State of Oregon
Department of Geology and Mineral Industries
Vicki S. McConnell, State Geologist

Open-File Report

OFR O-04-21

Sustainable Practices at Oregon Universities: Reducing Earthquake Risks and Improving Energy Efficiency in Buildings

by:

Robert Simonton[1], Yumei Wang[2], and Beau Dickey[3]

2004

[1]Oregon University System, P.O. Box 3175, Eugene, OR, 97403-0175
[2]Oregon Department of Geology and Mineral Industries, 800 NE Oregon Street, #28, OR 97232
[3]Oregon University System, P. O. Box 751, Portland, OR, 97207-0751

NOTICE

The Oregon Department of Geology and Mineral Industries is publishing this paper because the information furthers the mission of the Department. To facilitate timely distribution of the information, this report is published as received from the authors and has not been edited to our usual standards.

Oregon Department of Geology and Mineral Industries Open-File Report
Published in conformance with ORS 516.030

For copies of this publication or other information about Oregon's geology and natural resources, contact:

Nature of the Northwest Information Center
800 NE Oregon Street #5
Portland, Oregon 97232
(503) 872-2750
http://www.naturenw.org

Sustainable Practices at Oregon Universities

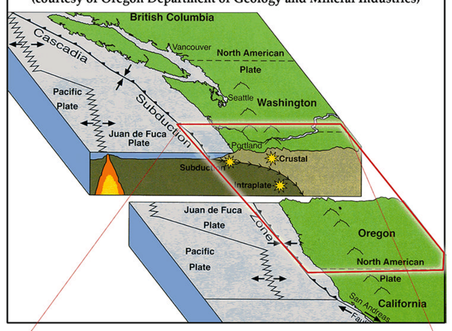
Reducing earthquake risks and improving energy efficiency in buildings

by Robert Simonton[1], Yumei Wang[2], and Beau Dickey[1]

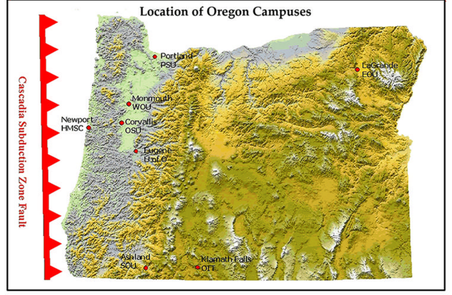
(1) Oregon University System (2) Oregon Department of Geology & Mineral Industries

Introduction

Pacific Northwest earthquake setting. Map and cross section showing the Cascadia Subduction Zone (courtesy of Oregon Department of Geology and Mineral Industries)



Location of Oregon Campuses



Oregon University System has over 100,000 students, employees, and visitors across seven state campuses. Over 1,000 buildings are maintained by the OUS facilities department.

OUS increases sustainability in buildings by:
1) Reducing earthquake hazards
2) Increasing energy efficiency

Operating university buildings efficiently by improving earthquake life-safety, limiting property damage caused by earthquake shaking, and reducing high energy consumption and operating costs are OUS's primary sustainable practice targets.

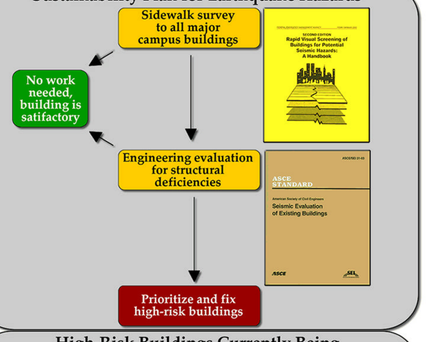
Lower Earthquake Risks

Goals:
- Protect lives & property damage control
- Survey, prioritize & fix buildings

One of the greatest threats to Oregon is a large earthquake on the offshore Cascadia subduction zone. OUS's sustainability plan on reducing earthquake risks is threefold: protects lives, limits property damage and minimize impact on campus activities. This cost-effective plan focuses on strengthening weak buildings from destructive earthquakes. The strategy includes:

1) Preliminary sidewalk surveys to identify potentially vulnerable buildings (FEMA 154 method) and geologic hazards (e.g., liquefaction and landslides)
2) Engineering surveys to identify specific structural deficiencies (ASCE 31 method)
3) Prioritization of high-risk buildings
4) Long term schedule to strengthen high-risk buildings that also have other needs (e.g., energy inefficiencies, deferred maintenance, ADA)
5) Conduct demonstration projects (see photo insets)
6) Strengthen buildings by 2032 with stable funding source

Sustainability Plan for Earthquake Hazards



High-Risk Buildings Currently Being Strengthened with DHS-FEMA Earthquake Funds

PSU Ondine Residential Hall: Renovation to improve structural earthquake deficiencies

PSU Montgomery Residential Hall: Highly vulnerable historic brick URM building

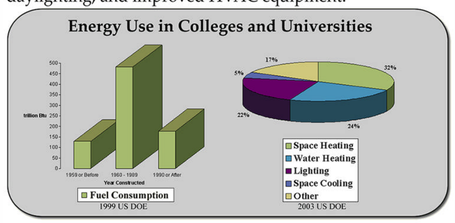
OIT Snell Hall: Damage to numerous campus buildings in 1993 quakes

Increase Energy Efficiency

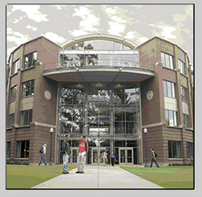
Goals:
- Consume less and lower operational cost
- Executive Order 03-03

Over half of all OUS facilities were constructed within a 15-year time frame between 1960 and 1975.This rapid growth was in response to the "Baby Boom" generation. Now, 30 to 45 years later, the subsystems in these buildings are simply worn-out and require replacement. Part of the replacement process includes sustainable alterations. In regards to energy end use, this will achieve savings of 30% or more by using components such as control systems, efficient lighting, daylighting, and improved HVAC equipment.

Energy Use in Colleges and Universities



To reach OUS sustainability initiatives, green building design is becoming an integral part of OUS capital construction. On average, buildings are responsible for 40% of global energy consumption. In contrast green buildings have less impact on the natural environment and are more energy efficient with lower operating and lifecycle costs.



UO Lillis Business Complex:

The Lillis Business Complex is one of the newest additions to the University of Oregon. The architecture surpassed building code energy standards by 40%. This building incorporates solar panels, light shelves, natural day lighting, occupancy sensors, thermal mass, and natural ventilation in its design.

OSU Kelly Engineering Center:

The 146,000 sq-ft Kelley Engineering Center will be built at the heart of the engineering section of campus. Opening in the fall of 2004, this building has enough "green" building features to be certified as a LEED (Leadership in Energy and Environmental Design) Silver structure, one of the first in the Oregon University System

Summary & Future Work

OUS's sustainable practices have a significant impact on the state. OUS is increasing campus sustainability by reducing earthquake hazards and increasing energy efficiency. Several hundred major buildings need to be retrofitted to improve earthquake safety and reduce energy consumption. Stable funds need to be established to mitigate earthquake and energy deficiencies in buildings.

Long Term Seismic and Energy Plans:

To reduce earthquake risks in a sustainable manner, OUS has developed a threefold plan: protect lives, limit property damage and minimize impacts on campus activities. At the same time that the weak buildings are being strengthened, energy systems are being improved. The timeline (see below) to strengthen weak buildings from destructive earthquakes depends on available stable funding.

Preliminary Timeline:

Date	Sidewalk surveys completed	Engineering evaluations on "suspect" buildings	Retrofit weak buildings
2005	75%	<5%	<1%
2007	100%	25%	5%
2009	100%	50%	10%
2011	100%	75%	20%
2013	100%	100%	30%
2015	100%	100%	40%
2017	100%	100%	50%
2019	100%	100%	60%
2021	100%	100%	70%
2023	100%	100%	80%
2025	100%	100%	90%
2027	100%	100%	100%

Long Term Sustainable Plan:

OUS has been challenged to define, for a system of higher education institutions, what sustainability means, how it should be pursued and how it will reshape internal and external institutional relationships. OUS has set three goals:

Goal #1: Collaborative Development of Principles
Goal #2: A Framework for Sustainability Governance
Goal #3: Develop New Financing Models for Challenges that Defy Current Systems

Pursuing these goals provide a better understanding of how activities on the campuses can contribute to sustainability and ultimately achieve a brighter sustainable future.

This poster is available through Nature of the Northwest Information Center, 800 NE Oregon Street #5, Portland, Oregon 97232, (503) 872-2750; a publication list is viewable at: <http://www.naturenw.org>

OPEN-FILE REPORT OFR O-04-21