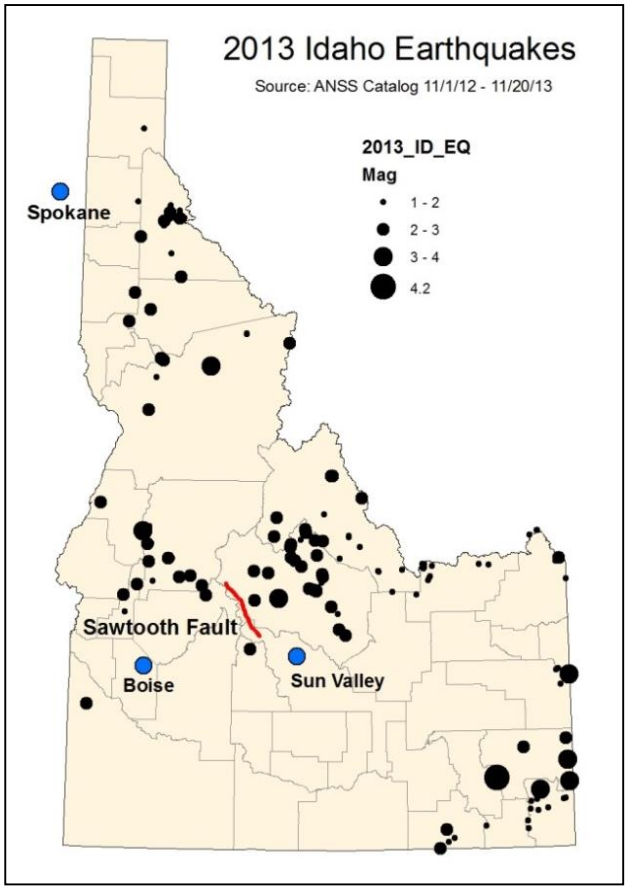

Figure 1: *Earthquakes in Idaho between November 1, 2012 and November 20, 2013.*

New Hazard Information

Evidence for an active shallow thrust fault beneath the city of Spokane, Washington was published by Wicks and others (Journal of Geophysical Research, B118, 1268-1276, 2013). The fault is about 18 miles west of the border with Idaho. This study has important ramifications for seismic hazards in northern Idaho.

Holocene offsets on previously unmapped scarps were documented on the Sawtooth fault using high resolution LiDAR by Thackray and others (Geology, 41, 639-642, 2013). The Sawtooth fault is about 25 miles from the Sun Valley-Ketchum area and about 60 miles from Boise.

Hazard Mitigation

National Earthquake Hazard Reduction Program seismic site class and liquefaction susceptibility mapping was conducted in Blaine County. This county contains the resort communities of Sun Valley and Ketchum. The mapping data are available for free download on the Idaho Geological Survey website at *www.idahogeology.org*.

The 2013 Idaho State Hazard Mitigation Plan (SHMP) was completed and obtained Federal Emergency Management Agency (FEMA) approval. The SHMP contains an updated seismic risk assessment and meaningful seismic hazard mitigation actions. In addition, the Idaho State strategic planning effort includes a seismic hazard scenario that has resulted in assisting in establishing effective standard operating procedures for earthquake disaster response.

The Great Idaho Shakeout was conducted in October with 103,230 registered participants. This is an increase of nearly 10% from last year's event.

WSSPC Policy Recommendation 13-10 Evaluation and Seismic Remediation of School Buildings

ATC-20/FEMA 154 training was conducted for the Idaho Division of Building Safety and used to initiate a statewide school seismic hazard assessment process.

Contributing Authors:

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MONTANA
EARTHQUAKE PROGRAM REPORT

Montana Bureau of Mines and Geology

Seismicity

The northern Intermountain Seismic Belt remained seismically active between October 1, 2012, and September 30, 2013 (Figure 1). During this period, using data from the Montana Regional Seismograph Network, the Earthquake Studies Office of the Montana Bureau of Mines and Geology (MBMG) determined hypocenter locations and magnitudes for 2,043 earthquakes in Montana and adjacent parts of Idaho, Wyoming, and Canada. This total included 41earthquakes with magnitudes ranging from 3.0 to 3.9, and one earthquake of magnitude 3.7. Residents reported feeling 20 earthquakes but none caused any damage. Information about recent Montana earthquakes is available on the Earthquake Studies Office website *http://mbmgquake.mtech.edu*.

Montana's largest earthquake during the past year occurred on June 6, 2013, in the southern Madison valley and had a M 3.7. This persistently active area is sparsely populated and only two residents reported feeling this earthquake on the US Geological Survey's Did You Feel It website.

A swarm of 100 earthquakes with M ≥ 1.0 occurred in the southern Tendoy Mountains southwest of Lima Montana. The swarm was active May 6-26, 2013, and included four earthquakes in the M3.0 to 3.2 range between May 21st and 23rd. None of these earthquakes were reported as felt.

A swarm of 27 earthquakes occurred May 4-23, 2013, just northwest of the town of Norris, Montana. The largest event was a M2.7 on May 14th. A vigorous swarm that included a M4.1 earthquake and more than 700 smaller shocks occurred in this area during the summer of 1987.

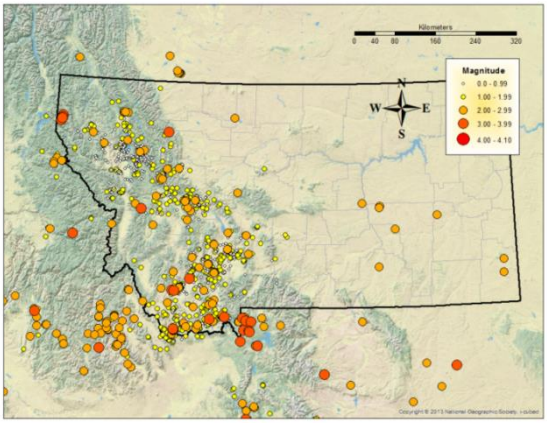

Figure 1: *Map of 2,043 earthquake epicenters from October 1, 2012 through September 30, 2013, determined from Montana Regional Seismograph Network data.*

A swarm of 40 earthquakes occurred in the Clarkston Valley, north of Three Forks, between June 18 and 27, 2013. The largest quake measured M2.5 on July 26th. The Clarkston Valley is the epicentral area of the June 27, 1925, M6.6 earthquake.

A brief swarm of 22 earthquakes occurred July 20-21, 2013, west of Marysville (northwest of Helena). The largest event measured M2.4.

Between December 5, and 20, 2012, a sequence of nine seismic events occurred in the vicinity of the Troy Mine in northwestern Montana. These unusual low-frequency events apparently correlate with roof-falls in an abandoned part of the mine. Event magnitudes ranged from 1.2 to 3.7.

Twelve seismic events with magnitudes ranging from 1.3 to 2.3 occurred throughout the year in the Coeur d'Alene Mining District in north Idaho. These events were most likely induced by deep hard-rock mines in the district.

Going into its eighth year, the aftershock sequence of the July 26, 2005, M5.6 Dillon earthquake continues. During the past year, the Earthquake Studies Office located 28 aftershocks with magnitudes of 1.0 or larger. The number of $M \geq 1.0$ aftershocks located since the Dillon main shock is now 1,754.

Montana Regional Seismograph Network

The MBMG Earthquake Studies Office continues to receive funding from the U.S. Geological Survey for partial support of the Montana Regional Seismograph Network. These funds are used for technical assistance with repair and maintenance of seismographs and telemetry equipment, data archival, and general network operations. This funding, together with generous support from the Confederated Salish and Kootenai Tribes, allows the MBMG to fund a full-time assistant/seismic analyst in the Earthquake Studies Office.

Earthquake Hazard Mitigation and Education

The MBMG has completed its first year of a cooperative agreement with FEMA's Earthquake Hazards Reduction State Assistance Program. The award has enabled the MBMG to make Montana's 1982-2013 earthquake catalog available as a data layer on MBMG's Online Mapping Application, providing visual, easy, and versatile access to Montana's extensive historical earthquake record. Improved access to these data—including current seismicity—will enhance Montana's earthquake/seismic hazard education and outreach efforts.

As described in USGS Circular 1351, the MBMG is a Collaborating Organization in the Yellowstone Volcano Observatory. The MBMG will coordinate with the seismic monitoring team in the event of geologic unrest in Yellowstone.

Montana participated in its first ShakeOut on October 23, 2013. Over 93,000 Montana residents participated in this inaugural event coordinated by Katie Gallagher in the Governor's Office of Community Service.

Montana Disaster and Emergency Services

Current seismic retrofits in progress:

- Creative Arts Complex, Montana State University, Bozeman, MT; two-thirds complete ($3 million total cost, FEMA Pre-Disaster Mitigation grant funding $2.2 million Federal Share).
- Mathews Hall, University of Montana-Western, Dillon, MT; in Phase I Engineering – Environmental Historic Preservation Award ($1.14 million total cost, FEMA Hazard Mitigation Grant Program funding $858,000 Federal Share).
- Montana Law Enforcement Academy; non-structural retrofit ready for HMGP award ($125,600 total cost, FEMA Federal Share funding $94,200).

Contributing Authors:

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NEVADA
EARTHQUAKE PROGRAM REPORT

Nevada Bureau of Mines and Geology

The NBMG continues to enhance the GIS capabilities to provide awareness, risk assessment (including earthquake fault identification and characterization) and vulnerability analysis statewide. The MyHazards website was developed for the public to review residential locations with an overlay of known faults statewide and functions in mobile devices. HAZUS input data continues to be enhanced, including adding a statewide inventory of potential URM buildings. The NBMG led the Nevada HAZUS users group and HAZUS training for local governments. The NBMG also supports MyPlan website, a confidential site for planners and emergency managers to review risk to their community from earthquake. A very large earthquake catalog with many annotated events is being developed for these websites and should be released early in 2014.

The Earthquake Hazard and Mitigation Section for the Douglas County Hazard Mitigation Plan was developed and written by the NBMG. The report reviewed earthquake faults in Douglas County and identified the eight largest faults that could potentially shake the County with devastating effects. These faults were characterized and analyzed for their earthquake potential and the consequences of largest expected events along them were modeled using the HAZUS loss-estimation program. Many recommendations for earthquake awareness, planning and mitigation were made. We continued in 2013 to give earthquake hazard talks to county officials at their local county seats; this is an important level of governance during emergency responses and recovery so there is great benefit to developing their background and capability with earthquakes.

Nevada Division of Emergency Management and Nevada Earthquake Safety Council

Earthquake programs in Nevada are currently administered by the Nevada Division of Emergency Management. As federal earthquake funding sources change the process of awarding grants, and amounts are drastically reduced, the partnership of agencies with interest in earthquake safety in Nevada increases in order leverage all available resources. Since its inception in 1992, the Nevada Earthquake Safety Council continues to provide a forum for the stakeholders to facilitate public input, develop consensus about seismic issues between the public and private sectors while serving as a public advisory body for Nevada's seismic policy.

In November of 2013, the Nevada Earthquake Safety Council (NESC), the Utah Seismic Safety Commission, the Idaho State Hazard Mitigation Officer and the Colorado Geological Survey held a joint meeting with a focus on earthquake issues related to the WSSPC policies, unreinforced masonry buildings, non-ductile concrete buildings, mutual aid, examples of outreach, awareness, partnerships and challenges.

In cooperation with NESC, the Nevada Bureau of Mines and Geology (NBMG), and the Nevada University system, Clark County Building is undertaking an initiative to ground proof the URM data through verification of location, type of construction and structure status. "

Nevada Seismological Laboratory

The Nevada Seismological Laboratory (NSL) promoted the Great Nevada Shakeout on October 17, 2013 at 10:17 am with participation of 560,000 registered participants statewide. Participation included all 17

school districts, NV Energy, Boyd Gaming, along with 42 other local small businesses both in northern and southern Nevada. Graham Kent, Director for the NSL worked with Casinos in northern Nevada, competing for events, requiring participation in the Nevada Great ShakeOut in order to be considered as a contender for the events. More information is found at the Nevada ShakeOut website http://www.shakeout.org/nevada/

Contributing Authors:

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Ron Lynn, Director/Building Official; Clark County Building Department/Liaison, Nevada Earthquake Safety Council
Janell Woodward, Administrative Assistant/Coordinator; Nevada Earthquake Safety Council

NEW MEXICO
EARTHQUAKE PROGRAM REPORT

New Mexico Bureau of Geology and Mineral Resources

Fault mapping proceeded in various parts of New Mexico as a part of the joint USGS-New Mexico Bureau of Geology STATEMAP Program. An on-going compilation map of the Alamogordo fault in the Tularosa basin will be completed by next year's WSSPC report. A new report on the terrace chronosequence along Cañada Alamosa in south-central New Mexico (McCraw and Williams, 2012, referenced above) provides estimates of times and amounts of surface rupture along the rift-related Willow Springs fault near Elephant Butte Reservoir.

New Mexico Institute of Mining and Technology (New Mexico Tech)

Seismicity in Central New Mexico

The New Mexico Tech Seismic Observatory (NMTSO) located 563 Md ≥ 0 earthquakes from October 1, 2012 – September 30, 2013. A majority of these events were located in the central Rio Grande rift near Socorro (Figure 1).

These events do not include small clusterings of events that have been observed, but not located, near Raton in northeast NM, near Carlsbad in southeast NM and a group of events northwest of Las Cruces (near Silver City). These clusters may be induced by oil-field activities, and/or explosions from nearby mines. The largest located event recorded by the NMTSO during this time was a Md magnitude 3.4 (NEIC magnitude 3.4) felt earthquake that occurred on February 28, 2013, located west of Socorro.

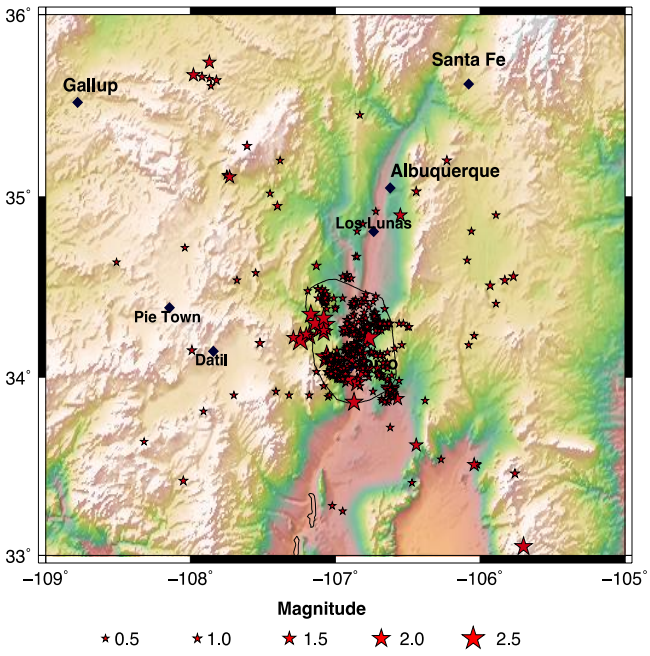

Figure 1: *Earthquakes in New Mexico and bordering regions from October 1, 2012 to September 30, 2013 (Ingate, unpublished data from the New Mexico Tech seismic network).*

NMTSO has modified publicly available webpages that contain information about earthquakes recorded and located by NMTSO, found at: *www.ees.nmt.edu/outside/NMTSO/quakelist.html*. Because of the limited funding for the seismic networks however, we cannot certify that these webpages are updated in a timely fashion, as the effort for locating events in this area largely falls to NMT graduate students when available. The network around the Waste Isolation Pilot Plant (WIPP) is funded through Nuclear Waste Partnerships, LLC, however those locations are not authorized for release. The Socorro Magma Body network is completely unfunded, thus locations for this area and the rest of the state are more limited.

Policy Recommendation 11-3 Earthquake Monitoring Networks

NMTSO submitted a white paper proposal to the Department of Energy to update the analog WIPP seismic network to a modern digital borehole network.

Notable publications related to earthquakes and faults in New Mexico

- Bilek, S., Aster, R., Ingate, S., 2013. Seismicity patterns linked to deformation associated with the mid-crustal Socorro Magma Body, central New Mexico, 2013 Seismological Society of America Annual Meeting.
- Pursley, J., Bilek, S.L. and Ruhl, C., Earthquake catalogs for New Mexico and bordering areas: 2005-2009, New Mexico Geology, v. 35, no. 1, 3-12, 2013.
- McCraw, D.J., and Williams, S.F., 2012, Terrace stratigraphy and chronosequence of Cañada Alamosa, Sierra and Socorro Counties, New Mexico: New Mexico Geological Society Guidebook, 63rd Field Conference, Warm Springs Region, pp. 475-490.

New Mexico Department of Homeland Security and Emergency Management

The New Mexico Department of Homeland Security and Emergency Management (OEM) continued efforts in the development of hazard mitigation plans for New Mexico that meet the Federal Emergency Management Agency's (FEMA) Disaster Mitigation Act requirements. These mitigation plans are assessing risk from various hazards, including earthquakes, and studying ways to reduce that risk. At this time 8 local, tribal and institutional mitigation plans have been approved by FEMA. The State Mitigation Plan Update was approved by FEMA on September 18, 2013, and is valid for three years.

Cooperation between OEM, NMBGMR, and professors from New Mexico Tech resulted in another successful Rockin' Around New Mexico for 28 teachers from throughout New Mexico. The three-day workshop in Socorro, New Mexico, featured volcanic and earthquake hazards, basic rock and mineral identifications, and local geologic history and processes.

Contributing Authors:

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OREGON
EARTHQUAKE PROGRAM REPORT

The Oregon Seismic Safety Policy Advisory Commission (OSSPAC) led the completion of the Oregon Resilience Plan (ORP), which included efforts by the Oregon Department of Geology and Mineral Industries (DOGAMI), Oregon Military Department, Office of Emergency Management (OEM) and many other agencies, local governments, the private sector and the general public, and involved over 170 individuals. The legislature was provided many briefings on the ORP. DOGAMI and OEM made progress on their missions of mitigating for earthquake, seismic and tsunami hazards. Numerous presentations to stakeholder groups, newspaper articles, op-eds, radio and TV interviews, and earthquake and tsunami drills were conducted by OEM and DOGAMI personnel throughout the year.

Oregon Department of Geology and Mineral Industries (DOGAMI)

DOGAMI has many partnerships and efforts that help protect people and property from earthquakes and tsunamis. Some 2013 accomplishments include the following:

WSSPC Policy Recommendation 12-1 *Earthquake Planning Scenarios*

DOGAMI published Open-File Report O-13-06, Ground motion, ground deformation, tsunami inundation, coseismic subsidence, and damage potential maps for the 2012 Oregon Resilience Plan for Cascadia Subduction Zone Earthquakes, by I. Madin and W. Burns. DOGAMI published Open-File Report O-13-09, Earthquake Risk Study for Oregon's Critical Energy Infrastructure Hub, by Y. Wang, S. F. Bartlett, and S. B. Miles.

WSSPC Policy Recommendation 13-10 Joint Policy for the Evaluation and Seismic Remediation of School Buildings

DOGAMI was involved with seismic safety of schools and building resilience in critical infrastructure including:

- Several DOGAMI personnel presented at the 2013 EERI Conference in Seattle, including co-organizing the plenary session on seismic school safety.
- DOGAMI continues to partner with the Oregon Department of Education and school districts to submit reports of annual seismic upgrades to public schools. The second year reports were submitted by September 30, 2013 *http://www.oregongeology.com/sub/projects/rvs/activity-updates/status.html*. In addition, the Oregon Department of Education reports seismic update information on their annual report cards of school districts.

WSSPC Policy Recommendation 12-2 Developing Earthquake Risk Reduction Strategies

DOGAMI was involved with enhancing seismic policies including:

- 2013 co-lead on new WSSPC Lifelines Reliability Policy.
- DOGAMI joined the Geotechnical Earthquake Engineering Research Association (GEER) Advisory Panel.
- DOGAMI personnel assisted the FEMA-funded Applied Technology Council ATC 71-5 Project, to update the Rapid Visual Screening method.

- DOGAMI is represented on the Cascadia Region Earthquake Workgroup board and participated in CREW activities (*www.crew.org*). These included:
  - Christchurch earthquake symposium.
  - communications workshop.
  - continuity of operation plans courses with the Society of American Military Engineers.
  - the update of the CREW Scenario publication (DOGAMI Open File Report O-13-22), and the new CREW School Safety Policy.
- The cooperative USGS/DOGAMI NEHRP-funded multi-hazard project completed geologic mapping in the greater Portland area in late 2013. This project, which incorporates bedrock mapping, surficial geologic mapping and geophysical data on a LiDAR-derived base map, and developing a 3D geologic model with geotechnical parameters, will be released in 2014.

WSSPC Policy Recommendations 11-1 Improving Tsunami Public Education, Mitigation, and Warning Procedures for Distant and Local Sources and 13-1 Rapid Tsunami Identification and Evacuation Notification

- As part of the National Tsunami Hazard Mitigation Program (NTHMP), DOGAMI worked with Oregon State University, the Pacific Geoscience Centre in Canada and Oregon Health, Science University (OHSU) and Virginia Institute of Marine Science, Center for Coastal Resources Management to complete tsunami inundation maps (TIM) for the entire Oregon coast. GIS files are being prepared for future release. The TIMs released in 2013 include:
  - Tsunami Inundation Maps (TIM series) for all of Clatsop County: *Clatsop Spit, Warrenton North, Warrenton South - Rilea, Astoria, Youngs River North, Youngs River South, Del Rey Beach, Gearhart - Seaside, Cannon Beach, Arch Cape - Falcon Cove*
  - Tsunami Inundation Maps (TIM series) for Douglas County: *Siltcoos Lake, Tahkenitch Lake, Umpqua River West, Sulphur Springs, Umpqua River East*, and *Clear Lake*, (*Gardiner, Reedsport*, and *East Gardiner* previously released)
  - Tsunami Inundation Maps (TIM series) for all of Lane County: *Neptune, Heceta Head, Mercer Lake, Florence, Cushman - Wendson, Tiernan - Mapleton, Dunes City*, and *Siltcoos Lake, Florence*, and *Dunes City*
  - Tsunami Inundation Maps (TIM series) for all of Lincoln County: *Lincoln City North, Lincoln City South, Gleneden Beach–Siletz River, Depoe Bay, Otter Rock–Beverly Beach, Newport North, Newport South, Toledo, Yaquina River, Seal Rock, Driftwood Beach, Waldport, Tidewater, Ocean Shores*, and *Yachats*,
  - Tsunami evacuation maps were completed for all communities for the state including for *Arch Cape, Astoria, Cannon Beach, Seaside & Gearhart, Sunset Beach & Del Rey Beach (Clatsop Plains), Youngs River Valley, Warrenton & Clatsop Spit, Florence* (updated 8-29-2013), *Dunes City, Depoe Bay, Gleneden Beach, Lincoln Beach, Lincoln City-North, Lincoln City-South, Seal Rock, Toledo, Waldport, Yachats, Yachats North (San Marine), Reedsport/Gardiner/Winchester Bay* and *Lakeside*.
- DOGAMI coordinated the Oregon tsunami hazard mitigation program with adjacent states, particularly California. The Agency asked California's advice on the best approaches to tsunami evacuation for the maritime community and served on the California Probabilistic Tsunami Hazard Analysis (PTHA) that is coordinated by the California Geological Survey. Probabilistic scenarios being considered by California form the basis for 5 of the 7 inundation zones depicted on Oregon TIM's (the S, M, L, XL, and XXL scenarios).

- Washington also asked for DOGAMI's advice on an appropriate Cascadia source scenario for design of tsunami refuges at Westport and Long Beach. The scenario chosen by Washington, the L or "Large" Cascadia scenario produces inundation closely matching the ~2500-year exceedance level in preliminary pilot PTHA studies at Crescent City (*http://nthmp.tsunami.gov/2012tsuhazworkshop/abstracts/WilsonCA-PTHA_abs.pdf*). The 2500-year exceedance level is also being considered by the American Society of Civil Engineers (ASCE) subcommittee that is establishing a procedure for determining tsunami loads for coastal building design standards. These design standards are being targeted by ASCE for inclusion in the International/Uniform Building Codes by the year 2017.
- The TsunamiReady™, TsunamiPrepared program, led by DOGAMI and OEM, continued the outreach and education program, working in five coastal counties (Clatsop, Lincoln, Lane, Douglas, and northern Coos). Coastal communities large and small are benefitting from new Community Emergency Response Team programs, Map Your Neighborhood classes, and tsunami preparedness workshops led by local community organizers that are trained through the program, *www.OregonTsunami.org*. Highlights of outreach in 2012-13 included:
  - TsunamiReady™ designations: This recognition by the National Weather Service was awarded to 12 coastal communities during 2012-2013, for a total of 23 cities or counties in Oregon designated as TsunamiReady™. In addition, seven entities in Lincoln County were honored as TsunamiReady Supporters, including fire districts, a school district, and the Hatfield Marine Science Center.
  - Evacuation drills: DOGAMI supported local jurisdictions in conducting five evacuation drills, with commitments from local fire districts to conduct more in autumn 2013 (for areas that needed to avoid drills during the busy summer business season). Approximately 300 people participated, and the drills brought many local officials together, some working with each other for the first time.
  - Rallies: Tsunami readiness rallies were held in 10 communities spanning five counties, with total attendance of 852 people. Rallies included a slide presentation by DOGAMI staff including local partners in some cases, with time for questions and info booths by local preparedness groups. Many more saw presentations via local cable access TV in two counties.
  - Workshops and other events: In addition to rallies, DOGAMI reached 3,263 people at other presentations, workshops, schools, info tabling events, and more.
  - Door to door outreach: Teams of CERTs and other volunteers walked neighborhoods in the hazard zones to hand deliver evacuation maps and other readiness info to 2,564 homes and businesses. Much of the door knocking resulted in face-to-face conversations, while materials were left on the doors of many who weren't home. Commitments have been given by fire districts to wrap up remaining door to door outreach to 1,500 homes in Lincoln County and a range of 500 to 2,000 in Clatsop County.
  - Media: In year four of the program, DOGAMI earned media coverage consisting of over 50 prominent stories in newspapers, radio, TV, and online news sources. Copies of all news coverage are included in the appendix to the final report, available from DOGAMI.
  - Materials: In all four years of the outreach program, DOGAMI purchased and delivered a total of over 600 tsunami signs (evacuation routes, assembly areas); over 185,000 evacuation map brochures; over 73,000 Living on Shaky Ground booklets; over 21,000 door to door outreach bags; whistles, magnets, t-shirts, venue fees, audio/visual, flyers, banners, reverse 911 calls, 10,000 postcards + postage, library books, CERT training supplies, NOAA weather radios, Map Your Neighborhood booklets, translation services for Spanish materials, advertising fees, Cascadia printing (20,000).

- DOGAMI staff served on the oversight committee to National Institute of Building Sciences (NIBS) on the HAZUS tsunami damage and loss method project. DOGAMI and OEM continued to work with the lead Oregon land use planning agency, Department of Land Conservation and Development (DLCD) to discuss implications of the new tsunami inundation maps for land use planning and meeting objectives of the Oregon Resilience Plan. Using resources from the NOAA Coastal Service Center, DLCD hired a consulting firm to develop model land use ordinances and policies that utilize the new inundation maps.
- DOGAMI and OEM collaborated with USGS on a pilot evacuation analysis of Cannon Beach using a new least-cost distance method; this project is now the template for a similar study of Seaside, Oregon. The method results in a map depicting difficulty of evacuation (time to walk to destination) for an input arrival location (safe zone/high ground), taking into account such things as terrain, buildings, fences, and vegetation barriers.

WSSPC 2013 Award in Excellence

DOGAMI earned a WSSPC Award in Excellence for Use of New Technology for DOGAMI Special Paper 43 Simulating tsunami inundation at Bandon, Coos County, Oregon, using hypothetical Cascadia and Alaska earthquake scenarios, by R. C. Witter, Y. Zhang, K. Wang, G. R. Priest, C. Goldfinger, L. L. Stimely, J. T. English, and P. A. Ferro. The publication can be downloaded from the DOGAMI website at: *http://www.oregongeology.org/tsuclearinghouse/resources/sp-43/SP-43_onscreen144dpi.pdf*

Oregon DOGAMI can be found online at: *http://www.oregongeology.org*

Oregon Military Department, Office of Emergency Management (OEM)

WSSPC Policy Recommendation 12-2 Developing Earthquake Risk Reduction Strategies

OEM receives support through the National Earthquake Hazard Reduction Program (NEHRP) State Assistance grant. Projects that this funding supports are:

- The Great Oregon ShakeOut – More than 270,000 Oregonians joined 24 million people worldwide for the Great ShakeOut on Oct. 17. Participation in Oregon was up by more than 100,000 this year.
- Printing, and re-printing, of the publications:
  - Living on Shaky Ground in Oregon (Including translated into Spanish)
  - Shaky Ground (English): 18,832 (Since April 2011, more than 76,550)
  - Shaky Ground (Spanish): 1,996 (Since February 2012, 6,473)
  - Emergency Go-Kit Passport (Translated into Spanish and Russian)
  - Go-Kit Passport (English): 26,684 (Since April 2011, more than 69,971)
  - Go-Kit Passport (Spanish): 3,849 (Since April 2011, more than 7,704)
  - Pocket Emergency Plan: 7,220 (Since December 2011, more than 8,000)
  - Tsunami Brochure: 36,197
- FEMA ATC-20/154/ROVER training in four communities.
- OEM participated in Earthquake and Tsunami outreach at numerous occasions reaching over 1000 members of the public.
- OEM participates in several national, regional and state seismic policy commissions and workgroups:
  - National Tsunami Hazard Mitigation Program (NOAA)
  - Cascadia Regional Earthquake Workgroup (FEMA)

- Western States Seismic Policy Council (FEMA)
- Oregon Seismic Safety Policy Advisory Commission (OSSPAC)
- Cascadia response plan coordination meetings with FEMA

Oregon OEM was awarded a 2013 Overall Award in Excellence for Mitigation Efforts for its Seismic Rehabilitation Grant Program, whose purpose is to help manage the high earthquake risk in the state of Oregon by using a seismic vulnerability assessment, rigorous cost benefit analysis and leveraged state bond funds to assist public schools and emergency response facilities in mitigating the seismic risk.

Oregon OEM can be found online at: *http://www.oregon.gov/OMD/OEM/Pages/index.aspx*

Oregon Seismic Safety Policy Advisory Commission (OSSPAC)

WSSPC Policy Recommendations 12-2 Developing Risk Reduction Strategies and 12-1 Earthquake Planning Scenarios

Under the leadership of OSSPAC, the Oregon Resilience Plan (ORP) was completed and delivered to the Oregon Legislature on February 28, 2013. The effort was mandated by House Resolution 3 (2012). It involved over 170 volunteers who served on eight workgroups and an advisory committee. Workgroups consisted of: Earthquake Scenario, Business Continuity, Coastal, Critical Buildings, Transportation, Energy, Telecom, Water and Waste Water. Briefings and policy recommendations were presented to the Legislature and the media (see the below list of legislative hearings and media coverage). In response to the ORP, the Oregon Legislature passed Senate Bill 33 that requires a temporary task force to develop an ORP implementation plan by October 1, 2014.

Additional ORP information can be found at:

- HR 3: *www.leg.state.or.us/11reg/measpdf/hr1.dir/hr0003.en.pdf*
- SB 33: *https://olis.leg.state.or.us/liz/2013R1/Measures/Overview/SB33*
- *ORP: http://www.oregon.gov/OMD/OEM/Pages/osspac/osspac.aspx#Oregon_Resilience_Plan*

ORP legislative hearings included:

- March 14: Hearing testimony for Joint Senate and House Committees on Veterans and Emergency Preparedness – Initial briefing
- May 14: Hearing testimony for House Transportation and Economic Development Committee – Implications of interdependencies on Oregon economy from Cascadia event
- June 6, 13, and 20: Hearing testimony for Joint Senate and House Committees on Veterans and Emergency Preparedness – Workgroup-subject-area specific implementation recommendations

Media coverage included:

- American Society of Civil Engineers (ASCE) (March 26, 2013) *http://www.constructioninst.org/CEMagazine/ArticleNs.aspx?id=23622324492*
- The Oregonian (Feb. 4, 2013): *http://www.oregonlive.com/business/index.ssf/2013/02/cascadia_earthquake_and_tsunam.html#incart_m-rpt-2*
- The Seattle Times (March 9, 2013): *http://seattletimes.com/html/localnews/2020525702_earthquakerecoveryxml.html*

- MSN/NBC News (March 18, 2013): *http://science.nbcnews.com/_news/2013/03/18/17358702-10000-could-die-in-northwest-quake-chilling-report-says?lite&lite=obnetwork*

OSSAP can be found online at: *http://www.oregon.gov/OMD/OEM/Pages/osspac/osspac.aspx*

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UTAH
EARTHQUAKE PROGRAM REPORT

Utah Geological Survey

Utah Geological Survey Paleoseismic Investigations

In 2013, the Utah Geological Survey (UGS) continued an active program of paleoseismic research on Utah Quaternary faults. The UGS and U.S. Geological Survey (USGS) Earthquake Hazards Program (Golden, Colorado) continued work on the Nephi segment of the Wasatch fault zone. Preliminary results from radiocarbon and luminescence dating constrain the timing of at least four late Holocene surface-faulting earthquakes on both the northern and southern parts of the segment. This work was funded in part by a grant from the USGS National Earthquake Hazards Reduction Program (NEHRP); the UGS plans to submit a final technical report in early 2014. Future paleoseismic research on the Wasatch fault zone is planned for the northern and southern parts of the Provo segment in collaboration with USGS Mendenhall Fellow Scott Bennett (and USGS colleagues), who plans to evaluate the structural segmentation of the fault. The UGS also collaborated with the USGS (Menlo Park, California) on trenches across the Bear River fault zone in northeastern Utah. Two trenches crossed an antithetic trace of the fault, which has evidence of at least two large-displacement surface-faulting earthquakes.

The UGS investigation of the Washington fault zone in southwestern Utah continued in 2013. Trenching at the Dutchman Draw site on the Fort Pearce section of the fault zone had previously revealed evidence for two Holocene surface-faulting earthquakes. Completion of 1:24,000-scale surficial geologic mapping along the fault in Utah resulted in a new segmentation scheme for the northern part of the fault zone (previous Northern section redefined as the Fort Pearce section, and identification of a Washington Hollow section at the extreme north end of the fault zone), a 3-kilometer boundary adjustment between the Fort Pearce and Sullivan Draw (in Arizona) sections, and redefinition of the former Mokaac section and formerly independently mapped Dutchman Draw fault as splays of the Fort Pearce section. Geochemical correlation and $^{40}Ar/^{39}Ar$ radiometric dating of mafic volcanic flows displaced by the Fort Pearce and Sullivan Draw sections provided a maximum, long-term slip rate estimate for the Fort Pearce section of ~0.3 mm/year, and 0.04 mm/year for the extreme northern end of the Sullivan Draw section. This work is funded in part by the UGS and in part by a USGS NEHRP grant.

Earthquake Working Groups

WSSPC Policy Recommendation 12-2 *Developing Earthquake Risk Reduction Strategies* and WSSPC Draft Policy Recommendation 14-6 *Basin and Range Province Earthquake Working Groups*

The UGS held meetings of the Utah Quaternary Fault Parameters, Utah Liquefaction Advisory Group, and Working Group on Utah Earthquake Probabilities Working Groups in Salt Lake City on February 4 to 7, 2013.

- The Utah Quaternary Fault Parameters Working Group reviewed current paleoseismic research activities in Utah, reviewed new slip-rate and recurrence-interval estimates for faults studied over the past year, and revised their list of highest priorities for future paleoseismic fault studies.
- The Utah Liquefaction Advisory Group continued its long-term goal to produce maps showing annual probabilities of liquefaction and liquefaction-induced ground displacement along the Wasatch Front, discussed the debate over the Earthquake Engineering Research Institute Monograph 12, and new for this year, invited a keynote speaker to improve technical training of local practitioners.

- The Working Group on Utah Earthquake Probabilities met in February and again in September to continue developing earthquake probability forecasts for the Wasatch Front region. The goal is to have a completed draft report by the end of the year, after which Working Group members will have one month to review the report to resolve remaining issues before submitting the report to outside review.

Working groups are facilitating production of large-scale ground-shaking maps for the Wasatch Front, based on a Wasatch Front Community Velocity Model *(http://geology.utah.gov/ghp/consultants/geophysical_data/cvm.htm)* that incorporates shallow shear-wave velocity (Vs30), deep-basin structure, and newly completed liquefaction-hazard maps. The UGS has compiled databases to identify existing data on (1) Vs30, (2) deep basin structure, (3) geotechnical data characterizing landslide shear strengths, and (4) Quaternary faults and folds. The geophysical databases are available at *http://geology.utah.gov/ghp/consultants/geophysical_data/index.htm*, and Utah's Quaternary fault data are available through the *Quaternary Fault and Fold Database of the United States* at *http://earthquake.usgs.gov/hazards/qfaults*.

Legacy USGS NEHRP Final Technical Reports for Utah

As part of the UGS *Paleoseismology of Utah* series, the UGS has acquired, scanned, and released in digital format previously hard-to-access "legacy" reports of paleoseismic fault investigations conducted in Utah. UGS Miscellaneous Publication MP13-3 includes 20 reports pertaining to USGS-funded NEHRP paleoseismic investigations conducted between 1978 and 2012, one report that predates the NEHRP program, and 36 annual or semi-annual Summaries of Technical Reports authored by NEHRP investigators. These reports contain information on some of the first paleoseismic investigations conducted in Utah. Original authors made few copies of these reports, and many are very difficult to locate. *Miscellaneous Publication MP13-3* is available at *http://geology.utah.gov/online/mp/mp13-03/mp13-03.pdf* and *http://geology.utah.gov/ghp/consultants/paleoseismic_series.htm*.

Wasatch Fault Zone High-Resolution LiDAR Acquisition

As part of efforts to reduce the risk from earthquakes, the UGS, and its partners, including the Utah Division of Emergency Management (UDEM), USGS, Federal Emergency Management Agency, Salt Lake County Surveyor's Office, and local cities, have joined together with the Utah Automated Geographic Reference Center to acquire high-resolution 0.5-meter LiDAR this fall for the entire Wasatch fault zone from north of Malad City, Idaho to near Fayette, Utah on the south. Additionally, LiDAR coverage will be acquired for all of Salt Lake and Utah Valleys. The UGS will use these data to begin mapping Wasatch fault zone traces at a scale of approximately 1:10,000. Fault trace mapping will be used to update the *Utah Quaternary Fault Database*, USGS *Quaternary Fault and Fold Database of the United States*, and update or create new surface-fault-rupture-hazard maps showing special study zones for development.

Utah Aerial Imagery and Low-Sun-Angle Photography

Over 78,000 aerial photographs of Utah are now available for searching, viewing, and downloading using the UGS Aerial Imagery Collection online application at *http://geology.utah.gov/databases/imagery/*. The collection includes low-sun-angle aerial photographs of the Wasatch, Hurricane, Washington, and West Valley fault zones, along with vertically oriented photographs from across the state, many covering these and other faults. Detailed information about the UGS Aerial Imagery Collection is available in Bowman (2012) and at *http://geology.utah.gov/online/aerial_photos/index.htm*.

Professional Outreach

The UGS helped organize the 2013 annual meeting of the Seismological Society of America in Salt Lake City. The meeting included sessions on local and regional earthquake geology and seismology, a public town hall meeting that coincided with the 2013 Great Utah ShakeOut, and presentations and a panel discussion on Utah's earthquake hazards and risk. The UGS provided two members of the program organizing committee, two speakers at the town hall meeting, two co-chairs of special sessions, and UGS staff made several presentations in technical sessions. Following the meeting, the UGS led a field trip along the Salt Lake City segment of the Wasatch fault zone. The field trip included stops at Holocene and latest Pleistocene fault scarps, a bedrock fault exposure, the UUSS, the UDEM Emergency Operations Center, the seismically retrofitted Utah Capitol Building, and the then under construction Salt Lake City Public Safety Building.

Utah Division of Emergency Management

Great Utah ShakeOut Drill and Exercise

The Utah Division of Emergency Management (UDEM) held its second annual Great Utah ShakeOut drill and exercise April 17 and 18. Even though the participation numbers were down from the first year, the target participants, schools, colleges and universities along with business were well represented. As in the previous year, the Capitol complex extended its play to include the evacuation and damage assessment of Capitol complex buildings and an accountability check of Capitol employees, guests, and visitors.

The day after the Great Utah ShakeOut drill a day long functional exercise was conducted in the State's Emergency Operations Center. The exercise built upon the previous year's exercise; the major objectives of this year's exercise were to better utilize Utah National Guard (UNG) assets, both ground and air, to provide documentation of closing mission and tasking assignments, and conferencing better with other Emergency Support Functions in developing missions.

One of the highlights of the exercise was a mission assignment to transport UGS geologists on an aerial reconnaissance mission flown by the UNG to look for geologic features left from the earthquake. The UGS geologists were successful in flying the desired route to identify faulting and other geologic features; establishing a future, pre-determined route with the UNG; and communicating these findings with their home base.

Urban Residential – Medium Density (URM) Residential Guide

Work is continuing on the URM Residential Rehabilitation Guide. UDEM is working with the Structural Engineers Association of Utah in updating the previous edition. The document illustrates different eras of construction of residential structures from the early 1900s to the mid-1970s in Utah. The document provides methods of rehabilitation for homeowners in an incremental fashion to avoid significant financial hardship in making the upgrades. Release is scheduled for spring of next year.

UDEM – USSC Partnership

UDEM is partnering with the USSC on their School Building inventory project and their certification of volunteer building inspector program. UDEM will be providing secure storage of data collected for the School Building inventory project. The school building data will be collected using the Rapid Observation of Vulnerability and Estimation of Risk (ROVER) software. UDEM will also be the administrator of the volunteer building inspector program that involves the issuing of certification cards and tracking volunteer re-certifications for the Commission.

Utah Seismic Safety Commission

WSSPC Policy Recommendation 13-10 Joint Policy for Evaluation and Seismic Remediation of School Buildings

In 2013, the Utah Seismic Safety Commission (USSC) supported two efforts to address the seismic safety of Utah schools. Most notable is the passage of 2013 Utah House Bill 278 – Public School Seismic Studies. This bill requires school districts to conduct or update seismic safety evaluations of schools constructed before 1975, if the school district issues certain general obligation bonds. The seismic-safety evaluations will be submitted to (and managed by) the USSC. In addition, a $150,000 appropriation to the Utah State Office of Education (USOE) for seismic-safety evaluations (rapid visual screenings) was included in the Governor's 2013 budget. The appropriation will be administered by a committee consisting of members from the Governor's office, USOE, school districts, Structural Engineers Association of Utah, and USSC.

The Salt Lake City Council placed in ordinance the Building Occupancy Resumption Program. The program is to preauthorize a post-earthquake building inspection which will allow a quick and thorough evaluation of possible building damage by qualified persons familiar with the structural design and life-safety systems of buildings. This private emergency inspection can facilitate rapid decisions regarding the closure or occupancy of the building or occupancy of only specific building areas. The Commission was in support of the Salt Lake City Building Inspection Department for this program and attended several council sessions to assist in its passage.

The Commission is finalizing a post-earthquake building safety program. The program, using classroom training along with field training, will create a credentialed volunteer cadre for building inspectors. Missouri and California programs were reviewed as part of the development of the Utah program.

In November 2013, the USSC plans to hold a joint meeting with the Nevada Earthquake Safety Council in Las Vegas, Nevada. The recent success at improving school seismic safety in Utah will be discussed.

University of Utah Seismograph Stations

WSSPC Policy Recommendation 11-3 *Earthquake Monitoring Networks*

The University of Utah Seismograph Stations (UUSS) continues to improve the capabilities of the Utah regional seismic network to detect, locate, and characterize earthquakes in Utah. During 2013, two new seismic stations were installed: (1) a new regional station in west-central Utah with both broadband and strong-motion sensors and (2) a Netquakes strong- motion instrument in North Ogden, Utah. A summary of the seismic activity is available in Quarterly Reports (Burlacu and others, 2013a, 2013b) on the UUSS webpage at *http://www.quake.utah.edu/EQCENTER/QUARTERLY/quarterly.htm*.

Notable seismic events during 2013 include a swarm of 27 earthquakes near Cedar City, Utah, in February with three events of $3.0 \leq \mathbf{M} \leq 3.7$ occurring on February 7. These events were widely felt in the surrounding region. A second notable event was a large landslide at the Kennecott open pit copper mine that occurred on April 10 (MDT). The landslide was recorded at both seismic and infrasound stations in the Utah Regional Network at distances from ~10 km to greater than 400 km. The landslide was composed of two rock avalanches separated by ~1.5 hours and was followed by several small induced earthquakes (Pankow and others, 2013). We continue to analyze both the landslide and induced earthquake data. A third notable seismic event was a **M** 4.9 earthquake that occurred on Sept. 21 in the upper mantle beneath the Wind River Range in southwestern Wyoming. Analyses to date by the UUSS and other organizations indicate a focal depth of 74 to 82 km and an oblique-reverse focal mechanism.

In research efforts, low- and high-noise reference curves for Utah strong-motion stations have recently been published (Thomas and others, 2013). These curves are useful for monitoring the health of the strong-motion stations. In other work, Christine Gammans completed an analysis of the 2011 M_W 4.5 Circleville, Utah, earthquake (Gammans, 2013). Christine found evidence that this earthquake occurred on a low-angle normal fault. Some aftershocks appear to have occurred on a secondary, almost vertical, plane. Aftershocks had both normal and strike- slip focal mechanisms. In a third study, J. Mark Hale looked for infrasound signals from Intermountain Region (including Utah) earthquakes occurring from 2007 to 2012 (Hale, 2013). Infrasound is low-frequency sound that travels through the atmosphere and is recorded at the Earth's surface on arrays of microphone-based sensors. Infrasound is readily generated by explosion sources and has also been recorded from many earthquakes. However, as Hale showed, not all earthquakes generate infrasound, and there is no clear relation between infrasound generation and earthquake size or depth. While there appears to be a ground motion threshold necessary for generating infrasound, exceeding the threshold does not guarantee observing infrasound signals.

In support of the UGS-USGS Working Group on Utah Earthquake Probabilities, UUSS has devoted considerable effort to developing a unified moment magnitude earthquake catalog for the Utah region for the time period 1850 through September 2012. This catalog is a "unified" catalog in the sense that it synthesizes existing UUSS and USGS catalogs and uses multiple size measurements to obtain a best estimate of the moment magnitude, M_W, for each earthquake. For this project we have developed 18 conversion relations between M_W and an assortment of shaking-intensity size measurements and instrumental magnitudes that have varied with time and reporting agency. The new earthquake catalog will be used to compute unbiased recurrence rates, duly accounting for magnitude uncertainty, for background earthquakes below the threshold of surface faulting.

Separate from network operations, UUSS personnel played key roles in the 2013 Seismological Society of America Annual Meeting held in Salt Lake City in April. UUSS provided a co-chair and two members of the program committee, two of the six speakers at the town hall meeting, five co-chairs of special sessions, and eight first-authors of technical presentations. UUSS has also been involved in helping the Utah Museum of Natural History with a visiting exhibit on natural disasters. Several seismologists from UUSS have participated in both training museum docents and answering questions from the public at the museum.

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WASHINGTON
EARTHQUAKE PROGRAM REPORT

Washington Department of Natural Resources, Division of Geology & Earth Resources and the Washington Military Department, Emergency Management Division
with supporting agencies Pacific Northwest Seismic Network and Washington State Department of Transportation

Washington State has continued to focus on reducing the impact of earthquakes and other geologic hazards and increasing state and community resilience through aggressive public education efforts and by providing the necessary tools for communities to become resilient and reduce or eliminate earthquake risks. Activities include the following accomplishments for Fiscal Year 2013:

- October 2013 was proclaimed by Governor Jay Inslee as "Washington Disaster Preparedness Month".
- On October 17, 2013, at 10:17 a.m., Washington State joined with the rest of the west coast of the United States as well as states and countries across the world by participating in the Great ShakeOut earthquake drill. During the second year of the Great Washington ShakeOut more than 880,000 people registered to participate in the drill. This is an increase of 170,000 participants from the inaugural Washington ShakeOut in 2012.

- As part of the Washington ShakeOut, Washington Emergency Management Division (EMD) and the outer coastal counties of Pacific, Grays Harbor, Jefferson, and Clallam conducted a Tsunami Warning Communications Test and encouraged community-wide evacuation drills. This included activation and broadcast of the actual tsunami warning tone across 56 All-Hazard Alert Broadcast (AHAB) sirens located along the entire outer coast.

- During the Washington ShakeOut, coastal schools and coastal communities practiced drop, cover, and hold earthquake safety measures followed by tsunami evacuation drills.
- Earthquakes pose substantial risks to transportation infrastructure in Washington State. As part of its bridge preservation program, the Washington State Department of Transportation (WSDOT) uses seismic retrofit of bridges to mitigate the potential risks associated with these events. The purpose of the Seismic Retrofit program is to minimize and avoid catastrophic bridge failures by strengthening bridges and structures to resist future earthquakes.

Bridges in the Seismic Retrofit Program (as of March 2013)	
Completely Retrofitted	278
Partially Retrofitted	134
Needing Retrofitting	496
Under Contract	6
Total	914

- EMD, the Washington State Office of the Superintendent of Public Instruction (OSPI), and United States Geological Survey (USGS) developed a new earthquake and tsunami safety video for Pacific Northwest and Alaska K-12 teachers. This new teacher resource was developed in collaboration and partnership with the states of Alaska and Oregon in an effort to coordinate and help standardize earthquake and tsunami safety messages and actions in the primary and secondary educational systems.


- EMD continues to partner with the Pacific Northwest Seismic Network (PNSN) to better understand regional earthquake hazards and to support risk reduction policies and hazard mitigation. The PNSN is based at the University of Washington (UW), with additional staff located at the Cascade Volcano Observatory in Vancouver, at the University of Oregon, and at the Hanford Reservation in Richland, Washington. The PNSN also hosts the Seattle Field Office of the USGS Earthquake Program and benefits greatly from direct and indirect contributions of their USGS colleagues. The following is an overview of related PNSN activities:
  - ShakeCast: The PNSN and EMD are partnering to help integrate USGS-developed ShakeCast software at the State EOC. The program is currently used to upload ground motion data and initiate HAZUS loss estimates with PNSN generated input ground motions. ShakeCast capabilities have been described to a variety of State Agencies and lifeline providers in Washington State during a presentation by PNSN at the Committee on Homeland Security's Infrastructure Protection Subcommittee meeting. A pilot project between the PNSN and University of Washington facility engineers has characterized a dozen structures of various construction types on the University of Washington campus. ShakeCast now produces tables of probable damage state for these buildings whenever a ShakeMap is generated in the Pacific Northwest.
  - The PNSN remains active in The Contingency Planners and Recovery Managers (CPARM) group and the Cascadia Region Earthquake Workgroup (CREW). PNSN assisted in the development of the CREW *Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario*, published in 2013.
  - PNSN provided tours and lectures on earthquake hazard to thousands of school children this year as well as provided speakers for dozens of organizations and public lectures. The PNSN provided interviews, consultations, and information services to citizens and media providers in the region and throughout the world about earthquake and volcano hazards in the Pacific Northwest.
- The PNSN has joined with the California Institute of Technology and University of California Berkeley (UC Berkeley) in a research program to develop a prototype West Coast Earthquake Early Warning System (EEW) with support from the Moore Foundation and the USGS. A workshop was held at UW in February to introduce the program to businesses, emergency managers and other regional stakeholder organizations. The workshop was completely filled and over a dozen follow up meetings with company and agency managers have been held. A majority of these organizations agreed to attend another workshop to explore founding a University/Industry Cooperative Research Center (I/UCRC). The EEW consortium has submitted a proposal to the National Science Foundation

to support development of this center. UW will also be co-hosting an international EEW workshop at UC Berkeley on January 13-15, 2014.

- The UW and the PNSN have also been awarded a multi-year, interdisciplinary Science, Engineering and Education for Sustainability (SEES) grant to characterize ground motions and impacts of a Magnitude 9 Cascadia Subduction Zone earthquake. The goal is to bring state-of-the-art science to bear on developing our understanding of the impacts to inform engineers, policy makers, and the public to implement appropriate mitigation and preparedness actions to build regional resilience. EMD and the Washington Division of Geologic and Earth Resources (DGER) will be collaborating with the UW, PNSN, and other partners on this effort.
- Washington State/Local Tsunami workgroup meetings were conducted this past year. Workgroup agenda items included: Design and Implementation of Vertical Evacuation Safe Havens along the Washington coast, Tsunami Public Education Train-the-Trainer Courses, new public education products, evacuation and assembly area signage, NOAA/National Weather Service Updates, Distribution of NOAA Weather Radios to Low Income Families, Training for Hospitality Industry Employees, the Great Washington ShakeOut and community evacuation drills, and future NTHMP funding.
- DGER has continued development of the Washington State Geologic Information Portal which has multiple geologic themes including a Natural Hazards Interactive viewer *https://fortress.wa.gov/dnr/geology/?Theme=natural_hazards*
- The geologic map theme includes layers of suspected active faults, reconnaissance liquefaction susceptibility and NEHRP site class maps, the earthquake catalogue of the Pacific Northwest Seismic Network, landslides, and tsunami inundation maps, as well as statewide geologic mapping. *http://www.dnr.wa.gov/ResearchScience/Topics/GeosciencesData/Pages/geology_portal.aspx*
- Other geologic hazard themes include the Interactive Tsunami Evacuation Map with an address locator and links to the tsunami evacuation brochures, 7 of which were updated to an easier-to-read format with an air photo base. *https://fortress.wa.gov/dnr/geology/?Site=tsunami_evac*
- Washington DGER, EMD, and Oregon DOGAMI also collaborated to create a Smartphone app for tsunami evacuation maps available at:
  - iPhone: *http://itunes.apple.com/us/app/tsunamievac-nw/id478984841?mt=8*
  - Android: *https://play.google.com/store/apps/details?id=org.nanoos.tsunami&hl=en*
- In 2012, EMD trained more than 300 professionals on seismic mitigation techniques, such as *Rapid Visual Screening of Buildings for Potential Seismic Hazards*, *Non-structural Earthquake Mitigation* as well as response and recovery techniques that include *Postearthquake Safety Evaluation of Buildings* using the ATC 20 courses.
- DNR has been assessing earthquake-induced landslide and liquefaction hazards in tsunami inundation zones as a guide to more robust evacuation planning along Washington coastal areas. Two publications have been completed:
  - *Earthquake-induced landslide and liquefaction susceptibility and initiation potential maps for tsunami inundation zones in Aberdeen, Hoquiam, and Cosmopolis, Grays Harbor County, Washington, for a M9+ Cascadia subduction zone event*, by S. L. Slaughter, T. J. Walsh, Anton Ypma, K. M. D. Stanton, Recep Cakir, and T. A. Contreras. 2013. Two color sheets: 36 x 43 in. and 36 x 28 in., scale 1:18,000, plus 39 p. text. *http://www.dnr.wa.gov/Publications/ger_ri36_aberdeen_liquefaction.zip*

- *Landslide and liquefaction maps for the Long Beach Peninsula, Pacific County, Washington—Effect on tsunami inundation zones of a Cascadia subduction zone earthquake,* by S. L. Slaughter, T. J. Walsh, Anton Ypma, K. M. D. Stanton, Recep Cakir, and T. A. Contreras. 2013. Three color sheets: 44.5 x 36 in., scale 1:18,000, plus 27 p. text. *http://www.dnr.wa.gov/Publications/ger_ri37_longbeach_liquefaction.zip*

- *Geologic map of the Lake Joy 7.5-minute quadrangle, King County, Washington*, by J. D. Dragovich, M. L. Anderson, S. A. Mahan, J. H. MacDonald, Jr., C. P. McCabe, Recep Cakir, B. A. Stoker, N. M. Villeneuve, D. T. Smith, and J. P. Bethel. 2012. Two color plates, 45 x 36 in. and 36 x 48.5 in., scale 1:24,000, with 79 p. text and 1 Microsoft Excel file. *http://www.dnr.wa.gov/Publications/ger_ms2012-01_geol_map_lake_joy_24k.zip*

- *Geologic map of the Eldon 7.5-minute quadrangle, Jefferson, Kitsap, and Mason Counties, Washington*, by T. A. Contreras, Eleanor Spangler, L. A. Fusso, D. A. Reioux, Gabriel Legorreta Paulin, P. T. Pringle, R. J. Carson, E. F. Lindstrum, K. P. Clark, J. H. Tepper, Domenico Pilegg, and S. A. Mahan. 2012. 42 x 36 in. color plate, scale 1:24,000, with 60 p. text. *http://www.dnr.wa.gov/Publications/ger_ms2012-03_geol_map_eldon_24k.zip*

- *Geologic map of the Brinnon 7.5-minute quadrangle, Jefferson and Kitsap Counties, Washington*, by Michael Polenz, Eleanor Spangler, L. A. Fusso, D. A. Reioux, R. A. Cole, T. J. Walsh, Recep Cakir, K. P. Clark, J. H. Tepper, R. J. Carson, Domenico Pileggi, and S. A. Mahan. 2012. 42 x 36 in. color plate, scale 1:24,000, with 47 p. text. *http://www.dnr.wa.gov/Publications/ger_ms2012-02_geol_map_brinnon_24k.zip*

Policy Recommendations 13-1 Rapid Tsunami Identification and Evacuation Notification

- EMD continued to partner with Federal Signal, Inc. to deploy the All Hazard Alert Broadcast (AHAB) Siren System that provides both tone and voice alert notification to at-risk communities for any hazardous situation. A total of 59 AHAB sirens have been placed by EMD in at-risk population areas along the coast. At least 96 AHAB sirens are needed along the outer coast to effectively provide tsunami warnings to out-of-doors populations.

- The Consolidated Reporting of EarthquakeS and Tsunamis (CREST) is a National Oceanic and Atmospheric Administration (NOAA) funded project to improve the nation's ability to rapidly assess the likelihood and severity of a damaging earthquake-generated tsunami. The PNSN operates 13 CREST stations in Washington and Oregon with digital broadband seismometers and strong motion accelerometers. Real time data from these stations is made available to the National Earthquake Information Center and the National Tsunami Warning Center. This year NOAA has withdrawn support for the maintenance and operation of these stations. The PNSN and USGS are working together to identify resources that can be tapped to continue to operate these essential seismograph stations.

- The PNSN has been working within the Advanced National Seismic System (ANSS) to acquire real-time geodetic monitoring (high-sample-rate GPS positioning) in the Pacific Northwest. This advance will significantly strengthen the region's ability to rapidly detect the crustal displacement signals that are associated with tsunami generation, facilitating more rapid and accurate regional warnings. David Schmidt, a geodesist, joined the faculty at UW in January 2013, and supports this effort.

- The PNSN has also set a long-term goal of providing early warning for strong shaking. With 1.8 million dollars of private support from the Moore Foundation, the UW and PNSN will build a prototype Earthquake Early Warning System for the Cascadia Region. This is part of a larger West Coast Earthquake Early Warning initiative supported by the Moore foundation with a 7 million dollar grant involving research groups at Cal Tech, UC Berkeley, UW, and the USGS. The early warning

system could provide up to three or four minutes of warning that a Cascadia megathrust earthquake is underway before the shaking reaches the Portland-Seattle urban corridor. Shorter-lead-time warnings would be provided for crustal earthquakes. The experimental system will be developed by 2014. Long-term federal support would be required to develop this experimental capability into an operational warning system.

Policy Recommendations 13-3 Post-Earthquake Technical Clearinghouses and 13-6 Post Earthquake Information System

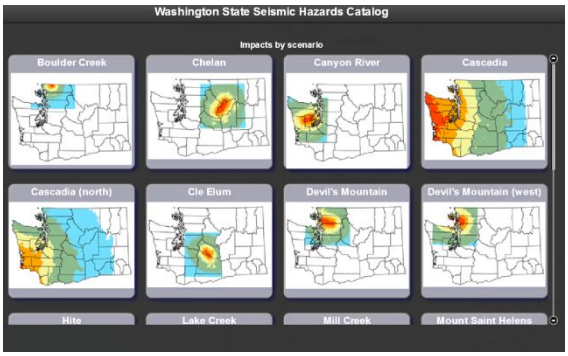
- The Washington Department of Natural Resources-Division of Geology and Earth Resources (DNR) with EMD has evaluated the different earthquake clearinghouses and are currently evaluating how best to establish an earthquake clearinghouse in Washington. After initial testing of an earlier Microsoft SharePoint-based system, it was determined to be ineffective in rapidly registering off-site and dispersed contributors that would need access in remote locations.
- Over the course of 2012-13, Washington DNR conducted an assessment of existing earthquake clearinghouse models that exist in the United States and provided a report entitled *Strategies for Establishing a Washington State Post Earthquake Information Clearinghouse* that provides recommendations for establishing a more effective and coordinated repository. Funding needs to be identified in order to advance the recommendations included within the report.

Policy Recommendation 13-4 Seismic Provisions in the 2012 International Building Code

The State of Washington has adopted the 2012 edition of *International Building Code*, including Appendix E, as stated in Washington Administrative Code (WAC) 51-50-003.

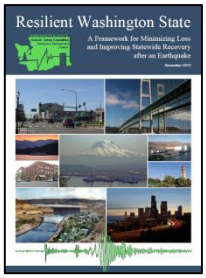
Policy Recommendation 12-1 Earthquake Planning Scenarios

EMD in collaboration with DGER, USGS, Federal Emergency Management Regions VIII & X, URS Corporation, and Western Washington University, continued the development of an interactive digital Earthquake Scenario Catalog for Washington State hosted by DGER. The purpose of this project is to provide the state and local jurisdictions with additional resources for use in hazard mitigation and response planning for earthquake events as well as to facilitate better exercise design. *https://fortress.wa.gov/dnr/SeismicScenarios*



The earthquake scenario catalog consists of 20 USGS ShakeMaps developed by Dr. Art Frankel, USGS Field Office at UW. HAZUS loss estimations have been developed for the state and most heavily impacted counties. Maps that spatially illustrate losses are generated for the following impacts: injuries and impaired hospitals, bridge functionality, estimated displaced households and shelter needs, potential search and rescue needs, liquefaction potential and lifeline functionality. The reports also include indices of community vulnerability and exposure for each scenario event. The fact sheets developed for each scenario are available for download. Dr. Frankel will be producing state of the art ground motion modeling for a variety of Cascadia Subduction Zone Scenarios as part of the UW SEES program that will include basin and soil effects to more accurately portray the distribution of shaking resulting from these scenario earthquakes.

Policy Recommendation 12-2 Developing Earthquake Risk-Reduction Strategies

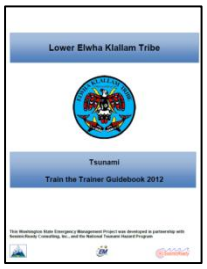


The Washington State Seismic Safety Committee (WASSC), co-chaired by the Director of WA EMD and the WA DNR State Geologist, completed a project entitled the "Resilient Washington State Initiative." The final report was published and released in November 2012. The RWS Initiative is a strategic planning process for achieving state-level resilience with respect to earthquake hazards. The first state-level assessment and resilience framework of its kind, the report identifies actions and policies before, during, and after an earthquake that can leverage existing policies, plans and initiatives to realize disaster resilience to earthquakes within a 50-year life cycle.

The Resilient Washington State Initiative built off a city-level assessment completed in the City of San Francisco by the San Francisco Planning and Urban Research Association (SPUR).

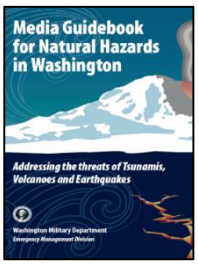
Policy Recommendation 11-1 Improving Tsunami Public Education, Mitigation, and Warning Procedures for Distant and Local Sources

- During 2012, the EMD Earthquake/Tsunami Program and SeismicReady Consulting completed multiple Tsunami Public Education Instructor Train-the-Trainer (T3) Workshops, with participants attending from various coastal Washington jurisdictions. County/Tribe-specific workbooks, presentations, and outreach materials were updated and delivered as a component of this training. The T3 Program provides participants with a basic understanding of fundamental principles and concepts in: Tsunami Science, Tsunami Warning, Tsunami Risk Reduction, and Conducting Community-level Tsunami Public Education.



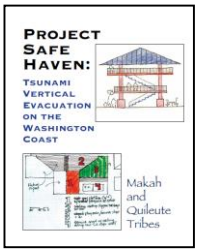
  Participants in local jurisdictions took part in the workshops, which are designed to train a cadre of professionals that are qualified to serve as Tsunami Public Education Instructors at the community level. Attendees included personnel from county and community organizations, as well such as Tribal Council, Emergency Management, Fire Departments, Community Emergency Response Team (CERT), Chamber of Commerce, and volunteer community members.

- The Earthquake Program updated two of its premier products, *The Disaster Response Guidebook* for *Hotels and Motels on Washington's Coast* and the *Broadcasters Tsunami Emergency Media Guidebook*. The Disaster Response Guidebook was revised to incorporate new information, tsunami evacuation maps for multiple communities were reprinted, and tent cards for placement in hotel/motel rooms were ordered and distributed to local emergency managers and hoteliers located in the tsunami hazard zone.



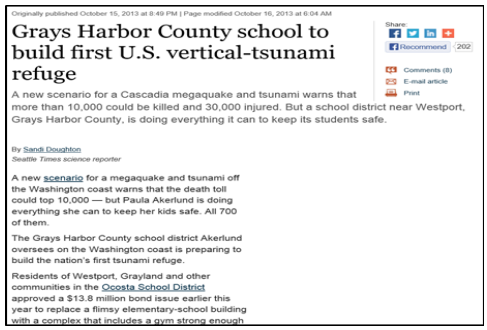
  The Broadcaster's Guidebook was updated and renamed to the *Media Guidebook for Natural Hazards in Washington.* This updated version includes a new earthquake chapter featuring subject matter expert contacts, updated seismic hazard maps, and revised USGS Earthquake Hazards Program products as well as key safety messages. Training for the local media on the revisions will be conducted by NWS Seattle, Washington EMD Public Information Officers, USGS, and the EMD Earthquake/Tsunami/Volcano Program.

- In March 2013, the collaborative tsunami vertical evacuation planning effort between EMD, DGER, UW, NOAA's National Tsunami Hazard Mitigation Program, USGS, and FEMA known as *Project Safe Haven* published site-specific hazard assessments to support local implementation of previously identified tsunami safe havens by local communities.



This grassroots approach to community and stakeholder engagement on integration of man-made high ground in vulnerable communities that lack available tsunami evacuation options has won numerous awards and led to preliminary planning for all of Washington's tsunami threatened communities.

In April 2013, Grays Harbor County voters approved a local levy measure to construct the first tsunami safe haven in the United States. This announcement received much attention and the school district garnered local and far reaching press coverage. Moreover, implementing tsunami vertical evacuation would also advance the recommendations with the "Resilient Washington" report.



Grays Harbor County school to build first U.S. vertical-tsunami refuge

A new scenario for a Cascadia megaquake and tsunami warns that more than 10,000 could be killed and 30,000 injured. But a school district near Westport, Grays Harbor County, is doing everything it can to keep its students safe.

By Sandi Doughton
Seattle Times science reporter

A new scenario for a megaquake and tsunami off the Washington coast warns that the death toll could top 10,000 — but Paula Akerlund is doing everything she can to keep her kids safe. All 700 of them.

The Grays Harbor County school district Akerlund oversees on the Washington coast is preparing to build the nation's first tsunami refuge.

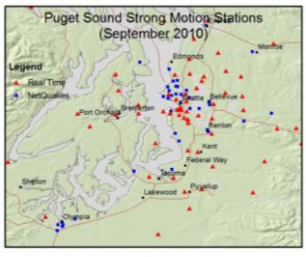
Residents of Westport, Grayland and other communities in the Ocosta School District approved a $13.8 million bond issue earlier this year to replace a flimsy elementary-school building with a complex that includes a gym strong enough

http://seattletimes.com/html/localnews/2022051420_shakeoutxml.html

http://q13fox.com/2013/10/18/tsunami-safe-school-planned-for-coast/#axzz2jKM5mtIg

Policy Recommendation 11-3 *Earthquake Monitoring Networks*

- The Earthquake Program Manager represented the National Emergency Management Association (NEMA) at the Advanced National Seismic System (ANSS) National Steering Committee (NSC) meetings. The committee reviewed regional efforts in the United States to enhance seismic monitoring of infrastructure in urban areas as well as latest technologic advances to support the USGS and regional seismic network capabilities to provide emergency managers with products that support rapid response and decision making.
- "NetQuakes" accelerometers have arrived in the Pacific Northwest. Puget Sound area papers printed a request for volunteers to host these instruments and over 1300 Washington residents responded. Using guidance provided by the PNW ANSS Advisory Committee, 75 "high priority" target sites have been selected from the volunteer database. Forty new NetQuakes stations, instruments operating in "triggered" mode, are now in operation (since 9/30/2010). The USGS provide 20 instruments from ARRA funds, 22 with ANSS dollars and an additional 27 from its Multi-Hazard Demonstration Project. In 2012 the Portland Metro Area, including Vancouver Washington, had 14 NetQuakes seismometers deployed and 7 instruments were installed in Spokane. The PNSN will have close to 100 instruments operating by the end of 2012.
- The PNSN is planning to build 25 modern strong motion seismic stations near the Oregon and Washington Coastline to enhance our earthquake early warning (EEW) capabilities. These stations will be co-located where possible with high sample rate GPS stations to allow more sophisticated, real-time modeling of unfolding CSZ earthquakes. This work will be completed in 2014 and 2015.



- Department of Natural Resources - Division of Geology and Earth Resources (DNR) has characterized the shear wave velocity profile at 20 ANSS sites under a NEHRP grant from the USGS.

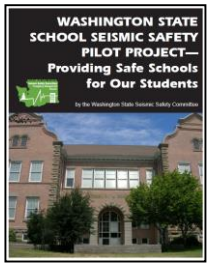
Policy Recommendation 11-4 Identification and Mitigation of Unreinforced Masonry Structures

- The PNSN and USGS Earthquake Program partners at the University of Washington have provided input into the City of Seattle Unreinforced Masonry Building policy development plan. In 2008, the City contracted with the engineering firm of Reid Middleton to collate information from earlier studies and to fill in knowledge gaps by conducting sidewalk surveys of suspect URMs in parts of the city where data was missing or incomplete. Based upon the results of the survey, the City organized stakeholder representatives to study potential incentives and regulations that would reduce the risk of losses from these dangerous structures. The Seattle City Council is currently discussing the potential for a mandatory seismic retrofit program, and the Department of Planning and Development anticipates presenting final recommendations to the City Council in the 2nd quarter of 2014.

Policy Recommendation 13-10 Joint Policy for the Evaluation and Seismic Remediation of School Buildings

- A goal that has been on the horizon for several Washington State agencies, including but not limited to the Military Department's Emergency Management Division (EMD), Department of Natural Resources- Division of Geology and Earth Resources (DNR), the Office of Superintendent of Public Instruction (OSPI), and Washington State's Seismic Safety Committee is to systematically evaluate all public school buildings and critical facilities within the Washington in order to establish the seismic risk for each. This will allow for the prioritization of structures in need of seismic retrofitting across the state and permit a strategic, targeted approach for alleviating the risk of potentially dangerous structures.

  The aforementioned agencies, with funding support from FEMA's State Earthquake Assistance Program, began a pilot project starting in April 2010 to evaluate school buildings in two school districts, Aberdeen School District and Walla Walla Public Schools. The assessments were conducted using a nationally accepted methodology known as *ASCE 31: Seismic Evaluation of Existing Buildings* by volunteer structural engineers from the Structural Engineering Association of Washington.



  In addition, the Washington State Office of the Superintendent of Public Instruction is in the process of completing the development of a mitigation plan that will include an initial count of potentially seismically vulnerable schools and a toolkit of potential options.

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WYOMING
EARTHQUAKE PROGRAM REPORT

Wyoming State Geological Survey

Geologic Hazards Website

Work has begun to redesign and update the Wyoming State Geological Survey (WSGS) geologic hazards website, including significant changes to the earthquake and Quaternary fault sections. The website will become more user friendly and provide more information about geologic hazards in Wyoming. The website will also contain pages specific to hazards mitigation and updated hazard maps.

Quaternary Faults Research

The WSGS continues a project started last year, compiling all available data on Quaternary aged faults in the state. The project will prioritize faults in the state based on a number of criteria, including MChar population and infrastructure risk, existing data, slip rate, and recurrence intervals.

Preliminary mapping has been completed on the northern section of the Rock Creek and Sublette Flat faults in western Wyoming (Lincoln County). The mapping has extended the trace of the Rock Creek fault approximately 2 km further to the north and better constrained the fault scarp over the northern third of the fault segment. The northern extent of the Sublette Flat fault has also been better constrained. The mapping was completed as part of the surficial mapping of the Fontenelle Reservoir 30' x 60' quadrangle and funded through the USGS StateMap program.

Preliminary mapping and field work has also begun on the Chicken Springs fault system in central Wyoming (Sweetwater County). The system is unique for Wyoming in that it appears to consist of numerous fault segments distributed laterally perpendicular to strike over a relatively short distance. Outside of the caldera-forming faults in Yellowstone National Park, faults in Wyoming tend to be single scarp faults which extend over long distances along strike. The Chicken Springs fault system is poorly understood, and limited data exists regarding it. This project is also being funded in part by the USGS STATEMAP program.

Induced Seismicity

A project looking at induced seismicity has also been started at the WSGS. The project is comparing existing epicenter data to well data, specifically the location and timing of epicenters to injections wells associated with natural resource development in the state. The study is slated to be completed and made available to the public in the spring of 2014.

Wyoming Office of Homeland Security

The Wyoming Office of Homeland Security (WOHS) undertook several earthquake preparedness, awareness, and mitigation activities over this past year. They include training, initial development of a ROVER database, attending the Earthquake Program Managers Meeting in Seattle, and participating in the Great Rocky Mountain ShakeOut.

Training

Over a two-day period, and utilizing National Earthquake Hazard Reduction Program (NEHRP) grant funds, WOHS trained 22 individuals in Rapid Observation of Vulnerability and Estimation of Risk (FEMA-154), Procedures for Postearthquake Safety Evaluation of Buildings (ATC-20), and Rapid

Observation of Vulnerability and Estimation of Risk (ROVER). Course capacity was reached in just three days of registration. Although students were responsible for their travel expenses to and from the venue, and were on their own for their evening meal, several "carrots" were incorporated into the course to attract quality students:

- The training was held in Jackson Hole, Wyoming. While the course occurred at a popular tourist location, it was scheduled to occur during 'off season' to take advantage of lower lodging rates.
- Lodging costs were covered for each student. Students stayed at a hotel where breakfast was provided.
- A working lunch was provided at the training.
- Wi-Fi capable tablets and keyboard covers were provided to each student who did not already own a tablet.

The training incorporated a field exercise, providing students an opportunity to apply the things they had learned. Critical infrastructure buildings in the local area were selected in advance to be surveyed, and a Point of Contact at each structure was notified to expect the FEMA-154 students. Students went out in teams of 2 or more. The teams were asked to maintain radio contact with the local EOC to ensure no one was lost, and structural surveys went smoothly. The students worked together to survey the selected structures, and incorporate them into Wyoming's ROVER database.

Individuals capable of completing structural assessments both before and following an earthquake are a benefit Wyoming enjoys following the course. Prior to attending the course, students agreed to be placed on Wyoming's Earthquake Structural Assessment Team resource list as a condition of receiving lodging, meals and a tablet.

ROVER Database

WOHS contracted with the ROVER Development Consortium to host their database. Initial database development was completed in the summer of 2013 and a small database is being housed with the Consortium.

Earthquake Program Managers Conference-Seattle, Washington

Wyoming was privileged to send three to the Earthquake Program Managers Meeting in Seattle in early May 2013. The Wyoming Earthquake Program Manager, an employee with the Wyoming Geological Survey Office, and the Critical Infrastructure Program Coordinator with WOHS took part in the meeting.

The Great Rocky Mountain ShakeOut

Wyoming participated in the ShakeOut for the first time this year. The ShakeOut occurred at 10:17 a.m. on the morning of October 17. As of October 21, 2,489 were registered participants in the ShakeOut. The ShakeOut was well received. This year's event will be something to build upon next year.

Contributing Authors:

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