

September, 2000

The Earthquake and Landslide Program

Information, Education and Partnership for Seismic Hazard Mitigation and Risk Management in Oregon

Earthquake hazards have been recognized as one of the major natural hazards in Oregon since the late 1980's, a result of the geologic research to identify and characterize the Cascadia subduction zone and crustal faults. The March 1993 Scotts Mills earthquake (M5.6) and the September 1993 Klamath Falls earthquakes (M5.9 and M6.0) demonstrated the potential hazards of crustal earthquakes in Oregon. The Scotts Mills earthquake resulted in \$30 million damage, while the Klamath Falls earthquakes caused two deaths and more than \$10 million in damage and economic losses. A recent nationwide study showed Oregon ranks third in the United States in the potential for damage and losses caused by earthquakes. The Oregon Department of Geology and Mineral Industries' (DOGAMI) own preliminary estimates of damage and loss from an M8.5 Cascadia subduction zone earthquake, using HAZUS97 software, are about \$12 billion, without factoring in the effects of tsunamis or the damage to Oregon's substantial inventory of unreinforced masonry buildings (URM's).

Because of Oregon's short history in dealing with seismic hazards, many fundamental issues, such as crustal fault activity and ground motion attenuation from subduction zone earthquakes, are still not fully understood. This brief period of time for recognition of the earthquake risk *and* the lack of larger earthquakes in recent history makes it difficult to implement aggressive mitigation measures. The earthquake program at DOGAMI focuses on providing better seismic hazard and risk information, educating Oregonians, and partnering with federal, state and local governments, private organizations and citizens to mitigate the hazards and risk. The department has also been mandated by the state to meet certain developmental benchmarks that measure progress in preparing communities to deal with geologic hazards.

BETTER INFORMATION

Seismic Source Characterization - Seismic hazard assessments in Oregon rely heavily on geologic evidence due to the short time-span of historical records. 2 areas of recent activity are:

1. **The identification of crustal faults in the northern Willamette Valley** - DOGAMI's current work is concentrated on the Mt. Angel Fault, which may have been the source of the damaging 1993 Scotts Mills earthquake. The work has produced new information on the fault and also attracted general public attention (reported by Oregonian Newspaper and TV news). Preliminary results

show the Mt. Angel Fault offsets near surface Pleistocene sediments at depth from 20 to 100 feet. DOGAMI is also a member of the research team that is currently investigating the Portland Hills Fault. These studies are funded by USGS.

2. **Ongoing study of the Cascadia subduction zone** - DOGAMI co-hosted the GSA Penrose Conference 2000 on the Cascadia subduction zone on June 4-8, 2000 in Seaside, Oregon. The conference brought scientists, policy makers, emergency managers, planners, and private citizens together to share the latest research and information on the potential for a subduction zone earthquake, as well as policy to deal with the hazard and risk posed by the zone. DOGAMI recently published the 156 page Program Summary and Abstracts from the Conference.

Seismic Hazard Mapping - Seismic hazards in urban areas are affected by the local geologic, hydrologic, and topographic conditions. DOGAMI continues to map these hazards in selected communities in Oregon. Recent publications include:

1. **Seismic Hazard Maps for Selected Urban Areas in Western Oregon** which provides an inexpensive general hazard assessment for small communities that could not afford their own mapping program but were not large enough to justify a major state-funded mapping efforts.
2. **Eugene-Springfield Seismic Hazard Maps.**
3. **Portland Metro Scenario Hazard Maps.**
4. **Earthquake-Induced Slope Instability of Salem Hills.**
5. **Tsunami Hazard maps in Coos Bay and Gold Beach.**

Seismic Risk Assessment - In 1998 DOGAMI conducted seismic risk assessments on a first ever state-wide level utilizing HAZUS97 software developed by the Federal Emergency Management Agency (FEMA). Results were published in Open File Report-O-98-3. Earthquake Damage and Loss Estimate for Oregon incorporated a simplified ground motion amplification map to give state wide and county by county economic losses for 2 different earthquake scenarios.

A summary of the results intended for a non-technical audience was published in 1999 as Special Paper 29 (WSSPC 2000 National Award in Excellence for Research Projects) and it has received a great deal of public attention. HAZUS provides a powerful tool to bridge hazard information and economic exposure in Oregon and has served as a catalyst for discussion, planning and mitigation. DOGAMI is working on county level risk assessments which incorporate ground motion amplification, liquefaction potential, and earthquake-induced landslide maps using HAZUS99. DOGAMI is also working on building inventory improvements. The counties include:

1. **Klamath County** - Three hazard maps (ground motion amplification, liquefaction potential, and earthquake-induced landslide/rockslide potential) have been produced and used in the HAZUS99 risk assessment of Klamath County. Using the 1993 Klamath Falls earthquake scenario, estimates showed damage to about 3,500 buildings, with economic losses of about \$36 million, and several injuries, which are in the same range as the reported damage and losses during the actual 1993 earthquakes. A second scenario earthquake of M 6.0, located at the Klamath Falls City center, estimated damage to about 10,000 buildings, with economic losses of about \$246 million, and about 50 injuries and deaths.

2. **Tillamook County** - This FEMA funded Project Impact study is ongoing. The HAZUS99 preliminary estimates were presented at the GSA Penrose Conference in June. The M8.5 Cascadia earthquake model predicts damage to 13,000 buildings with economics losses of about \$200 million.
3. **Benton County** - DOGAMI is also currently working on seismic risk assessments through a Project Impact grant similar in scope to the Tillamook County project.

EDUCATION

Intensive public education efforts along the coast of Oregon have resulted in an increased understanding of the earthquake and tsunami threat by local governments, businesses and the general public. DOGAMI and OEM have provided the expertise and hardware for coastal communities to designate and post tsunami evacuation routes. Local workshops, town-hall meetings and press conferences continue to keep coastal residents informed with the latest information on earthquake, tsunami and landslide hazards. DOGAMI has also opened a coastal field office to better serve this vulnerable population.

An earthquake and tsunami educational curriculum has been developed and distributed free for grades K – 12 that is appropriate for coastal and inland schools. DOGAMI has partnered with the Red Cross to distribute other educational and informational materials to the general population and DOGAMI's retail outlet, the Nature of the Northwest Information Center, distributes earthquake, tsunami and landslide information free of charge. The Department also co-sponsors with OEM an annual state-wide Duck, Cover and Hold Drill broadcast over the emergency alert system.

DOGAMI staffers continue to present the latest research to private and public sector groups across the state, in venues ranging from campground chats to legislative hearings. Quarterly publications Oregon Geology and the new Cascadia provide thousands of subscribers in Oregon and beyond the latest geologic information on earthquakes and tsunamis. News conferences to announce new publications attract substantial media coverage. A newly revised website will also provide a wealth of information on earthquake and tsunami hazards and current department efforts.

PARTNERSHIPS

With great effectiveness, DOGAMI has formed partnerships with federal, state, and local governments, private organizations, and concerned citizens to disseminate information on earthquake hazards and risks and to facilitate long range planning and mitigation, including:

1. **Federal Government** - DOGAMI is working with several federal agencies on seismic hazard and risk assessments in Oregon, including a lifeline project with the USGS in southern Willamette Valley and the previously mentioned FEMA Project Impact studies.
2. **State Government** - DOGAMI has built an active partnership with the Oregon Emergency Management Agency (OEM) in seismic hazard and risk mitigation and helped to develop the State of Oregon Natural Hazards Mitigation Plan. DOGAMI is helping the Oregon Department of Land Conservation and Development (DLCD) to develop the Seismic Technical Resource Guide as a tool for local governments to self-evaluate seismic hazards in their communities (Statewide Planning Goal 7). The agency is also working with the Oregon Department of Administration Services (DAS) to identify seismic hazards and risks to state-owned facilities.
3. **Local Government** - DOGAMI is a Project Impact partner in Tillamook and Benton

Counties in providing seismic hazard and risk information for the counties to guide their planning and mitigation efforts. DOGAMI continues to partner with the communities along Oregon coast to plan for and mitigate tsunami hazards. The department is also actively involved in communities throughout Oregon as a resource for understanding earthquake hazards and risks.

4. Other organizations - DOGAMI is working with the Institute of Business and Home Safety (IBHS) for Oregon to be recognized as a showcase state for seismic hazard and risk mitigation. Earlier this year the agency co-sponsored an earthquake and tsunami hazards and mitigation workshop for the coastal lodging industry and additional workshops are planned throughout the state. DOGAMI also participates in CREW activities.

CONTACTS AND GENERAL INFORMATION

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Information on Oregon's outdoor recreational opportunities, geology and scenery, plus the largest selection of maps in the Northwest and any DOGAMI publication is available from the Nature of the Northwest Information Center, jointly operated by DOGAMI and the USDA Forest in the State Office Building in Portland.

**Nature of the Northwest Information Center
800 NE Oregon St. #5, Portland, OR 97232
Info@naturenw.org or www.naturenw.org
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For more information on upcoming events and current projects, contact James Roddey at 800 NE Oregon St., Portland, OR 97232, (503) 731-4100, ext. 242, james.roddey@state.or.us, or DOGAMI field offices at 1831 First Street, Baker City, (541) 523-3133, 5375 Monument Drive, Grants Pass, (541) 476-2496, the Coastal Field Office, 313 SW 2nd, Suite D, Newport, (541) 574-6642 and the Mined Land Reclamation Program, 1536 Queen Avenue SE, Albany, (541) 967-2039.



The Oregon Department of Geology and Mineral Industries is headquartered in Portland and is an independent agency of the State. It has a broad responsibility in developing a geologic and engineering understanding of natural hazards, then applying this information to help mitigate the risks of earthquakes, landslides, floods, and tsunamis. The Department is also the lead state regulatory agency for mining, oil, natural gas and geothermal exploration.

