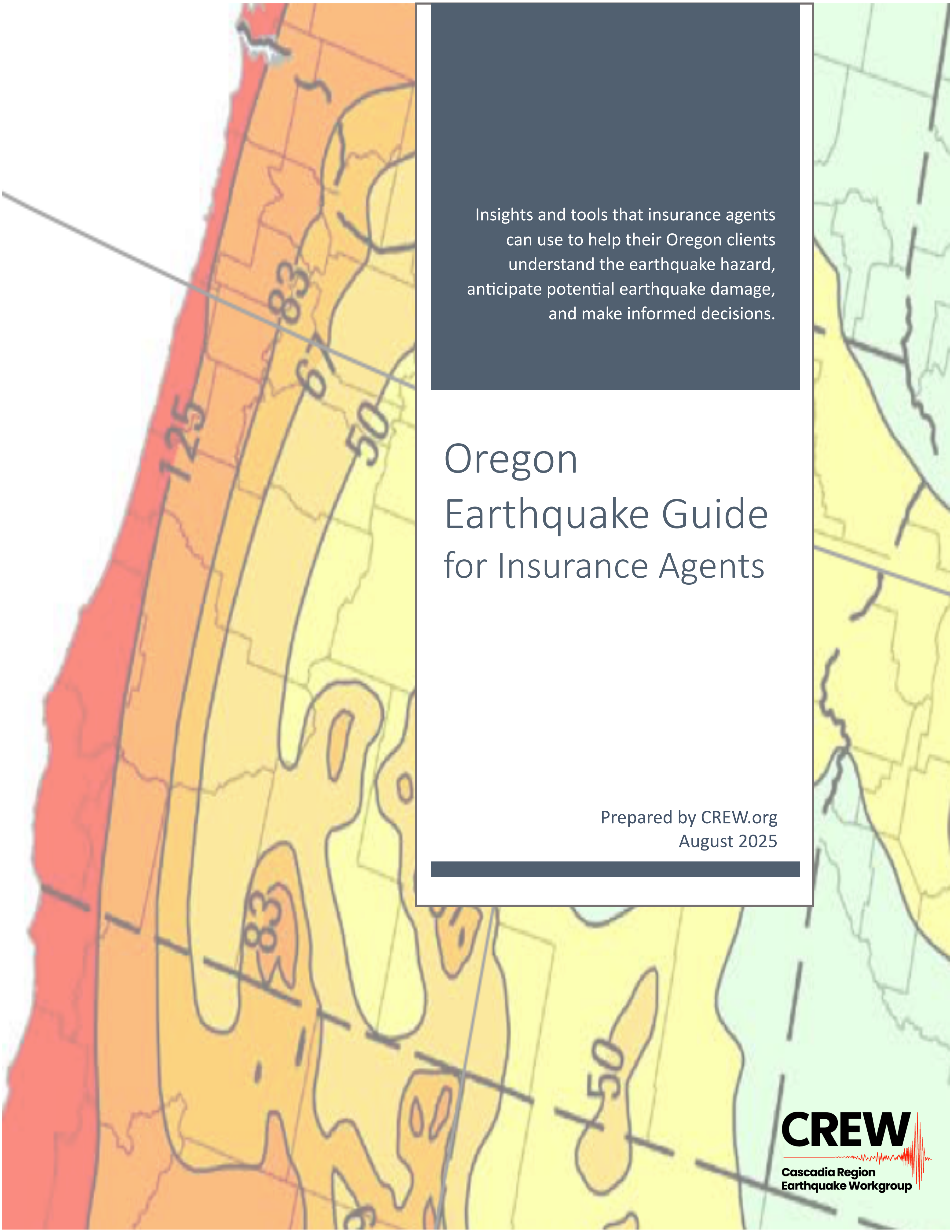


Insights and tools that insurance agents can use to help their Oregon clients understand the earthquake hazard, anticipate potential earthquake damage, and make informed decisions.

Oregon Earthquake Guide for Insurance Agents

Prepared by CREW.org
August 2025

CREW
Cascadia Region Earthquake Workgroup

Oregon Earthquake Guide for Insurance Agents

August 2025

Prepared by:

CREW | Cascadia Region Earthquake Workgroup

Pascal Schuback, Executive Director

Kyra Nourse, Project Coordinator

Funding for this publication was provided by an FY2024 grant from FEMA National Earthquake Hazards Reduction Program

Table of Contents

Part I. Know Your Earthquake Hazard

1 l Oregon’s Earthquake Hazard

What’s the Difference Between Hazard and Risk?

The term **“hazard”** refers to the presence of active earthquake faults that will cause the ground to shake when the fault moves suddenly (known as fault “slip” or “rupture”). The hazard is present whether or not people live within the area that will be affected by ground shaking.

“Risk” refers to the potential consequences of ground-shaking for people and the structures they build within an earthquake hazard area.

So, if a building or other structure was built in an earthquake hazard area, it is at risk. How high the risk is—and how serious the damage caused by an earthquake—will depend on a number of factors, most notably:

- The strength of earthquake shaking.
- The type of ground the structure was built on.
- The design of the structure.
- Any retrofitting that may have been done to improve an existing structure’s ability to withstand the effects of shaking.
- The measures taken to secure furnishings and other non-structural parts of the building to prevent them from moving, falling, or breaking during an earthquake.

Where Do Earthquakes Occur in Oregon?

Types of Earthquakes in Oregon

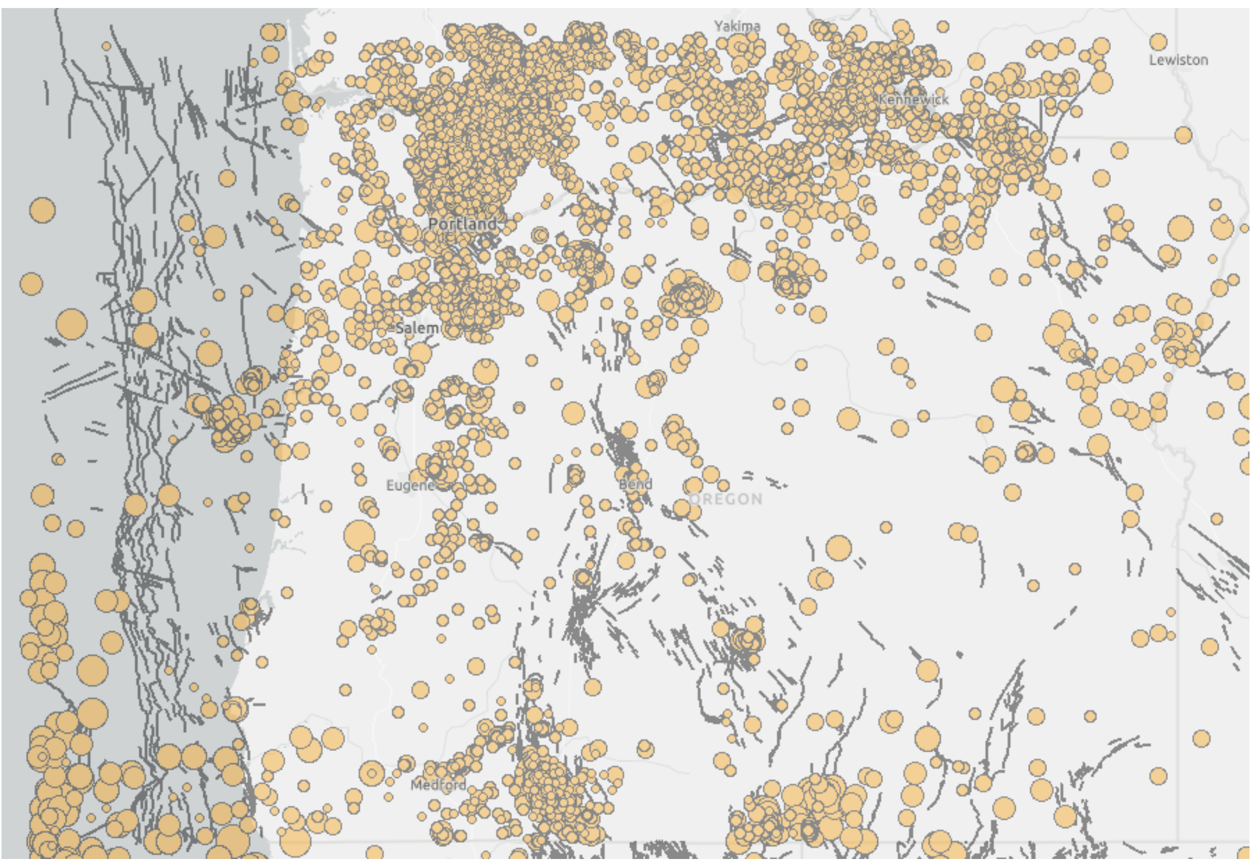
Oregon experiences earthquakes from a number of sources:

- The ***Cascadia subduction zone*** stretches from northern California to southern British Columbia. Along this zone, tectonic plates collide: the oceanic plates are slowly pushed beneath the North American plate. Because the plates tend to stick, their motion isn’t smooth and easy. Instead, pressure builds up until it overcomes the sticking point: then the subduction zone ruptures; the size of the earthquake depends on the extent of the rupture. The Cascadia subduction zone is capable of producing very large earthquakes—as large as magnitude 9.0—which can last several minutes and trigger a tsunami. To learn more, visit the *Cascadia Subduction Zone* webpage and see the fact sheet *Cascadia*

[Earthquake and Tsunami Knowledge Points for Emergency Managers and the Public (PDF)]() by the Oregon Department of Geology and Mineral Industries.

- Other more common earthquakes are generated by faults of varying depths that cut across Oregon:
  - **Shallow/crustal earthquakes**, such as the Scotts Mills earthquake (magnitude 5.6) and the Klamath Falls earthquake sequence (magnitudes 5.9 and 6.0), which struck Oregon in 1993.
  - **Deep earthquakes**, like the magnitude 6.8 Nisqually earthquake in Washington in 2001, which occur along the subducting oceanic plate beneath Oregon.

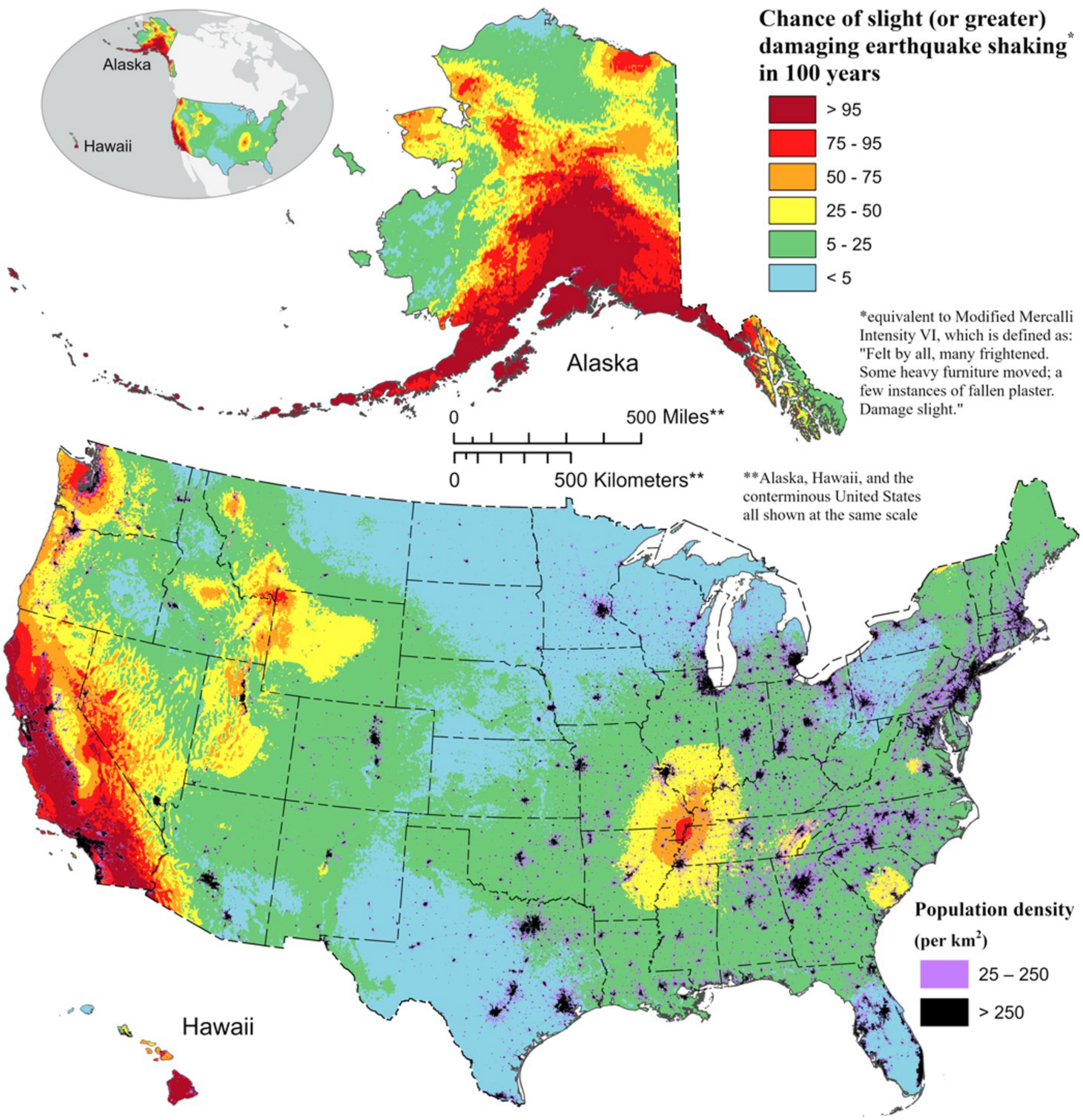
Aftershocks. The main shock of an earthquake is followed by aftershocks, which vary in size and typically continue over a period of months, decaying exponentially over time. Some aftershocks may be strong enough to cause additional damage; in certain cases, an aftershock may be more damaging than the main shock. (Deep earthquakes are an exception, as they are more likely to be followed by aftershocks that can be detected by seismometers but are rarely felt by people.)



Where Do Earthquakes Occur in Oregon? This map of Oregon is from HazVu, the statewide geohazards viewer; it shows two features of the Earthquake Hazard map layer: past earthquake epicenters, 1971–2022 (shown as circles, with different sizes indicating magnitude), and known active faults (shown as dark gray lines).

Modeling the Earthquake Hazard in Oregon

It isn't possible to predict where a fault will rupture or when an earthquake will occur, but modeling based on geologic evidence and research can help define the hazard and shed light on potential ground shaking in different regions. The map below comes from the [2023 update of the US National Seismic Hazard Model](). Color-coding indicates the chance that damaging shaking (measuring VI or above on the [Modified Mercalli Intensity scale]()) will occur over the next 100 years. The National Seismic Hazard Model is produced using the best available science and is regularly updated to incorporate new discoveries and the latest research.



What Are the Odds?

Earthquakes cannot be predicted, so geologists use the best available scientific data to estimate the chances of earthquake shaking—of varying strengths and frequencies—within specified timeframes in different places across the United States. The results are then used to produce National Seismic Hazard Maps. Most probability estimates are based on the average rate of earthquakes over long periods of time in the mapped locations.

Oregon's Tsunami Hazard

A tsunami is a series of waves that follows on the heels of an earthquake when the ocean floor above the fault rupture is lifted abruptly upwards. Oregon's Pacific coastline is vulnerable to both distant- and local-source tsunami waves.

- **Distant tsunamis** are triggered elsewhere around the Pacific, such as by a large subduction zone earthquake off the coast of Alaska or Japan: the tsunami waves from a distant earthquake travel across the Pacific Ocean to Oregon's coast, where they may cause flooding and unusually strong currents.
- **Local tsunami** waves can be caused by an underwater landslide near the shore, but the largest tsunamis are triggered by a major earthquake along the Cascadia subduction zone, which lies just off Oregon's coast.

The tsunami inundation zone includes low-lying coastal land and typically extends inland along bays, inlets, and riverbeds. The Oregon Department of Geology and Mineral Industries (DOGAMI) publishes maps of Oregon's tsunami inundation zones for both distant and local tsunamis: Go to the Oregon Tsunami Clearinghouse to access maps and learn more.

For More Information….

- *Earthquakes in Oregon* webpage, Oregon Department of Geology and Mineral Industries (DOGAMI) | Oregon.gov
- Oregon HazVu webpage | access the statewide hazards viewer; see also *Appendix A*
- *Recent Earthquakes in the Pacific Northwest* webpage | Pacific Northwest Seismic Network (PNSN)
- *Oregon Tsunami Clearinghouse* webpage, Oregon Department of Geology and Mineral Industries (DOGAMI) | Oregon.gov
- *Living with Earthquakes in the Pacific Northwest* by R. S. Yeats| Oregon State University

Go back to Table of Contents

2 | Examples of Damaging Earthquakes in Oregon

Klamath Falls Earthquake Sequence (1993)

Two shallow/crustal earthquakes occurred on the evening of September 20, 1993: a magnitude 5.9 quake was followed a little more than two hours later by a magnitude 6.0 earthquake.

The shaking damaged buildings in the town of Klamath Falls (located about 12 miles away from the source of the quakes), causing masonry to crack, chimneys to fall, and parapets to collapse. Some houses were shifted off their foundations. Aftershocks continued for some three months, including one measuring magnitude 5.4.

Scotts Mills M5.6 Earthquake

The magnitude 5.6 Scotts Mills earthquake struck at 5:34 a.m. on March 25, 1993, near the town of Scotts Mills in Marion County. This quake was widely felt: as far south as Roseburg in Douglas County, Oregon, and as far north as Seattle, Washington. Damage to structures in communities near Scotts Mills included toppled chimneys and the partial collapse of unreinforced masonry walls. Other "non-structural" impacts included broken windows and items damaged when they fell from shelves.

Stateline M6.0 Earthquake (Milton-Freewater)

The magnitude 6.0 earthquake that shook up northeastern Oregon and southeastern Washington in 1936 is the largest historical earthquake reported in that area of Oregon. The intensity of shaking was strongest around Milton, Stateline, and Umapine. The quake caused changes in the flow of well water. Damage to structures included fallen plaster, broken windows, cracked walls, and cracked and fallen chimneys. Several houses were shifted off their foundations. Some unreinforced masonry buildings were severely damaged and some collapsed. People also reported damage to furniture that was overturned, and broken dishes and other items that were thrown to the ground.

Cascadia Subduction Zone M9.0 Earthquake

The last major rupture of the Cascadia subduction zone—an approximately 700-mile-long fault zone lying off the coast of northern California, Oregon, Washington, and British Columbia—occurred in January of 1700. The resulting magnitude 9.0 earthquake is known from geologic and archaeological evidence, tree-ring dating, oral histories of Native American and First Nation peoples, and a Japanese record of a mysterious tsunami that struck the coast of Japan at that time. In the Pacific Northwest, the earthquake caused intense ground shaking that lasted for several minutes, ground subsidence, and devastating flooding from a local tsunami.

Learn more: *M9.0 – The 1700 Cascadia Earthquake* (USGS Earthquake Hazards Program)

A Glimpse into Potential Future Earthquake Impacts

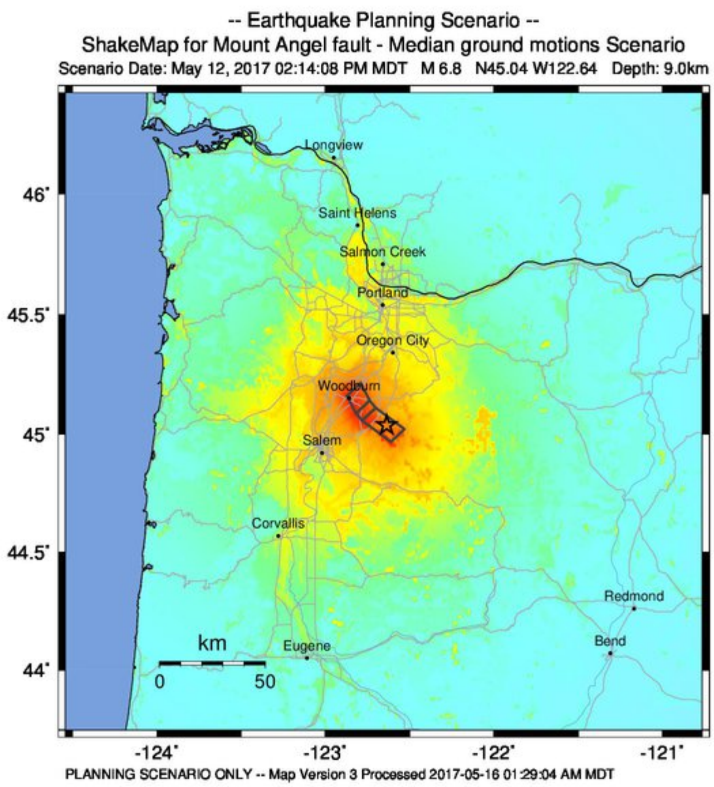
In addition to looking at historical earthquakes to understand what kinds of damage earthquakes cause, it can be helpful to examine how various future earthquake scenarios are likely to impact people, buildings, and infrastructure. These types of assessments are chiefly used by community and emergency planners; but the window into potential earthquake effects that such assessments provide can help anyone to visualize local, community-wide impacts, such as number of buildings likely to be damaged. Appendix B provides links to recent hazard risk assessments for counties and communities in Oregon.

Go back to Table of Contents

Part II. Earthquake Damage & Costs

3 | Severity of Expected Earthquakes

While it isn't possible to predict when an earthquake will happen, hazard geologists work to identify active earthquake faults, and they study evidence from past earthquakes to understand both what sizes of earthquakes could occur in the future and how likely they are to happen. Geologists also study how different soils and landscapes behave during an earthquake, which can help people anticipate the potential effects of ground shaking in a given place.



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	<0.02	0.1	1.4	4.7	9.6	20	41	86	>178
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2012)

Earthquake "scenario" maps are one of the tools that geoscientists create to help people understand and plan for potential earthquakes along a given fault. This map (left) illustrates a possible scenario for a future magnitude 6.8 earthquake on the Mt. Angel Fault near Scotts Mills in Marion County, Oregon.

Magnitude vs. Intensity

"**Magnitude**" is an objective measure of the size of the earthquake at the site of the fault rupture. When an earthquake occurs, the earthquake's size is measured by seismographs, and the final number is calculated using a magnitude scale (such as the *moment magnitude scale*). For example, the 1993 Scotts Mills earthquake had a magnitude of 5.6.

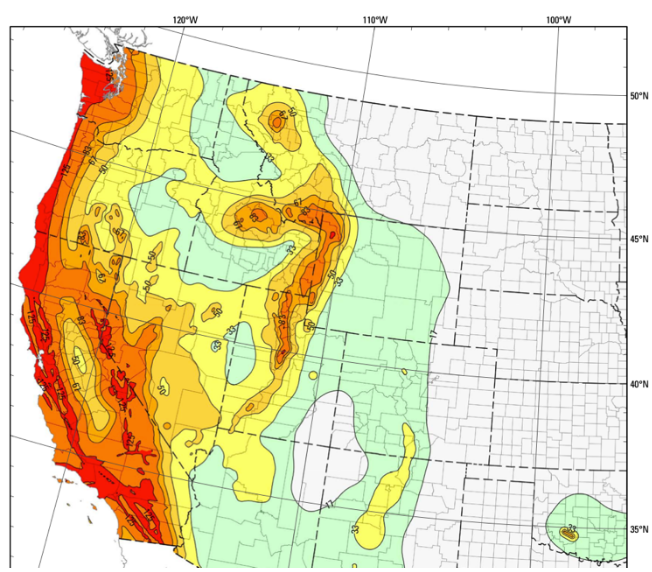
As a measure, think of magnitude as akin to the watts of a lightbulb: wattage indicates how much energy is used, not how the light that results will illuminate or cast shadows in different spaces of a room. While we may generally expect a larger magnitude earthquake to cause stronger shaking than a smaller one, magnitude is not a measure of the strength of the shaking ("**intensity**") that people will experience or the amount of damage caused—these factors vary depending on both the local geology (particularly the type of soil) and how near people and structures are to the source of the earthquake. In the US, an earthquake's intensity is measured using the Modified Mercalli Intensity (MMI) scale: the resulting measurements are subjective (based on local observations of shaking and damage), and they differ from place to place.

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

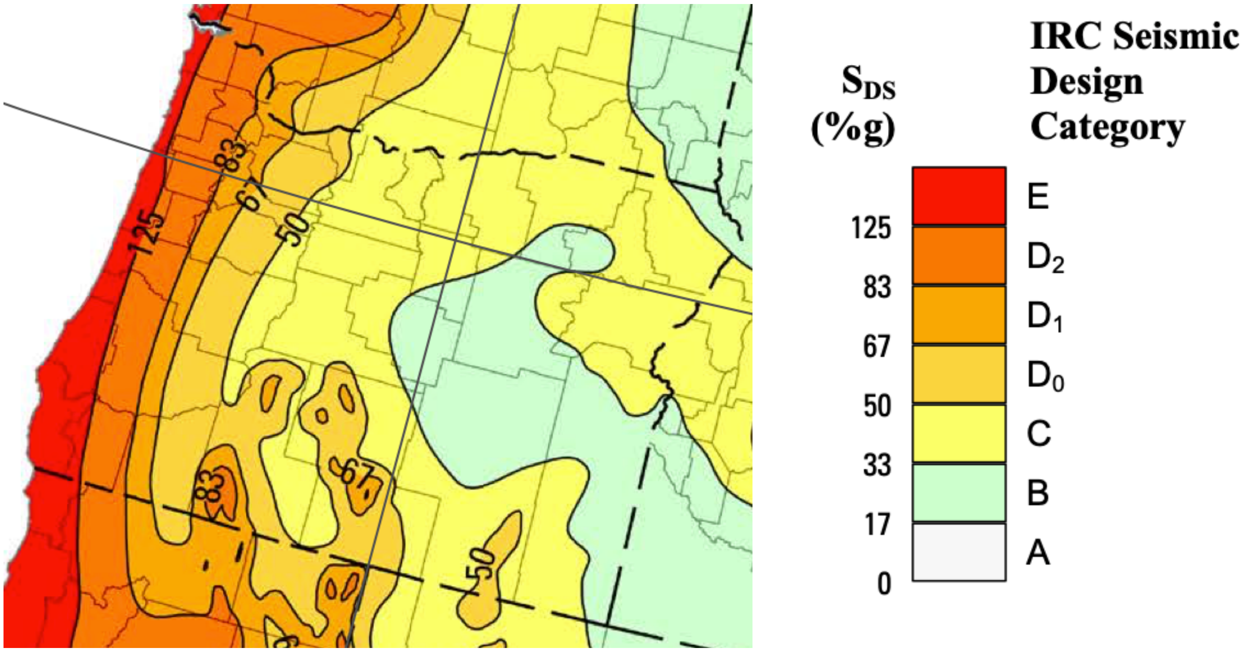
The Modified Mercalli Intensity scale, including abbreviated descriptions of the types and degrees of damage associated with each level. (Source: US Geological Survey)

How Intense Could the Shaking Be Here?

One way to get an idea of the level of possible shaking at a given location is to look up the seismic design category for that area. A **seismic design category map** is a hazard tool that shows building professionals the possible earthquake shaking across each state and territory so that they can take this into account when they design structures.



(Right) Seismic Design Category Map for International Residential Code (IRC), showing the seismic design categories for the western United States. (Source: FEMA P-2192-4)



Closeup of Oregon, showing seismic design categories across each county (Source: FEMA P-2192-4).

Leaving aside the technical details that building professionals use, a homeowner or renter can use the seismic design categories—*A* (white) through *E* (red)—to get an idea of the intensity of earthquake shaking they could experience.

Find Your County

Baker: B and C
Benton: D_2
Clackamas: C, D_0 and D_1
Clatsop: D_2 and E
Columbia: D_2 and D_1
Coos: D_2 and E
Crook: B and C
Curry: E
Deschutes: B, C, and D_0
Douglas: C, D_0, D_1, D_2 and E
Gilliam: C
Grant: B and C
Harney: B, C, and D_0
Hood River: C and D_0
Jackson: D_0, D_1 and D_2
Jefferson: C
Josephine: D_2 and E
Klamath: C, D_0, D_1 and D_2
Lake: C, D_0 and D_1
Lane: C, D_0, D_1, D_2 and E
Lincoln: D_2 and E
Linn: C, D_0, D_1 and D_2
Malheur: B and C
Marion: C, D_0 and D_1
Morrow: C
Multnomah: D_0 and D_1
Polk: D_2
Sherman: C
Tillamook: D_2 and E
Umatilla: B and C
Union: B and C
Wallowa: B and C
Wasco: C
Washington: D_1 and D_2
Wheeler: B and C
Yamhill: D_1 and D_2

Refer to the table below to see what each letter/color signifies in terms of earthquake shaking and damage.

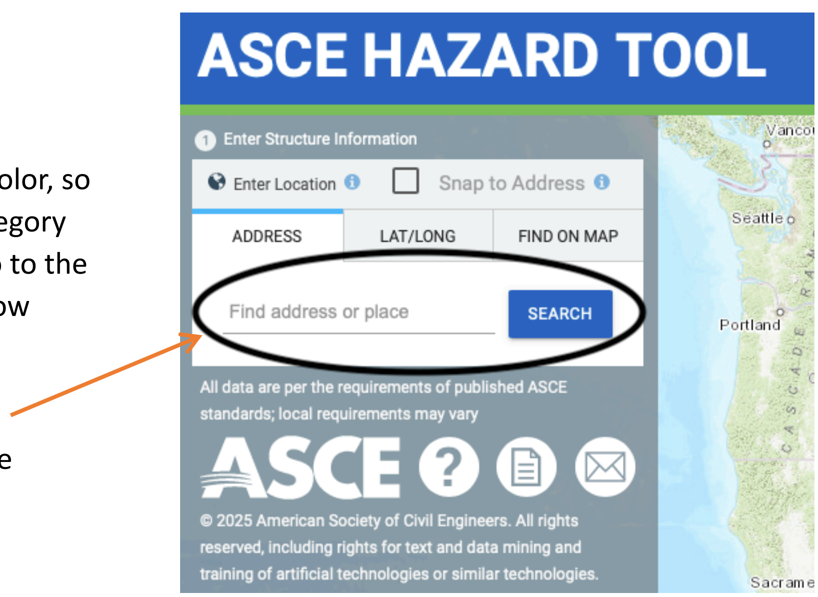
Seismic Design Category / Map Color	Earthquake Hazard	Potential Effects of Shaking	MMI*
A / white	Very small probability of experiencing damaging earthquake effects.		
B / green	Could experience shaking of moderate intensity.	**Moderate shaking**—Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.	**VI**
C / yellow	Could experience strong shaking.	**Strong shaking**—Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built structures.	**VII**
D_0 / gold **D_1** / light orange **D_2** / dark orange	Could experience very strong shaking (the darker the color, the stronger the shaking).	**Very strong shaking**—Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures.	**VIII**
E / red	Near major active faults capable of producing the most intense shaking.	**Strongest shaking**—Damage considerable in specially designed structures; frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. Shaking intense enough to completely destroy buildings.	**IX**

*MMI = [Modified Mercalli Intensity Scale]

Find the Seismic Design Category for a Specific Address

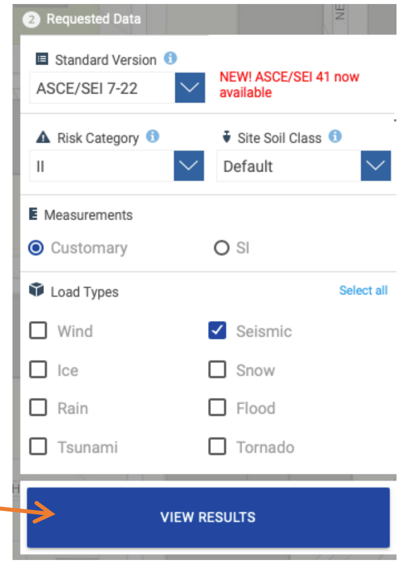
Few counties are uniformly one color, so to learn which seismic design category applies at a particular address, go to the ***ASCE Hazard Tool*** online and follow these steps:

Step 1: Type the address into the *Address* prompt and then click the **Search** button.



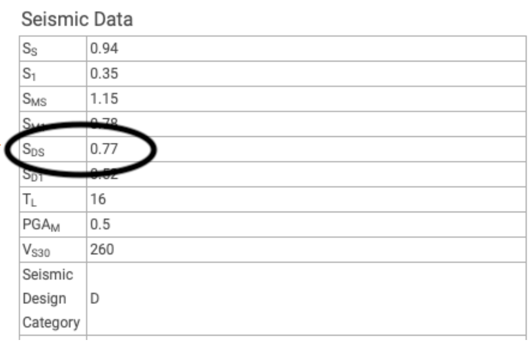
Step 2: Under ***Requested Data*** select the following settings:

- **Standard Version:** ASCE/SEI 7-22
- **Risk Category:** II *(for home or ordinary business/office buildings)*
- **Site Soil Class:** Default
- **Measurements:** Customary
- **Load Types:** Seismic



Step 3: Click the **VIEW RESULTS** button.

Step 4: Click the **SUMMARY** button; then find the S_{DS} value in the summary chart.



Seismic Data

S_S	0.94
S_1	0.35
S_{MS}	1.15
S_{M1}	0.78
S_{DS}	0.77
S_{D1}	0.52
T_L	16
PGA_M	0.5
V_{S30}	260
Seismic Design Category	D

Step 5: Use the table below to find the seismic design category that corresponds with S_{DS} value for the address that you entered.

CALCULATED S_{DS}	Seismic Design Category
S_{DS} is less than or equal to 0.17g	**A**
S_{DS} is greater than 0.17g but less than or equal to 0.33g	**B**
S_{DS} is greater than 0.33g but less than or equal to 0.50g	**C**
S_{DS} is greater than 0.50g but less than or equal to 0.67g	**D_0**
S_{DS} is greater than 0.67g but less than or equal to 0.83g	**D_1**
S_{DS} is greater than 0.83g but less than or equal to 1.25g	**D_2**
S_{DS} is greater than 1.25g	**E**

Table reproduced from content at codes.iccsafe.org

For More Information….

- Read about magnitude vs. intensity at the US Geological Survey (USGS) website.
- Find Oregon earthquake scenarios on the US Geological Survey (USGS) website: *earthquake scenarios webpage* | *interactive scenarios map*; and see **Appendix B**.

Go back to Table of Contents

4 | Anticipating Earthquake Damage

Common Forms of Earthquake Damage

- **Broken Personal Property & Inventory.** Shaking can knock items off shelves and out of cupboards and cabinets; items that fall may break or may damage whatever they fall against. Appliances, bookcases, and other unanchored furniture may move or overturn.
- **Damage to Fixtures & Non-Structural Elements of a Building.** An earthquake can break windows and non-flexible utility connections. Light fixtures may fall. Shaking may shift, disconnect, or otherwise damage a building's unsecured mechanical, plumbing, and electrical components (such as a hot water heater, air conditioner, or furnace). Some damage, such as broken gas lines, can cause a fire.
- **Building Shifted Off Its Foundation.** A wood-frame house, for example, may not be bolted to its foundation if it was built prior to the date when seismic building codes were enforced. Unless the house has been retrofitted, an earthquake could move it off its foundation. Even a small shift can cause a lot of damage and be very expensive to fix.
- **Collapse of Unreinforced Masonry.** Older masonry buildings and even wood-frame homes with brick chimneys may be vulnerable to severe damage during an earthquake:
    - **Chimneys.** Damage to unreinforced masonry chimneys is a common—and dangerous and costly—type of damage. Chimneys may crack and shift position, or they may break off entirely: a chimney could fall away from the building and onto whatever is next to it; or it could fall onto or through the roof.

I Own a House in Earthquake Country

This free brochure can be shared with insurance clients to help them imagine potential earthquake damage and expenses.

The brochure is available in both digital (PDF) and printable (trifold flier) formats in the Featured Outreach Products section of educate.insureagainstearthquakes.org

- **Parapets & Walls.** Unreinforced masonry buildings are older structures that predate seismic building codes. They may be built of brick, adobe, concrete, or stone. Earthquake shaking can cause parapets to fall to the ground and walls to crack or even separate from the structure and collapse.

> **Tips to Share with Insurance Clients.** Buildings constructed before seismic building codes were adopted and enforced may be more vulnerable to earthquake damage unless they have been retrofitted.
>
> - The county assessor's office is likely to have a record of a building's date of construction. Ask the local building department what seismic codes were enforced when it was built.
> - Consult a structural engineer or qualified contractor to learn how specifically the building could be damaged in an earthquake and what type of retrofitting they'd recommend.

Site Conditions that Can Make Damage Worse

Earthquakes can trigger other hazards that may cause greater damage. For example:

- Structures built on soft soils may experience a greater intensity of shaking than those on firmer types of ground. Soft soils typically include artificial fill and loose sediments such as soils found in river valleys and around estuaries.
- Certain types of soil can behave like a liquid when shaken by an earthquake. (This phenomenon is called "liquefaction.")
- Unanchored buildings on steeply sloping ground may be more vulnerable to damage than those on level ground.
- Some buildings may be constructed on or below existing landslides that an earthquake can set in motion.

Oregon HazVu: Statewide Geohazards Viewer includes map layers that can reveal some of these secondary hazards, including liquefaction and landslide susceptibility. (See *Appendix A*.)

For More Information….

- About retrofitting to reduce or prevent earthquake damage:
  - "From General to Particular: What an Earthquake Could Do to Your House" podcast | Ready to Recover podcast series (crew.org)
  - Home mitigation guide: Earthquake Safety at Home (FEMA P-530), pages 25–49

Go back to Table of Contents

5 I Talking About Earthquake Insurance

Points to Emphasize

Insurance agents are in a position to help people understand both the earthquake hazard and earthquake insurance. When talking with insurance clients and shoppers, here are a few points to emphasize:

- ***Standard homeowners, renters, condo, and business insurance policies don't cover earthquake damage.*** Many people think that their standard property insurance policy includes earthquake coverage.[1] Explain that:
    - No base property insurance policy covers all types of perils.
    - Damage caused by an earthquake isn't covered unless the policyholder chooses to buy earthquake insurance, either as an endorsement or as a separate policy.
    - Without earthquake insurance, all repairs and any additional living expenses resulting from earthquake damage must be paid for out of pocket.
- ***Earthquake insurance covers physical damage and loss caused by ground shaking.***
    - Explain that earthquake coverage also typically covers additional living expenses, including costs such as rent for temporary housing if the policyholder must live elsewhere while repairs are made. Note, however, that not all policies include this coverage.
    - Consider recommending that the insured's earthquake coverage limit be at least as much as their standard property policy limit.
    - Explain that some insurers may offer premium discounts for properties that meet seismic building codes.
- ***Earthquake insurance typically doesn't cover damage resulting from secondary effects of an earthquake, such as a landslide, tsunami/water damage, or fire.*** Explain that:
    - Damage and loss caused by fire may be covered by a standard homeowners or renters policy, even if the fire was caused by an earthquake.
    - Damage and loss caused by a tsunami is typically covered by a flood insurance policy, which may be purchased through the National Flood Insurance Program (FloodSmart.gov) or from private flood insurance companies.

---

[1] A consumer survey conducted by the National Association of Insurance Commissioners (NAIC) suggests that this misapprehension is common (see pp. 37 and 41 of the NAIC report).

Explain the Deductible

Insurance clients may not be familiar with how an earthquake insurance deductible works. In Oregon, the deductible is usually a percentage (typically 10–20%) of the insured amount, which may be the replacement value of the property. When speaking to clients and shoppers:

- Explain what the deductible is and how it works. Point out any separate deductibles, such as a deductible for contents or for a detached structure like a garage.
- Explain that the policyholder is responsible for paying for their repair and recovery expenses up to the amount of the deductible(s) before the insurance policy pays out.
- Explain that insurance purchasers can choose lower deductibles. Demonstrate how this choice may impact premiums and claim payments in different scenarios.

Examples to Illustrate:

Earthquake Deductibles | The Oregon Division of Financial Regulation provides a brief example.

"Understanding Earthquake Deductibles" in *A Consumer's Guide to Earthquake Insurance* (pp. 4–6) | The National Association of Insurance Commissioners offers an illustrated explanation.

A New Option for Disaster Insurance: Parametric | United Policyholders provides illustrations of both a deductible and how a parametric earthquake insurance policy might be applied toward paying the deductible of a conventional insurance policy.

For More Information….

- About earthquake insurance:
  - *Earthquake Insurance* webpage | Oregon Division of Financial Regulation
  - *Earthquake Insurance 101* (This free self-guided learning module discusses both residential and business coverage.) | CREW.org
- Free resources to help educate people about earthquake insurance:
  - educate.insureagainstearthquakes.org
  - *A Consumer's Guide to Earthquake Insurance* (PDF) | National Association of Insurance Commissioners
- About tsunami insurance: FloodSmart.gov
  - National Flood Insurance Program webpage for insurance agents
  - National Flood Insurance Program webpage for consumers

Go back to Table of Contents

Appendices

Appendix A. Oregon HazVu Help

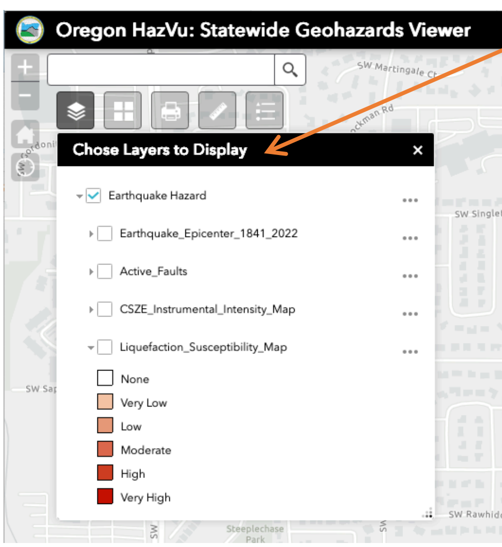
Oregon HazVu is the statewide geohazards viewer maintained by the Oregon Department of Geology and Mineral Industries (DOGAMI). It can be accessed online for free.

HazVu displays the state's geological hazards visually as layers on a map. Users can focus on a wide area or narrow their view to show a specific address; and they can choose which hazards and data to display by turning layers on and off.

How to Use HazVu

To get started, open the HazVu hazards viewer: https://gis.dogami.oregon.gov/maps/hazvu/

When first opened, HazVu displays a map of the entire state. You can manually navigate to a specific area and zoom in; or you can type an address in the search box (in the upper left corner of the viewer), and the map will zoom in for you.



You can then choose which layers you want to open by checking boxes in the "Choose layers to display" window.

If you click the small arrow icon next to a top-layer option (such as "Earthquake Hazard"), you will be able to choose additional sub-layers as well. For example, one sub-layer is "Liquefaction Susceptibility Map."

Clicking the arrow icon next to this sub-layer heading will open additional options; these options also serve as a key by showing what each color appearing on the map signifies.

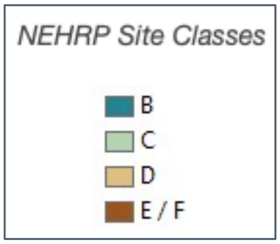
For more detailed guidance on how to use the viewer, open DOGAMI's *help page*.

Earthquake Layer and Keys in Oregon HazVu

For more complete information about what each layer contains and how to interpret the content, visit the Hazards & Assets page:
oregon.gov/dogami/hazvu/Pages/hazards-assets.aspx

Earthquake Hazards Layer

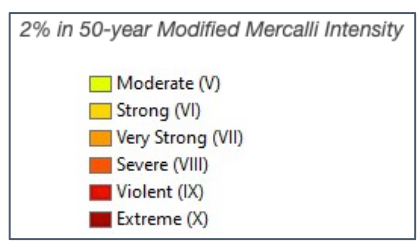
Soil Amplification: Soft or loose soil and near-surface geologic deposits can greatly amplify the shaking in an earthquake. Research sponsored by U.S. Geological Survey (USGS) and Federal Emergency Management Agency (FEMA) has defined a series of site classes that can be used to calculate the amount of amplification that will occur. **These are called NEHRP (National Earthquake Hazards Reduction Program) site classes and range from A (very hard rock, no amplification) to E (soft soil, strong amplification) and F (very soft soil with special characteristics that require detailed investigation).**



The site classes are formally defined based on the velocity of shear waves (one form of earth-quake shaking) in the upper 30 m (100 ft) below the earth's surface. Where shear wave velocity data are not available, the soil amplification map is made by assigning NEHRP class values to the best available mapping of surface layers. *Data credit: OSHD, release 1.0, Oregon Department of Geology and Mineral Industries (DOGAMI)*

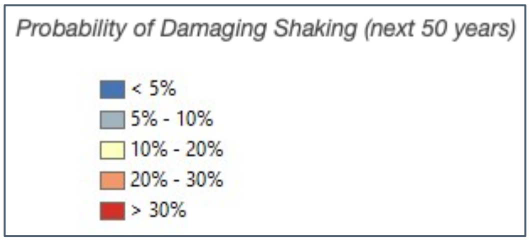
Perceived Shaking and Damage Potential: The USGS produces standardized seismic hazard maps for the nation through its National Seismic Hazard Mapping (NSHM) project. These consider all possible earthquake sources and show the strength of shaking expected at several different probability levels including 10% chance in 50 years, 5% chance in 50 years, and 2% chance in 50 years. These maps show highly technical shaking parameters that are not readily understood by a non-technical audience and that do not relate simply to general earthquake damage. The maps also do not include the amplification effects of near-surface soft soils (as described above).

DOGAMI created this derivative product that adjusts the USGS "2% in 50-year" probabilistic map using the NEHRP site classes from the statewide soil amplification map. The shaking values are based on the Modified Mercalli scale, which describes how earthquakes affect people, objects, and buildings in a general way. The "2% in 50-year perceived shaking and damage potential" map shows the level of shaking that is expected to be exceeded only once every 2,475 years, based on our current understanding. In other words, there is an estimated 98% chance that only lesser levels of shaking will be experienced in the next 50 years. The map shows the Modified Mercalli Intensity in discrete classes, but expected levels of

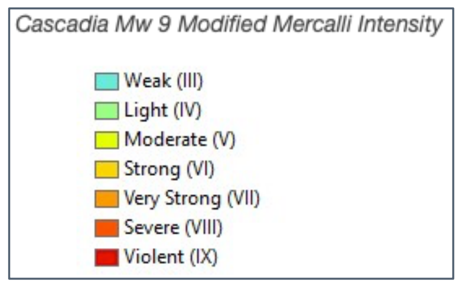


shaking vary in a more gradational way across the state. *Data credit: OSHD, release 1.0, Oregon Department of Geology and Mineral Industries (DOGAMI)*

Probability of Damaging Shaking: While the Perceived Shaking and Damage Potential map shows the highest shaking level expected at a fixed probability (once in 2,475 years), the Probability of Damaging Shaking uses the same data to show the likelihood of experiencing shaking as high as Mercalli Intensity VII in a 50-year time period. Mercalli Intensity VII is the level at which weak buildings begin experiencing considerable damage, and well-built ordinary structures have slight to moderate damage. It is meant to answer the question, "how likely am I to experience a damaging earthquake at my home, school, or workplace in the next 50 years?" *Data credit: OSHD, release 1.0, Oregon Department of Geology and Mineral Industries (DOGAMI)*

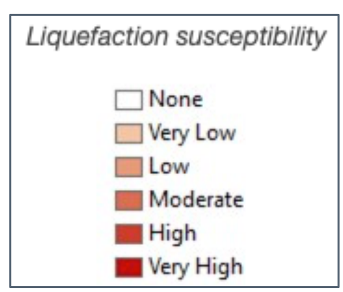


Perceived Shaking and Damage Potential, Cascadia Subduction Zone Mw9: These data show the average (median) level of shaking estimated from an ensemble of 30 models of magnitude 9 earthquakes rupturing the full Cascadia Subduction Zone (Wirth et al., 2021), updated with the more detailed Oregon soil amplification map. The shaking levels are shown as Modified Mercalli Intensity classes; stronger shaking will produce greater structural damage.



Tsunamis, or earthquake-generated ocean waves, are another major hazard associated with Cascadia subduction zone earthquakes. For more information see the Tsunami Hazard section of HazVu or the DOGAMI [Tsunami Clearinghouse]. *Data credit: OSHD, release 1.0, Oregon Department of Geology and Mineral Industries (DOGAMI)*

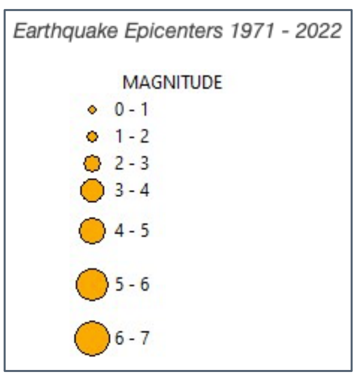
Liquefaction Susceptibility: Layers of loose sand or silt that are saturated with water commonly liquefy when shaken strongly or repeatedly by an earthquake. The liquefied materials lose most of their ability to support overlying soil layers and structures, and buildings and bridges sink and tilt, while riverbanks may slump and flow into the river channel. In many large earthquakes, much of the severe damage that occurs is due to liquefaction.
Although liquefaction is very damaging, it only affects specific geologic deposits. The liquefaction susceptibility layer shows where there are surface layers that might liquefy in a strong earthquake and how liquefaction-prone those layers are. The liquefaction susceptibility map is made by assigning susceptibility values – Very High, High, Moderate, Low, and Very Low – to the best available mapping of surface layers. Bedrock is not susceptible to lique-



faction, so all areas that are mapped as bedrock in Oregon Geologic Data Compilation are not shown. *Data credit: OSHD, release 1.0, Oregon Department of Geology and Mineral Industries (DOGAMI)*

Active Faults: Faults are considered active either when many recorded earthquakes can be accurately located and shown to be along the fault, or where the fault has moved in geologically recent times and left a mark on the landscape or in young geologic deposits.

The USGS (through its NSHM project) has compiled databases of potentially active faults in cooperation with DOGAMI and other state geologic surveys. The USGS databases/maps are based on literature and include all faults for which there is some published evidence of movement (therefore earthquakes) in the past 1,600,000 years. Further information on the estimated recency of activity is available from the USGS webpage. *Data credits: U.S. Geological Survey (USGS) and Oregon Department of Geology and Mineral Industries (DOGAMI), Quaternary fault and fold database for the United States, accessed January 27, 2023.*



Earthquake Epicenters (1971-2008): An earthquake epicenter is the point on the Earth's surface that is directly above the location where an earthquake originates. More information: PNSN/Earthquake Map.

Data credits: Pacific Northwest Seismic Network (PNSN) and Oregon Department of Geology and Mineral Industries (DOGAMI)

Other HazVu Layers of Interest

- Cascadia Earthquake Hazard Layer
- Tsunami Hazard
- Landslide Hazards

Go back to Table of Contents

Appendix B. Oregon Earthquake Assessments

The Oregon Department of Geology and Mineral Industries (DOGAMI) produced a series of reports detailing natural hazard risk assessments for specific counties in Oregon. These studies look at scenarios for multiple hazards: flooding, earthquakes, landslides, and wildfires. The assessments give emergency planners and other disaster preparedness professionals insights into how communities could be affected by a given hazard. The reports can also be useful to anyone wanting to expand their understanding of local natural hazard risks and the potential impacts of a scenario earthquake.

- Multi-Hazard Risk Report for Harney County, Oregon
- Multi-Hazard Risk Report for Linn County, Oregon
- Multi-Hazard Risk Report for Clackamas County, Oregon
- Multi-Hazard Risk Report for Douglas County, Oregon
- Multi-Hazard Risk Report for Polk County, Oregon
- Multi-Hazard Risk Report for Morrow County, Oregon
- Multi-Hazard Risk Report for Benton County, Oregon
- Multi-Hazard Risk Report for the City of Cottage Grove, Oregon
- Multi-Hazard Risk Report for Tillamook County, Oregon
- Multi-Hazard Risk Report for Marion County, Oregon
- Multi-Hazard Risk Report for Wallowa County, Oregon
- Earthquake regional impact analysis for Columbia County, Oregon, and Clark County, Washington
- Earthquake regional impact analysis for Clackamas, Multnomah, and Washington counties, Oregon
- Multi-hazard and risk study for the Mount Hood region, Multnomah, Clackamas, and Hood River Counties, Oregon

For communities and parks on Oregon's coast, DOGAMI produced assessments of the numbers of people, businesses, and critical facilities in the tsunami inundation zones and the potential damage and impacts of a scenario Cascadia subduction zone earthquake and tsunami. The 2025 report updates the previous countywide studies published by DOGAMI between 2020 and 2023.

Earthquake and Tsunami Impact Analysis for the Oregon Coast (Open-File Report O-25-01). The previous county-by-county coastal earthquake and tsunami impact analyses are also available:

- Curry County (2023)
- Lane, Douglas, and Coos Counties (2022)
- Lincoln County (2021)

- Tillamook County (2020)
- Clatsop County (2020)
- Gearhart, Rockaway Beach, Lincoln City, Newport, and Port Orford (2020)

Go back to Table of Contents

Appendix C. Acknowledgments

CREW would like to thank everyone who contributed their time and expertise to review and improve the content of this guide. In particular, we would like to acknowledge:

- Oregon Department of Geology and Mineral Industries (DOGAMI), with special thanks to Dr. Lalo Guerrero, Geology Hazards Specialist.
- Oregon Department of Consumer and Business Services, Division of Financial Regulation, with special thanks to Craig Vattiat, Consumer Education and Engagement Coordinator.
- Professional Insurance Agents Western Alliance, with special thanks to Kim Legato, Executive Vice President.
- NW Insurance Council, with special thanks to Kenton Brine, President.

Funding for this publication was provided by an FY2024 grant from FEMA National Earthquake Hazards Reduction Program

Go back to Table of Contents