



#### ABSTRACT

Subduction zone earthquakes are notorious for being among the most powerful events in nature, with examples including the 2011 magnitude 9.0 in Japan, the 2005 magnitude 8.6 in Indonesia, and the 1964 magnitude 9.2 in Alaska. Some of those areas that experienced the more recent earthquakes are still recovering from the consequences. Western Oregon is positioned on the leading edge of the Cascadia subduction zone with a documented 300-500 year recurrence interval that is coming due soon. Seismic hazards in the Willamette Valley include ground shaking, liquefaction and co-seismic landslides. Advancements in building codes, seismic retrofitting and investment in hazard reduction strategies are much needed. This paper examines the seismic hazards associated with living in the Willamette Valley and the types of strategies used to mitigate potentially disastrous effects to life and property.

### INTRODUCTION

The Cascadia Subduction zone is where the Juan De Fuca plate is subducting under the North American plate. This subduction zone spans from Northern California all the way up to Vancouver Canada, and that area has the potential to generate one of the most powerful earthquakes modern day humans have experienced. The Willamette Valley will have to deal with an almost unimaginable amount of shaking and that alone can cause destruction everywhere. One of the biggest hazards that The valley faces is Liquefaction. Both Salem and Portland are both built around rivers, and that means that the sediment is probably saturated or close to saturation. Many of the buildings in downtown Salem and Portland were built long before this potential Earthquake was known about, and if an earthquake hit today a majority of those old buildings would be destroyed. If the Willamette Valley isn't prepared properly it could take us years to recover, whereas if we are prepared then it could be months if not weeks to return functionality.



# Earthquake Hazards of the Willamette Valley

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Figure 1. The Cascadia subduction zone was discovered in the 1980's by Brian Atwater, and has the potential to produce earthquakes on the scale of the 2011 Japan or the 2005 Indonesian earthquakes.

#### **PROJECT OVERVIEW**

1.2 Million people call the Willamette Valley home, and every single person that calls this place home will be affected one way or another. These Earthquakes occur anywhere between 200 years to 1000 years apart from each other, but either way it's fair to assume that another one will happen the only question is when will it happen? A majority of those people probably live close to or near some sort of river system. Those rivers are prone to liquefaction. Liquefaction occurs when the ground is saturated with groundwater and as the seismic waves from the earthquake shake the ground becomes extremely unstable. This can cause whole buildings to topple over. Another worry for the Valley is the infrastructure, bridges and mountain passes can be destroyed in an instant, and if that happens then everyone will be trapped in the valley. Portland itself has a bunch of bridges that will most likely not withstand the amount of shaking. Without those bridges it's going to be very difficult for help to get to the people that need it. Many of the first buildings in Salem are built from brick, and they will crumble in an instant if there is any decent amount of shaking.



Figure 3. There are many different options for retrofitting buildings for earthquakes. Some of those options include cross braces (Left), counterweight, and anchoring (right).

#### DISCUSSION

The best thing that we can do is retrofit the really old buildings and bridges so that they are better prepared for when the Earthquake does happen. The best way for us to improve these old buildings is to just add more supporting structures, whether that's cross braces, walls, more pillars, and or a stronger foundation. Now the bridges are now being retrofitted with cables because it's not uncommon during an earthquake that sections of bridges fall apart because of the tension and compression waves. There are many options for retrofitting both buildings and bridges to help lessen the affects of a huge earthquake. One of the biggest problems is getting people to pay for all these upgrades; we can either pay now as a resiliency and it won't be as bad when the big one does happen and be back to normal within a couple months, or do nothing and then when this huge earthquake does happen everything is devastated and it takes much longer for the Willamette Valley

to recover.





### CONCLUSION

No one can for sure say that it will come if it even will come, but the geologic record shows that it's been happening on a cycle for thousands of years. Another massive earthquake will most likely come our way within the next 50 years. We control how prepared we are. We should look into building important buildings away from areas prone to liquefaction. Retrofitting is probably our best option for saving all of the old and important buildings and bridges. We should be proactive and pay in advanced rather than wait for the "Big One" to hit.

#### References

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