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Testimony on "Are We Prepared? The State of **Earthquake Risk Reduction in the United States"**

SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION
SCIENCE, SPACE, AND TECHNOLOGY COMMITTEE
UNITED STATES HOUSE OF REPRESENTATIVES
April 7, 2011

My name is Vicki S. McConnell. I am the Director of the Oregon Department of Geology and Mineral Industries (DOGAMI), an executive branch agency in the state of Oregon. I serve Governor Kitzhaber and the state as the Oregon State Geologist. The agency is tasked by statute to be the centralized source of geologic and geoscientific data and geologic hazard data for the state of Oregon. As such we work in close partnership with several federal programs that are focused on earthquake hazards characterization and risk reduction. We implement those programs at a state and local level. My testimony will focus on the state of these programs, how they do or do not accomplish their goals of earthquake risk reductions, and recommendations for improvement.

I am also representing the Western States Seismic Policy Council (WSSPC) whose mission is to develop seismic mitigation policies and share information to promote programs intended to reduce earthquake-related losses throughout the 13 western states, 3 U.S.territories, a Canadian territory and a Canadian province, and liaisons to 7 western state seismic safety councils and commissions. WSSPC is a 501(c)(3) non-profit organization and is funded by the Department of Homeland Security's Federal Emergency Management Agency (FEMA) and the U.S. Geological Survey (USGS). Headquartered in Sacramento, California, members are the State Geological Survey and Emergency Management Directors.

Thank you for this opportunity to comment on the state of earthquake risk reduction in the United States, discussing the importance of coordination between federal, state, and local stakeholders for emergency preparedness, and allowing me to recommend improvements to federal programs.

Although I will be providing examples about how Oregon is working toward earthquake risk reduction and identifying and mitigating the hazards associated with earthquakes I want to stress that earthquake faults, seismic hazards, tsunamis, and seismic-induced landslides care little for state or national boundaries. When considering the effects of these hazards and how to reduce those effects we must consider the geologic regions and think about national investments in risk reductions.

First and foremost, I want to stress that the return on investment made by building resilient communities is tremendous; resilient communities spring back quickly with rapid economic recovery; with infrastructure from schools to roads reoccupied and with the need for state and federal assistance minimized. My primary recommendation to you is to maintain robust federal programs within the National Science Foundation, NOAA, NIST, NASA, FEMA, and the USGS that address earthquake and tsunami hazard research, mitigation, and preparedness particularly the cooperative federal-to-state and local programs that implement the federal missions and goals.

Some examples of these federal programs include the USGS Earthquake Hazard Program, the NIST-administered National Earthquake Hazards Reduction Program and the NOAA administered National Tsunami Hazards Mitigation Program. These are federal programs that build resilient communities and do so through collaboration with experts outside the federal government. Through competitive and other grants, federal agencies work with scientists, engineers and local-area experts to understand the hazard, prepare communities, reduce losses and keep the local economy on track after a natural disaster hits.

We must continue to observe and understand hazards, prepare for hazards, mitigate potential losses and respond to hazardous events. These long-standing federal programs and partnerships provide the foundation for resilient communities. While the events in Japan are tragic, the fatalities, injuries and losses could have been orders of magnitude worse if not for Japan's attention to research, technology and preparedness leading to some of the most resilient communities in the world.

I offer four examples of work being conducted in Oregon that is crucial to developing resilient communities. These projects were possible because of federal assistance from NEHRP and other programs. My written testimony provides references to all four if you would like further information.

- Oregon is the first state in the nation to conduct an evaluation of the seismic vulnerability of all public schools and emergency response facilities statewide and to develop a grant program to assist with seismic rehabilitation of the most vulnerable facilities. While these are primarily state funded programs both relied on data and guidance provided by NEHRP. By funding overarching development standards and guidelines, the national program assists the states with developing comprehensive research and science and engineering evaluations.[1]
- Portland METRO Multi-Hazard Project. Through a collaborative effort of DOGAMI and USGS Earthquake Hazard Program, USGS Landslide Hazard Program, and National Cooperative Geologic Mapping Program a series of hazard maps for the Portland Oregon metro area are being developed. These maps will be used to drive the development of local land use planning and building codes for the Portland urban growth zone.
- Oregon's Department of Transportation published in 2009 the *Seismic Vulnerability of*

[1] To view the final seismic vulnerability report go to: http://www.oregongeology.org/sub/projects/rvs/default.htm. To view the results of the rehabilitation grant programs go to: http://www.oregon.gov/OMD/OEM/plans_train/SRGP.shtml

Oregon State Highway Bridges: Mitigation Strategies to Reduce Major Mobility Risks. This study incorporates FEMA HAZUS risk assessment modeling funded by NEHRP as well as NEHRP soil conditions data to determine peak ground acceleration (PGA). Their findings indicate that 38% of state-owned bridges in western Oregon would fail or be too heavily damaged to be serviceable after a magnitude 9.0 earthquake and that repair or replacement would take 3-5 years essentially cutting the Oregon coastal communities off from the rest of the state.

The Oregon Lidar Consortium is using an excellent modern technology called light detection and ranging (or lidar) to identify and locate faults and related hazards throughout Oregon. Lidar allows us to image the bare earth by removing vegetation, so we can see fault structures, old landslides and other features that define hazards. Lidar was developed through research and development, led primarily by researchers funded through the National Science Foundation and the U.S. Geological Survey. It is now an essential tool for research and for land-use planning. See Figure 1 for an example of bare earth lidar imagery of fault scarps or go to: http://www.oregongeology.org/sub/projects/olc/default.htm

It is now estimated that the fatalities in Japan from the Tohoku earthquake and tsunami may reach 25,000 and the economic damage may reach $300 billion. Across the Pacific Ocean – there was $30 million in damage in Hawaii, $7 million in damage in Oregon, and one death and more than $50 million in damage in northern California. Most of the death and damage in Japan and beyond Japan can be attributed to the tsunami. Although it will take more time to assess what has happened in Japan, it is clear that Japan's R&D, technology and preparedness saved hundreds of thousands of lives and billions of dollars in damages from the massive earthquake and also probably from the ensuing massive tsunami.

We have similar geologic and seismic areas off the northwest coast of the continental United States and the coastline of Alaska as they do off the coast of Japan. The Pacific Plate and other smaller plates are subducting beneath the North American Plate and in all three areas history has recorded very large magnitude megathrust earthquakes followed by massive tsunamis. These include a magnitude[2] 9.0 Cascadia Subduction Zone earthquake in northwestern United States in 1700, a magnitude 9.2 Aleutian-Alaska Subduction Zone earthquake in Alaska in 1964, and the recent magnitude 9.0 Tohoku earthquake. Additionally, we now realize that these subduction zones are prone to magnitude 8.0 and higher earthquakes occurring as frequently as ten times the magnitude 9.0 and larger earthquakes. See Figure 2 at the end of this testimony for a timeline of Cascadia Subduction Zone earthquakes over the last 10,000 years.

Are we ready for another Cascadia Subduction Zone earthquake? Or an earthquake on the Portland Hills Fault similar to the recent New Zealand earthquakes? No we are not; however we have made great strides toward understanding and mitigating for such natural disasters through state implemented programs funded in partnership with federal agencies or that use data gathered by federal agencies.

[2] Earthquake magnitudes are expressed in the moment magnitude scale.

Your subcommittee and the full committee can help to ensure that the federal programs are there to help the states develop resilient communities across the nation. My colleagues here today are explaining the excellent work that NIST and FEMA are conducting and I bring your attention to several other federal agency programs whose mission is to reduce earthquake risk..

NSF supports research at universities to understand and monitor earthquakes and tsunamis. NSF's EarthScope-US Array experiment, which has been deploying a network of seismic instruments that are moving across the country, has demonstrated how useful a robust national seismic network could be. For example, the US Array instruments helped to detect several low magnitude seismic swarms in Oregon. While not directly hazardous, this previously undetected seismic activity indicates areas in the state that need additional hazard characterization and research. Unfortunately, most communities cannot afford to maintain the US Array instruments so they have been pulled out as NSF's experiment moves east. The remaining USGS-supported regional seismic network can no longer detect the smaller events that would help us understand earthquakes or that might be critical for an early warning system for many urban areas throughout the country.

The USGS 's Advanced National Seismic System (ANSS) is crucial for developing earthquake resilience. It includes a backbone network, a global information center, a strong ground motion network and 15 regional networks. When an earthquake strikes, ANSS delivers real-time information, providing situational awareness for emergency-response personnel. The Pacific Northwest regional array in my area is operated jointly by the University of Washington and the University of Oregon. USGS support of a national seismic and geodetic network, with collaboration from state and university-based regional networks, is vital to understand and mitigate the hazards related to earthquakes. Without greater support for these networks they may deteriorate, leaving us highly vulnerable to earthquake hazards (essentially blind to earth movements). We recommend that the USGS work closely with their state and local stakeholders to design the information tools and seismic hazard maps that are useful to land use planning and emergency response.

The USGS Earthquake Hazards Program is also vital to earthquake resiliency. The external Earthquake Grants program, which has successfully engaged leading scientists and engineers through a peer-reviewed grant process brings local expertise to basic and applied earthquake research. We recommend that progress to build a prototype earthquake early warning system be evaluated and continued. This system would warn people within seconds after a major earthquake starts to shake the ground, in time for many people to take cover, protect their children, and automatically implement electronic safety measures (such as opening firehouse doors, slowing trains, and backing up computers). Japan already has a functional system in place, but the President's budget calls for the United States to stall its efforts. The system that we need would surely save lives and facilitate a rapid recovery after an earthquake strikes. The Earthquake Hazards Program also needs funding to take advantage of new technologies (such as better seismic instrumentation, more geodetic measurements, and more use of lidar in mapping faults) that are improving our abilities to reduce risks from earthquakes.

The NOAA Tsunami Warning Program and the National Tsunami Hazard Mitigation Program in concert with federal earthquake programs and in partnerships with state efforts is essential to understanding and mitigating tsunami hazards. While we did have death and damage in the United States resulting from the Tohoku earthquake and tsunami it would have been much, much worse without the federal programs designed to track distance tsunami activity, model and calculate the waves' path and arrival times, advise and warn state and local communities, and most importantly empower communities to prepare and respond. Developing resilient communities depends on understanding the social and demographic factors that affect how individuals and communities respond to natural disasters and to best deliver the message that, "Yes, you can plan for and survive an earthquake or tsunami." Oregon has 7 communities and 3 counties that have been declared "Tsunami Ready" through NOAA's Tsunami Ready program.

It is important to require federal programs and their stakeholders to coordinate their activities and missions to optimize the investment. An example of this coordination is the Advisory Committee on Earthquake Hazards Reduction (ACEHR) that guides and advises the many NEHRP programs.

Finally above all of these coordinated activities in R&D and technology is the NASA fleet of Earth-observing satellites. These satellites provide information about the land, ocean and atmosphere before and after an event. DESDyNI, which stands for Deformation, Ecosystem Structure and Dynamics of Ice is under development and would observe deformation from earthquakes, volcanic eruptions and landslides, among other things. It would include InSAR and lidar to follow earth movements. It would be helpful to support the development of this satellite without too much delay because of budgetary concerns.
(http://science.nasa.gov/missions/desdyni/)

Thank you, again, for this opportunity to comment on the Nation's Earthquake Preparedness and the federal programs that assist building resilient communities.

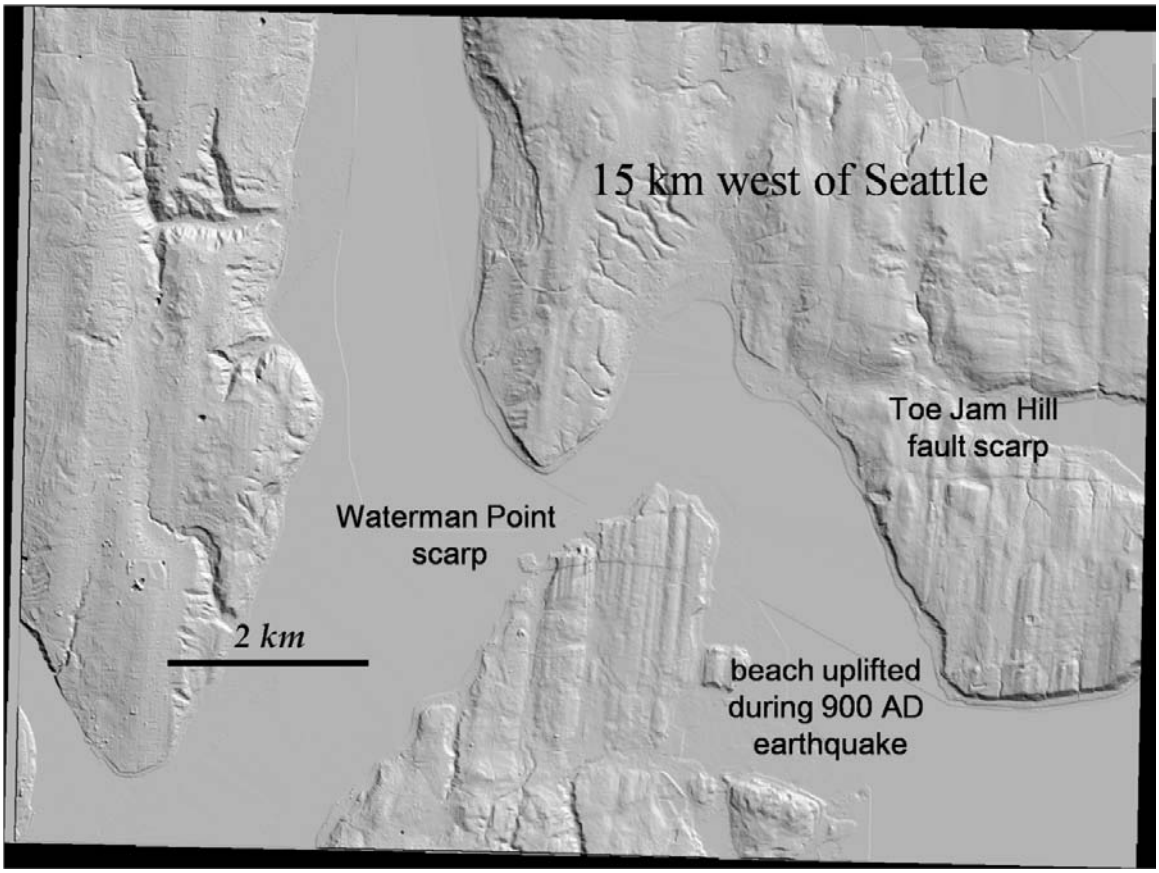

Figure One. Scarps of the Seattle Fault Zone delineated across Puget Sound, WA. Bare earth Lidar image from the Puget Sound Lidar Consortium, Finding Faults with Lidar in the Puget Sound Lowland.

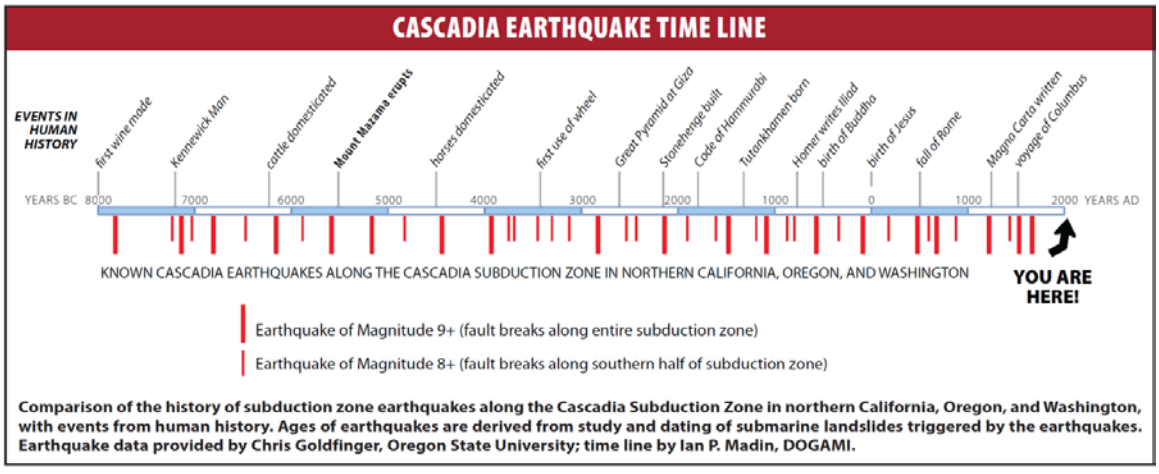

Figure 2. Funding though the National Earthquake Hazard Reduction Program in the National Science Foundation and the U.S. Geological Survey has allowed local experts to study and reveal the earthquake history of the Cascade Subduction Zone.