

Ready to Rock and Roll

Earthquake Preparedness in Oregon



Why we're here talking about *earthquakes and tsunamis*



Getting from here to there ...



What are the geologic hazards in Oregon?

- Earthquakes
- Volcanoes
- Tsunami
- Landslides



What are the geologic hazards in Oregon?

- **Earthquakes**
 - Cascadia Subduction Zone
 - Crustal
 - Deep Intraplate
 - Volcanic
- **Tsunami**
 - Local (from subduction zone off our coast)
 - Distant (from subduction zone elsewhere)



Everything you wanted to know about plate tectonics...



... in 30 seconds or less

- Tectonic Plates move around
- Tectonic Plates spread apart and create new land
- Tectonic Plates dive under each other
- Tectonic Plates roll over each other

SOURCE: <http://sos.noaa.gov/videos/Scotese.mov>

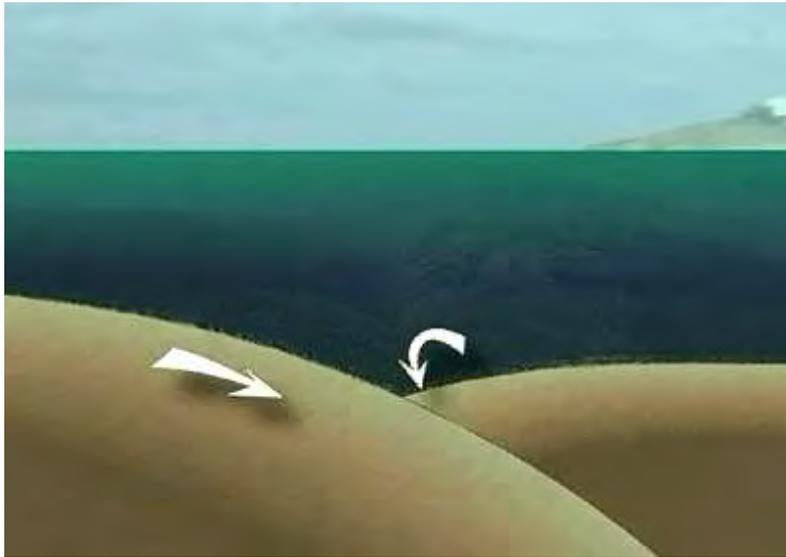


Earthquakes

- **Earthquakes** occur when rock underground suddenly breaks along a fault. This sudden release of energy causes the seismic waves that make the ground shake.



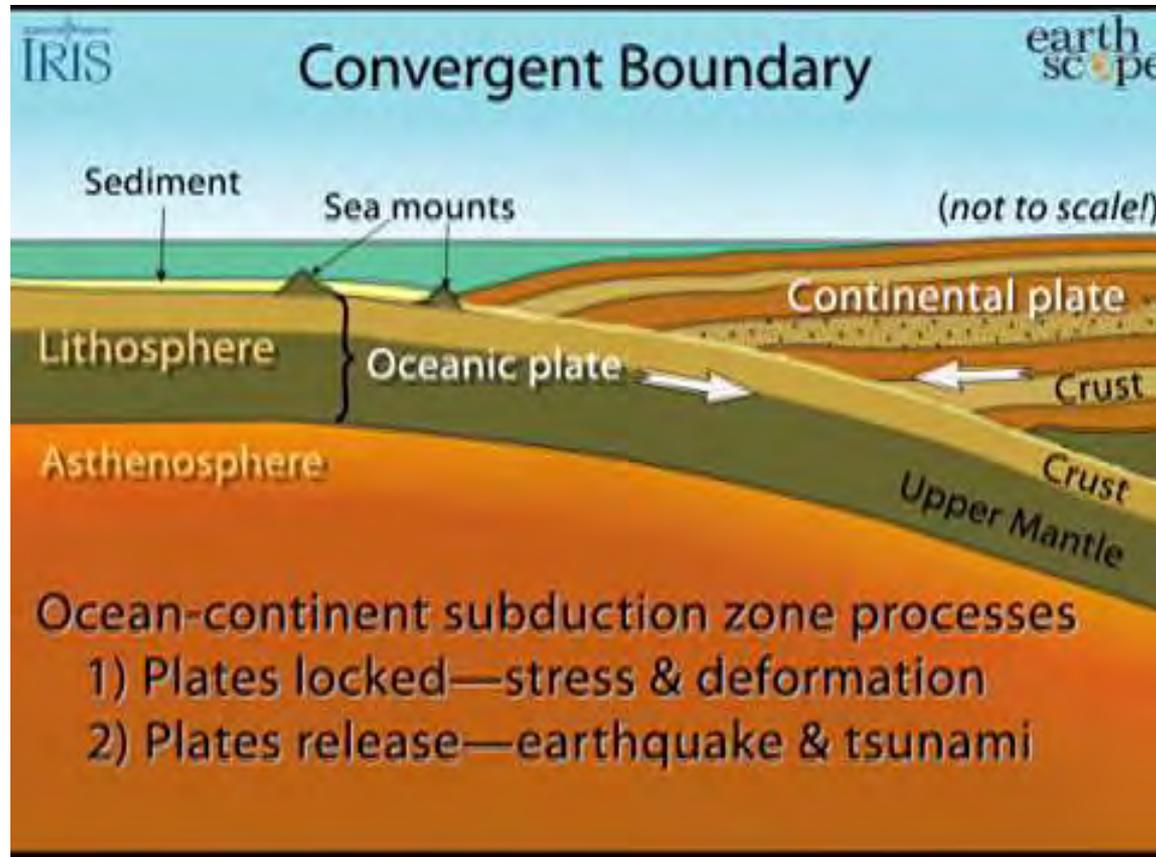
Tsunamis



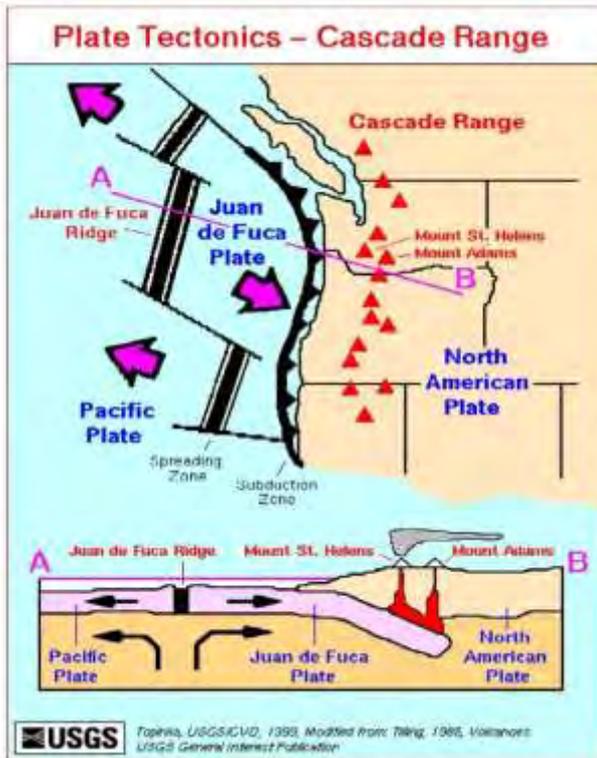
- **Tsunamis** are generated when geologic events cause large, rapid movements in the sea floor that displace the water column above.
- The **Pacific Coast is at risk** both from locally and distantly generated tsunamis.



What is the Cascadia Subduction Zone?



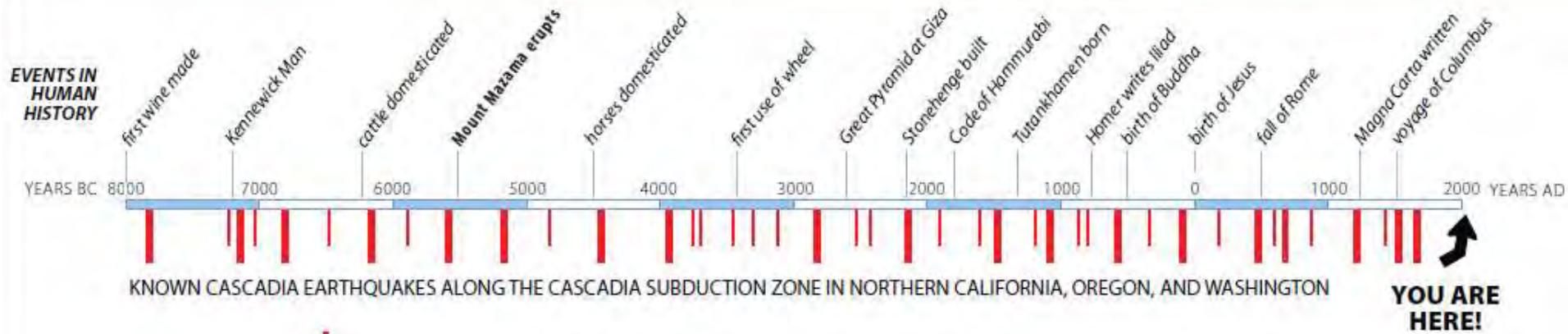
Know your Cascadia Subduction Zone



- 600 miles long, from northern California to British Columbia
- **Capable of producing very large earthquakes (M9+) that impact a wide area**
- Similar in size and impact to the 2004 Sumatra earthquake
- **Can produce devastating tsunamis**
- 37% chance of a mega-thrust earthquake in the next 50 years *

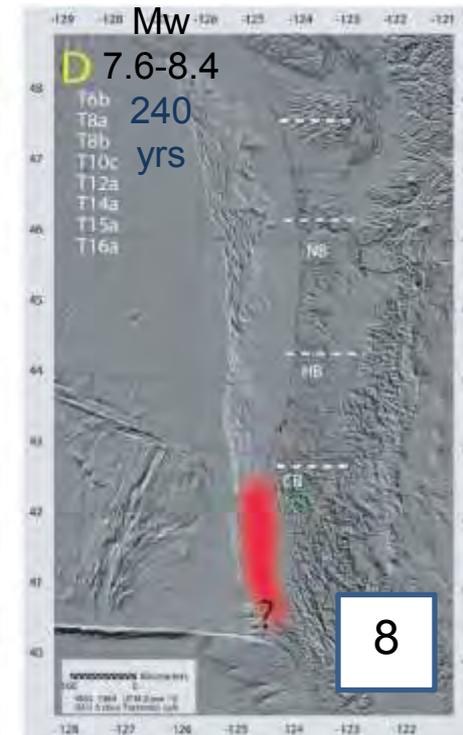
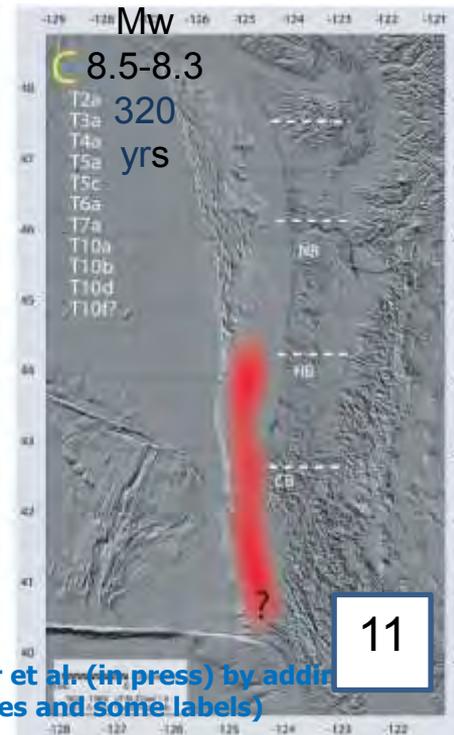
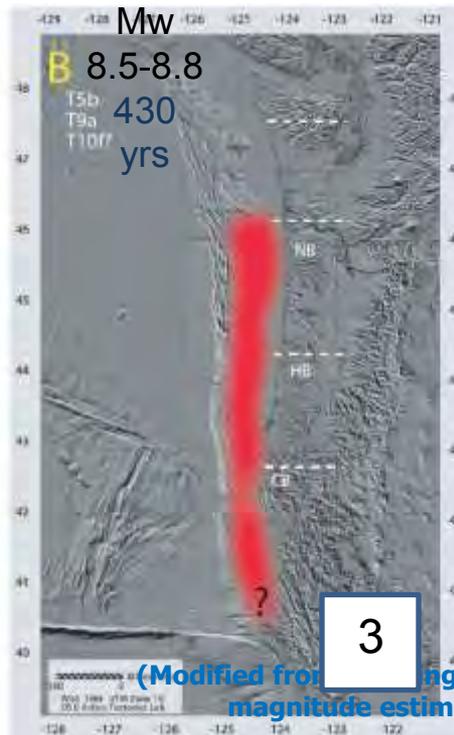
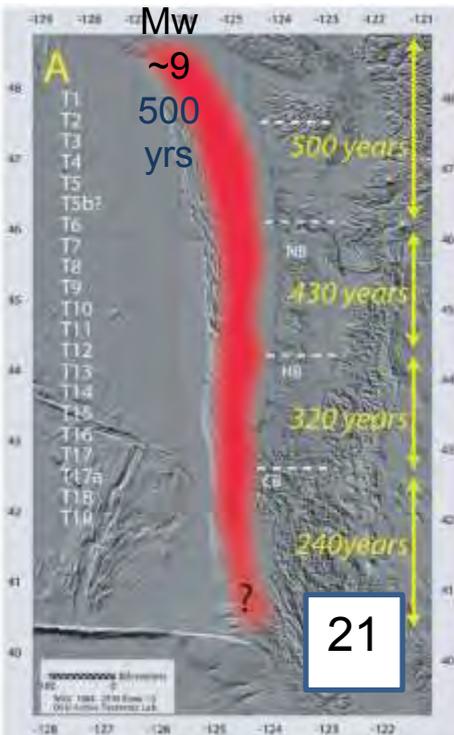


Cascadia Subduction Zone Earthquakes



Earthquake of Magnitude 9+ (fault breaks along entire subduction zone)

Earthquake of Magnitude 8+ (fault breaks along southern half of subduction zone)



(Modified from [Langer et al. \(in press\)](#) by adding magnitude estimates and some labels)

Know your Cascadia Subduction Zone



Ghost forest at Copalis River, WA

- Last Cascadia Subduction Zone earthquake occurred in 1700
- When will the next one occur?
 - We just don't know
- Average recurrence:
 - 240 years (south of Cape Blanco)
 - 5-600 years (entire length)
 - 190-1,200 years between EQ



In the last 10,000 years...

19 full
length
ruptures

22 partial
length
ruptures

- 19 earthquakes
 - 8.7 to 9.2 – really huge earthquakes.
- 22 additional
 - slightly smaller – more like 8.0 – 8.2

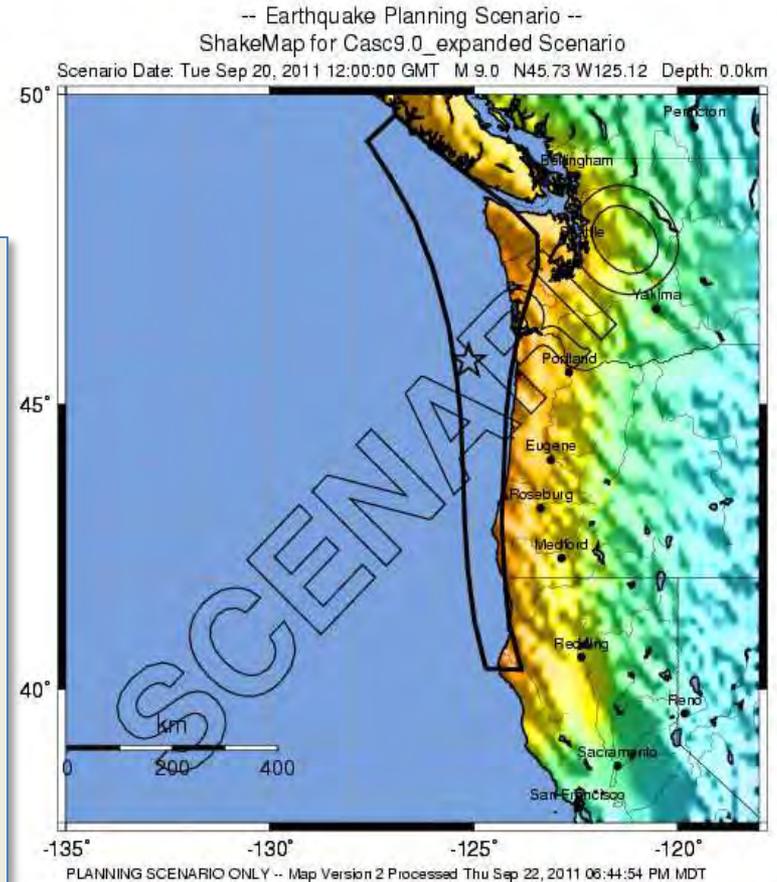
We're in the **Zone**

And it **WILL** happen again



Cascadia Planning Assumption

- Strong Ground Shaking
 - M9 w/ 2 - 4 min shaking
- Tsunami
 - within 15 to 25 minutes
- **Approximately 15 million people live in the hazard zone (CA, OR, WA, BC)**



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X



What are the hazards?

Strong ground shaking



2010 Haiti
earthquake



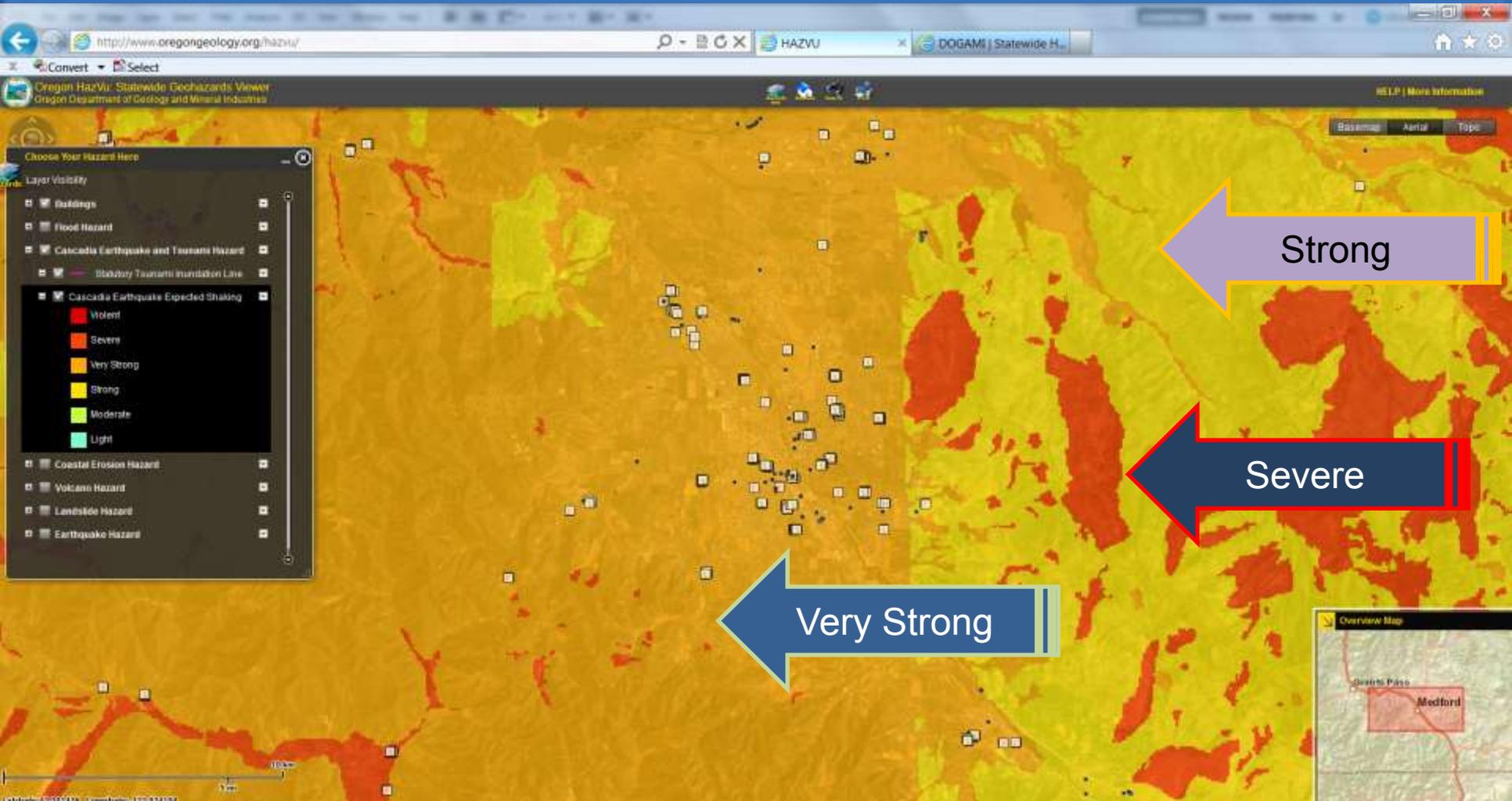
2011 Tohoku
earthquake



1993 Molalla High School



Shaking intensity - CSZ



Source: <http://www.oregongeology.org/hazvu>

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What are the hazards?

Coastal subsidence



2004 Sumatra



Mainichi Shimbun, Reuters



What are the hazards?

Landslides



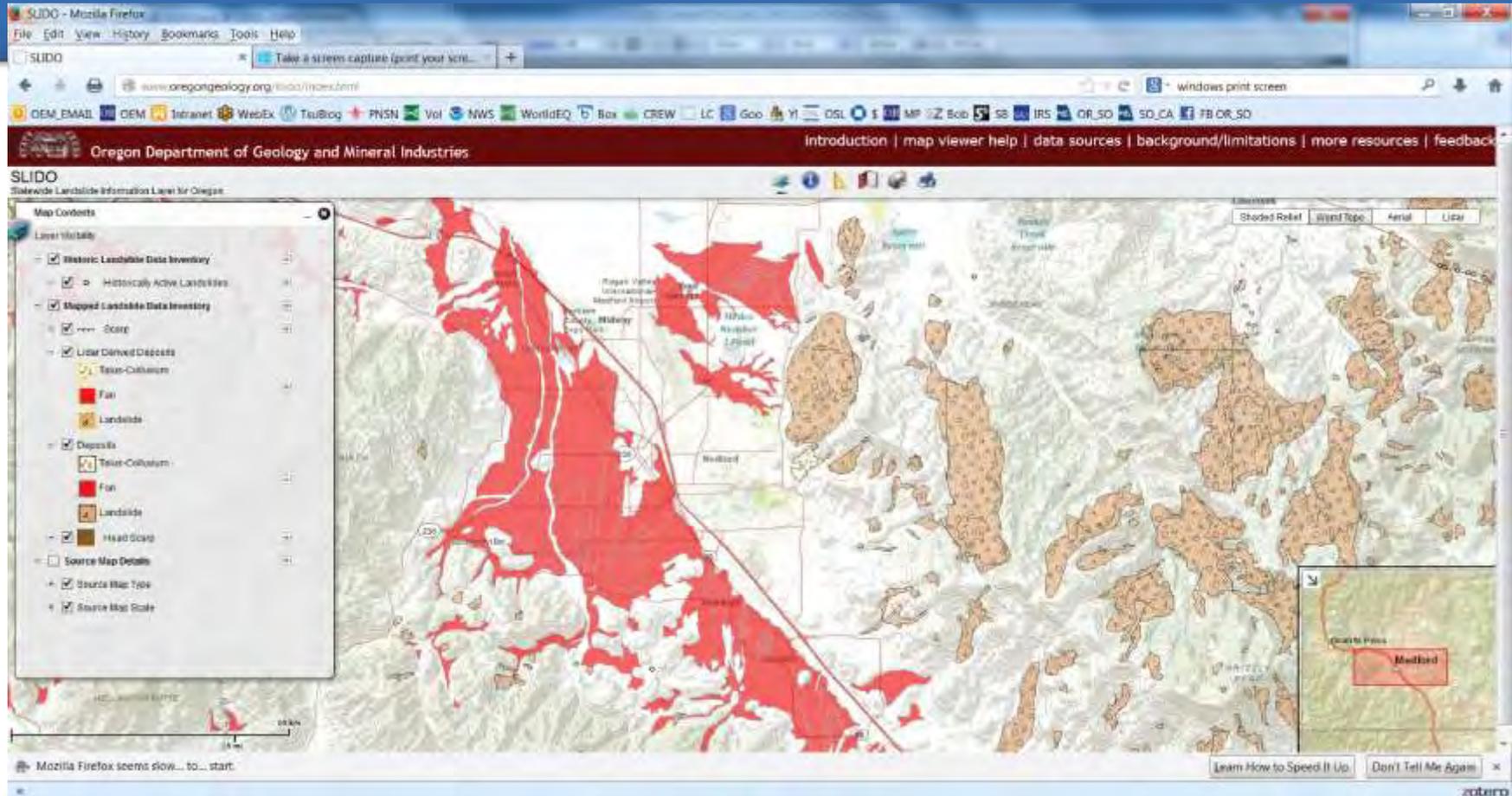
Landslides in Ferndale, WA



2010 Taiwan



Landslides in Jackson County



<http://www.oregongeology.org/sub/slido/>

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What are the hazards?

Liquefaction



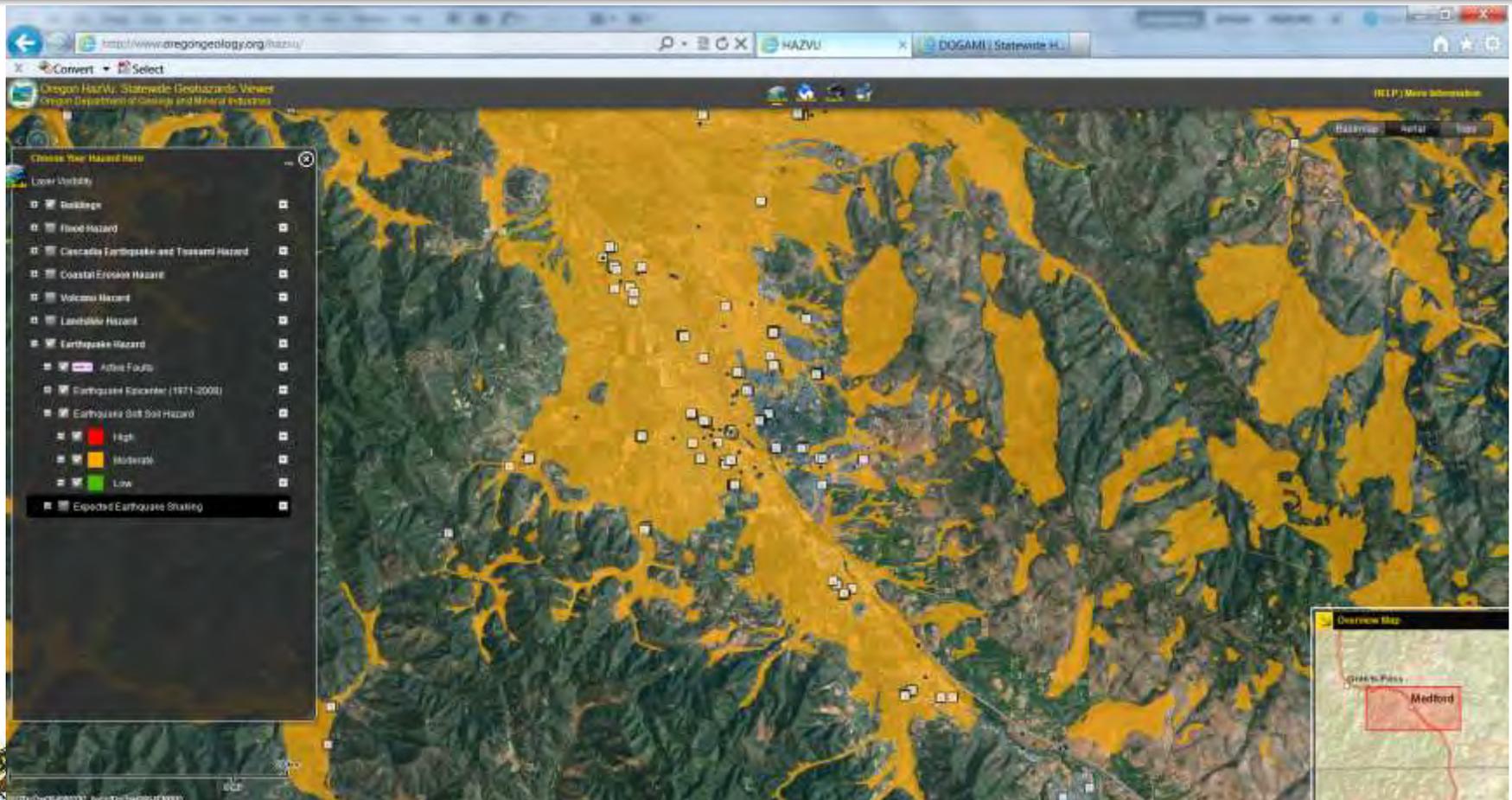
1964
Alaska



2011 Christchurch, New Zealand
Oregon Office of Emergency Management



Liquefaction



What are the hazards?

Tsunami



2004 Indonesian tsunami

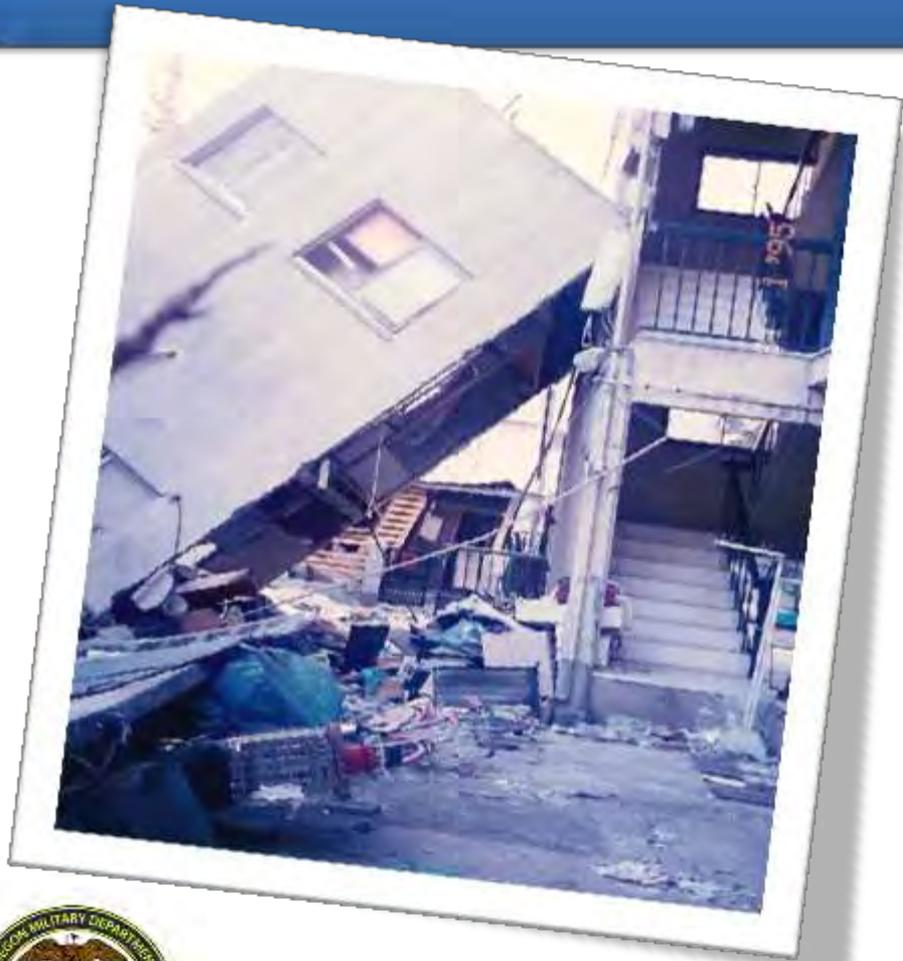
2011 Tohoku tsunami



What are the Implications?



Damage to Homes



- Massive sheltering in short to long term
- Massive rebuilding



Damage to Schools



- 300,000 students in buildings subject to collapse during a Cascadia event
- Non-structural damage
- Needed for cultural continuity



Damage to Businesses



- Billions in damages
- Decades to rebuild



Roads Damaged



Landslides – Roads Blocked



Yaquina Bay Mudslide March 2012



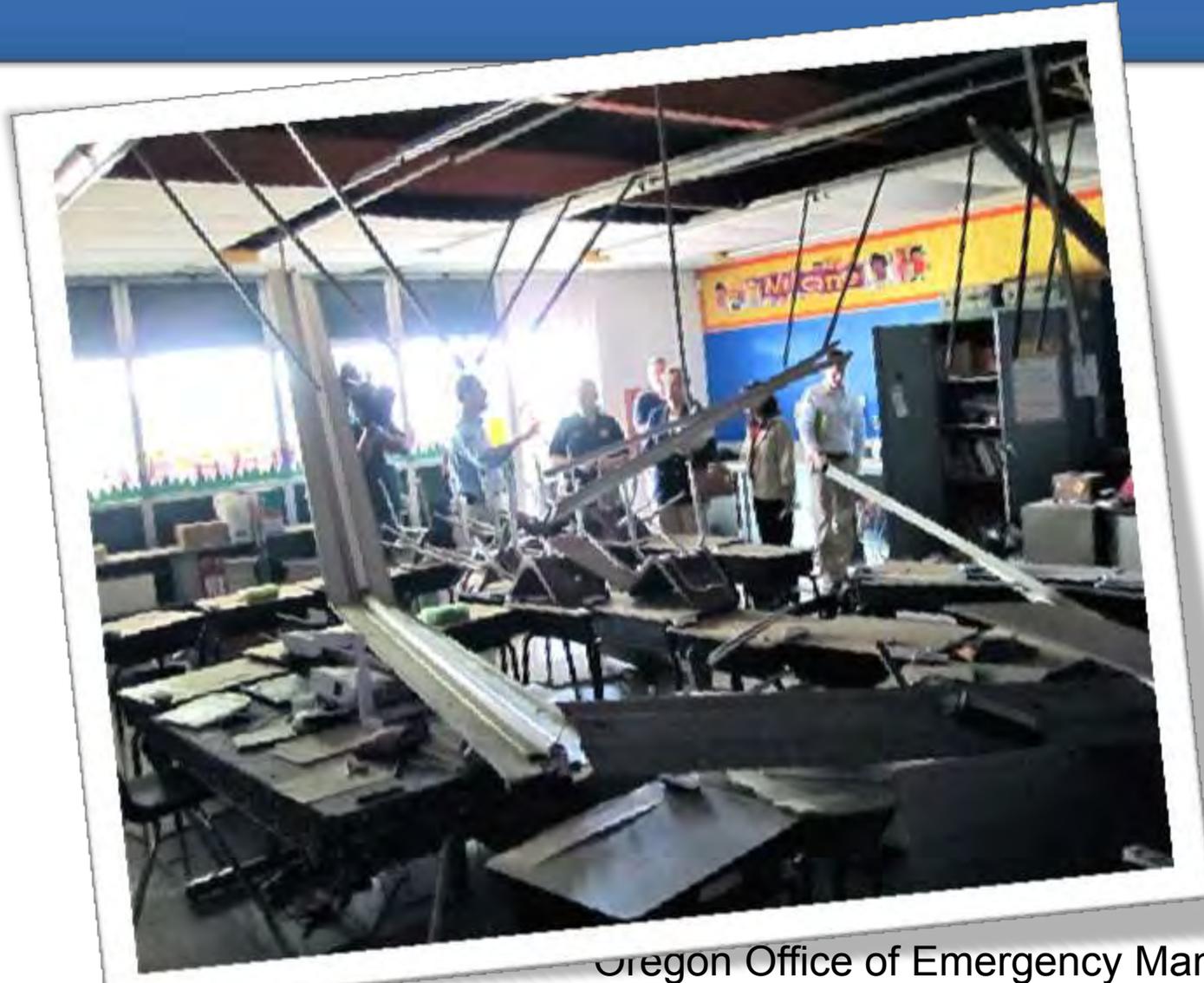
Bridges will Collapse



Cascadia Scenario Bridge Functionality

- 399 bridges totally or partially collapsed
- 621 bridges heavily damaged.
- Routes connecting Interstate I-5 with the HWY 101 would be closed.
 - closure could be 3 to 12 months.
- Restoration could take 3 to 5 years.

Aftershocks



Injuries



Hypothermia



- Hypothermia is a significant risk
- Rainy Coastal Environment



Prepare for Island Life

Psychological

Communication
Plan

Meeting Place

Emotional
Recovery

Physical

Shelter & Warmth

Water & Food

Medical &
Sanitation



Emotional Recovery

Imagine Extended
Camp Life without
infrastructure



Give Everyone a Job!



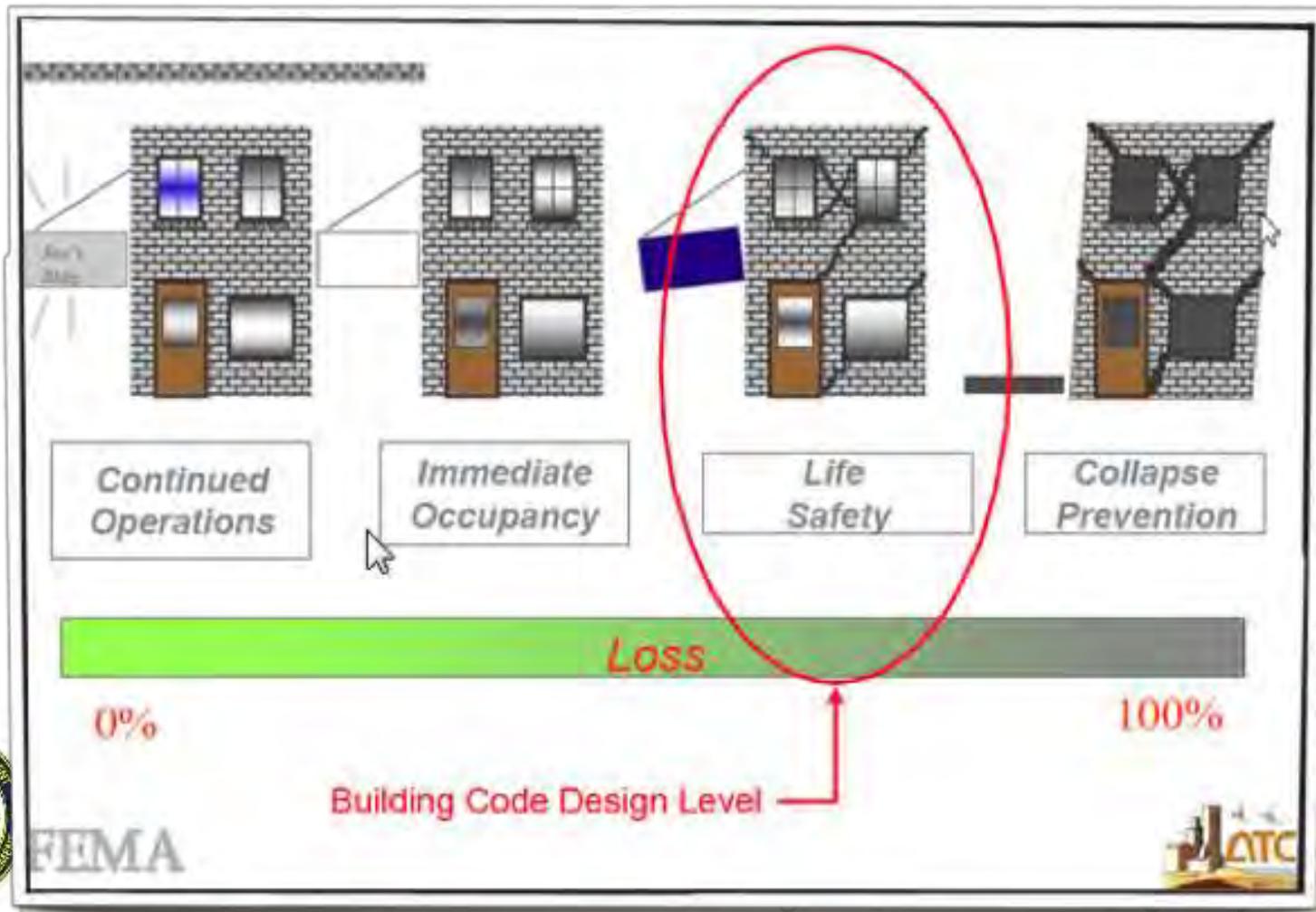
Without Utilities



- No Running Water
- No Electricity
- No Communications
- No Sewer System
- No Garbage Pick-up
- No Fuel
- No Groceries in the Store
- No Pharmacy



Living Outside (...in Oregon)



Protection from the Rain



Make-shift Shelter



This is not a viable solution on the Oregon Coast – WIND!



Shelter & Warmth

High Occupancy Tent

Tube Tent



Expect Broken Windows

- ***Plastic Sheeting***
- ***Duct Tape***



Water

Water Filter Straw



55-Gallon Barrel of Water



Food



First Aid & Medications



Oregon is at risk
from an earthquake and
tsunami that can significantly
impact our people and
economy for decades.



What Oregon is doing to mitigate for the earthquake hazard



House Resolution 3, adopted in April 2011, directed the Oregon Seismic Safety Policy Advisory Commission (OSSPAC)

“to lead and coordinate preparation of an Oregon Resilience Plan that reviews policy options, summarizes relevant reports and studies by state agencies, and makes recommendations on policy direction to protect lives and keep commerce flowing during and after a Cascadia earthquake and tsunami.”



The Oregon Resilience Plan: Reducing Risk and Improving Recovery

for the Next Cascadia Earthquake and Tsunami

- Report to the 77th Legislative Assembly from Oregon Seismic Safety Policy Advisory Commission (OSSPAC)
- February 2013
- http://www.oregon.gov/OMD/OEM/osspace/docs/Oregon_Resilience_Plan_Final.pdf



Key Findings

- Casualties (1,250 to more than 10,000)
- Economic Loss (close to 20% state GDP)
- More than one million truck loads of debris

Liquid fuel vulnerability

How much liquid fuel do you use
in **one month?**



Timeframes for service recovery under present conditions:

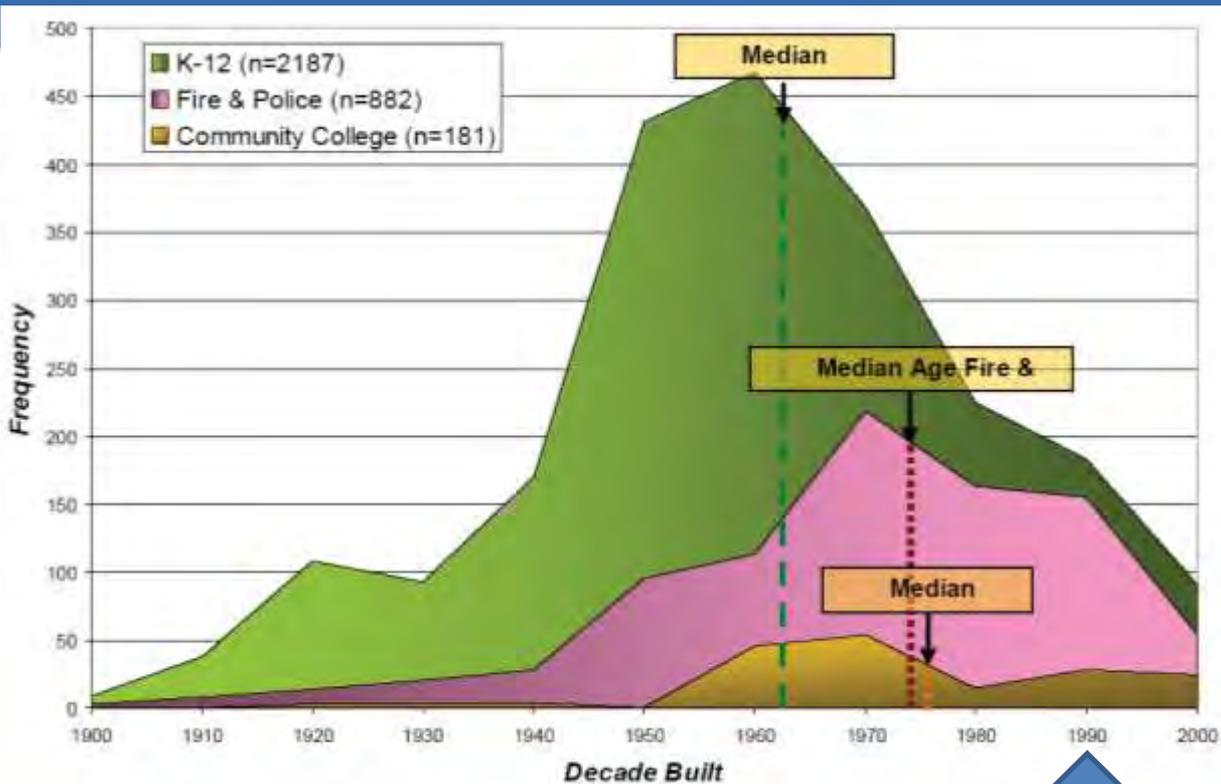
Critical Service	Zone	Estimated Time to Restore
Electricity	Valley	1 to 3 months
Electricity	Coast	3 to 6 months
Police and fire stations	Valley	2 to 4 months
Drinking water and sewer	Valley	1 month to 1 year
Drinking water and sewer	Coast	1 to 3 years
Top-priority highways (partial restoration)	Valley	6 to 12 months
Healthcare facilities	Valley	18 months
Healthcare facilities	Coast	3 years



Resiliency CAN be achieved

- After the February 27, 2010 M8.8 Maule Earthquake, Chile
 - 90% communication services and 95% power supply within two weeks, and re-start commercial flights after ten days.
- After the March 11, 2011 M9.0 Tohoku Earthquake,
 - 90% power supply in ten days, 90% telephone lines in two weeks, and 90% cellular base stations in 19 days.

Impact of Cascadia on our aging Oregon Education & Emergency Facilities



**First seismic building codes
in Oregon**

Oregon Office of Emergency Management



Key recommendations

- Complete an inventory
 - **critical buildings**
 - **local agency, transit, port, and rail assets**
 - **energy and information and communications sectors**
 - **water and wastewater**



Key recommendations

- Launch a sustained **program of capital investment** in Oregon's public structures, including
 - Fully funding **Oregon's Seismic Rehabilitation Grants Program** for K-12 schools, community colleges, and emergency response facilities
 - Seismically **upgrading lifeline transportation routes** into and out of major business centers statewide by 2030



Key recommendations

- Craft a **package of incentives** to engage Oregon's private sector
 - Developing a **seismic rating system for new buildings** to incentivize construction of buildings more resilient than building code compliance requires and to communicate seismic risk to the public
 - Tasking the Oregon Public Utilities Commission to provide oversight for **seismic preparedness of the energy providers** currently under its jurisdiction
 - Working with the hospitality industry to develop plans to **assist visitors** following a major earthquake and tsunami and to plan strategies to rebuild the tourism industry



Key recommendations

- **Update Oregon's public policies**
 - Revising **individual preparedness communications** to specify preparation from the old standard of 72 hours to a minimum of two weeks, and possibly more
 - Developing a policy and standards for installation of **temporary bridges** following earthquake disruption



Senate Bill 33

- Tasks the Resilience plan workgroup to develop an implementation plan
- Report due to Oregon State Legislature
 - **October 1, 2014**



What your community can do



Community actions

- **Assess your risk**

- Inventory public buildings

- FEMA 154 - Rapid Visual Screening of Buildings for Potential Seismic Hazards

- Assess lifelines and infrastructure

- **Educate**

- Public

- Public officials

- Continuity of operations

- **Mitigate**

- What does your community value?





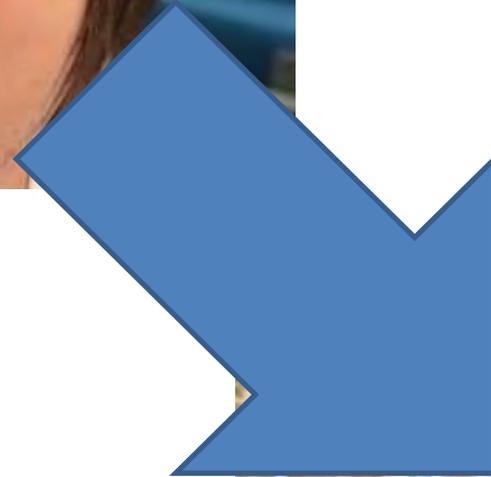
A state-wide
Drop, Cover and Hold On Earthquake drill.
Shakeout.org/Oregon



What your family can do



It pays to be prepared...

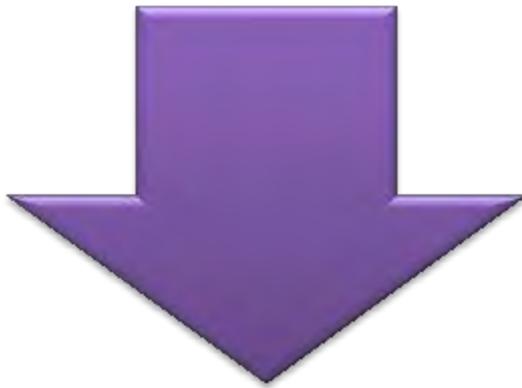


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Survive the Earthquake

Prevention

- Modify Your Environment



Protection

- Modify Your Behavior



Prepare in Seven Steps

- * 1- Identify Hazards
- * 2- Create a disaster plan
- * 3- Prepare disaster kits
- * 4- Identify and fix weaknesses
- * 5- Protect yourself during earthquake
- * 6- Evacuate if necessary
- * 7- Follow your earthquake plan



1- Identify hazards & secure your space

❖ **Secure your space by identifying hazards and securing moveable items.**



Start with the free stuff

- Move heavy or large items to the floor or low shelves.
- Move things that can fall on you away from where you spend a lot of time.
- Move heavy or unstable objects away from doors and escape routes.

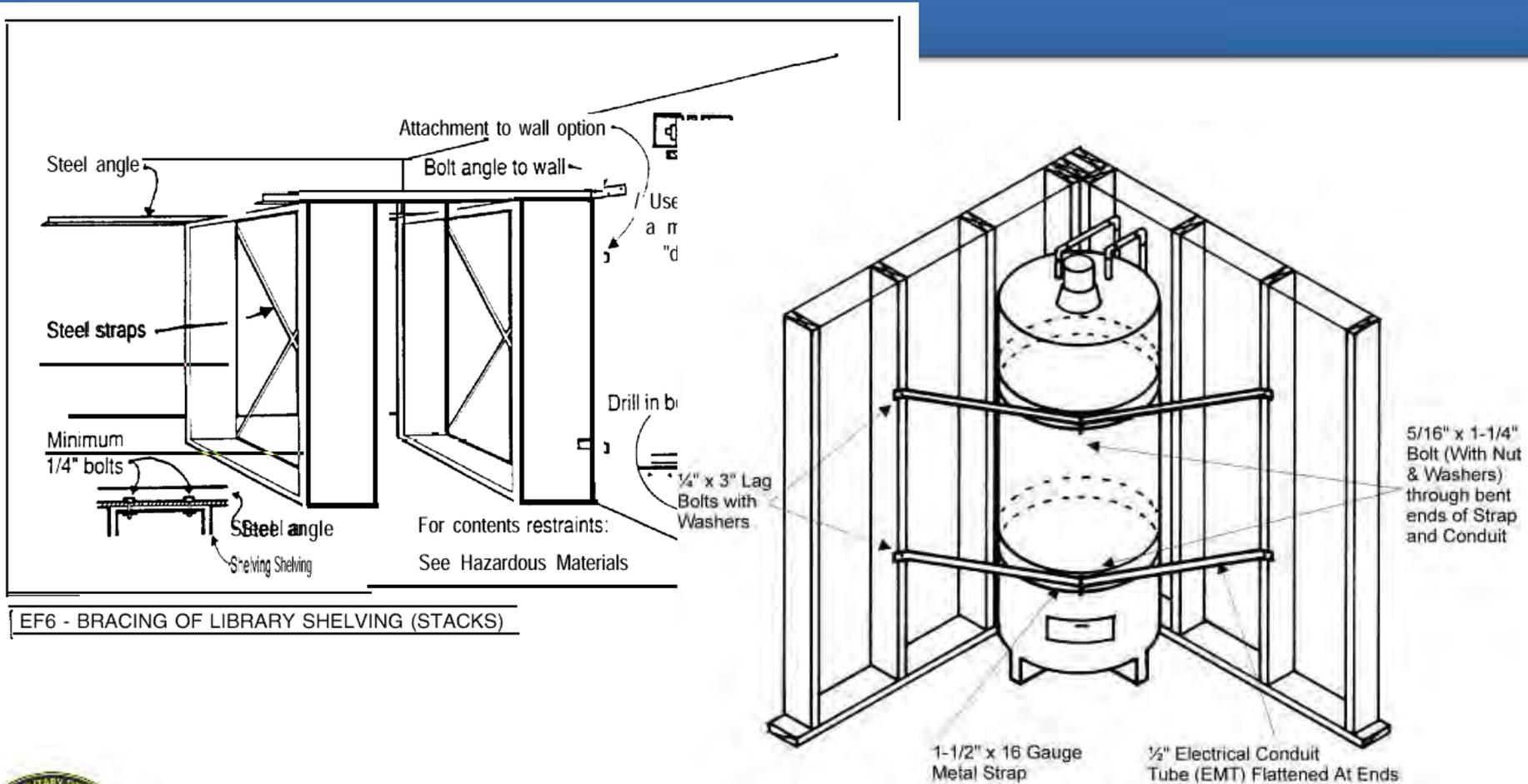


Secure Heavy Furniture

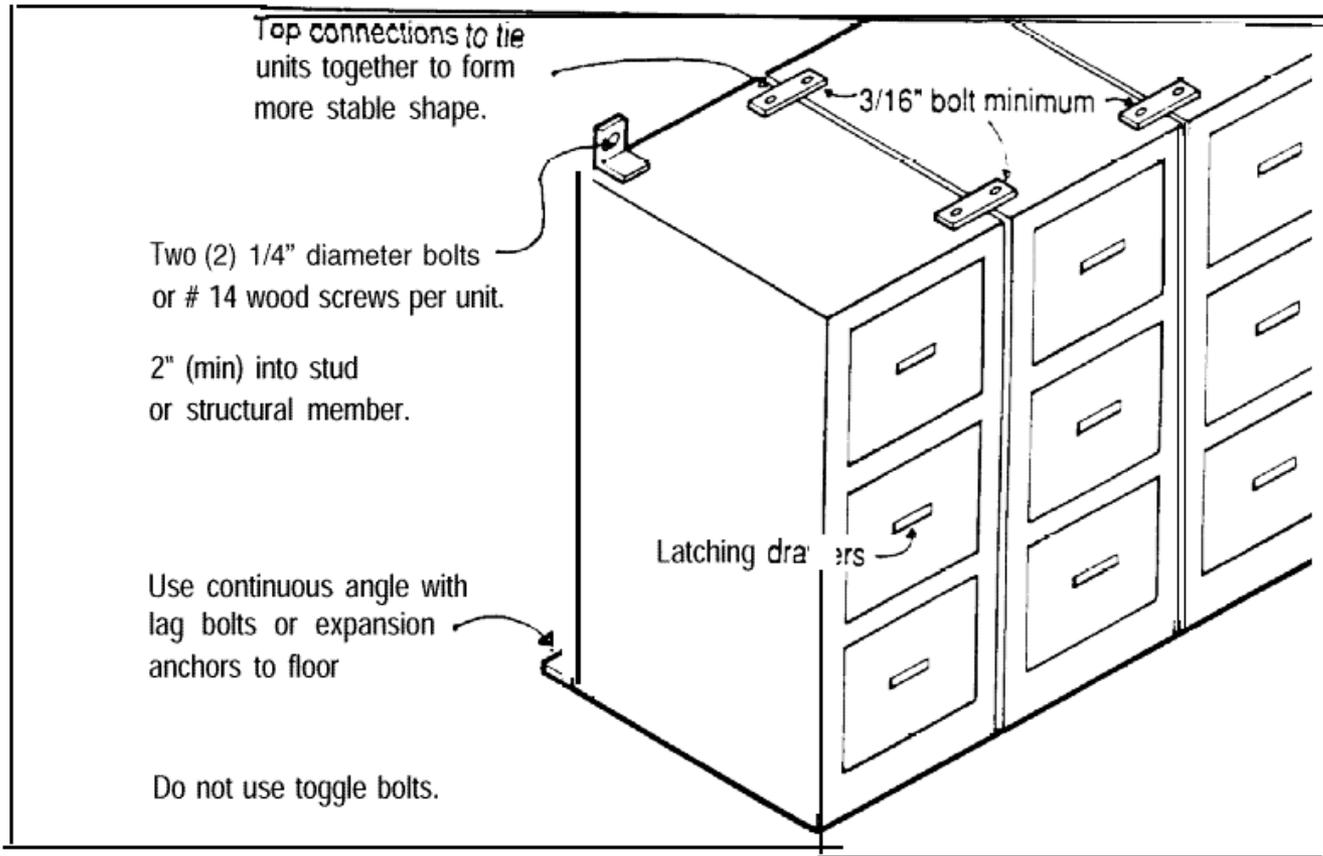
- ***Velcro straps***
- ***L brackets***



Secure furnishings



Secure furnishings



EF2 - CABINETS ATTACHED AT TOP, BOTTOM AND SIDES TO STRUCTURE



Nothing Above Bed



Tie Supplies to Bed

- *Flashlight/Head-Lamp*
- *Sturdy Shoes*
- *Leather Gloves*



Office Hazards

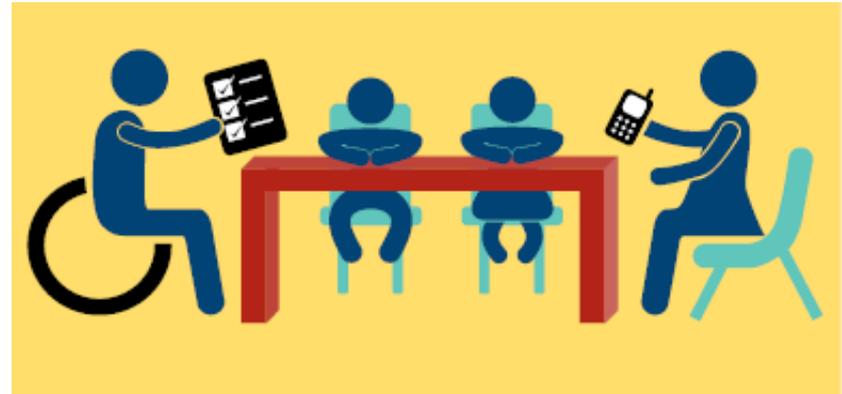


- * Look at office spaces to see if large objects or even heavy binders could fall and injure you.
- * Move heavy objects to a lower shelf.



2- Plan to be safe

- * Plan on how to respond after an earthquake or tsunami



Be a survivor – Plan NOW!

- Who ya gonna call?
 - Where will my family be and how will I reach them?
 - Have an out-of-town emergency contact
- Become a HAM radio operator
 - Contact Fred Molesworth, OEM
 - Fred.Molesworth@state.or.us



But what can I do?

- Where will I get medical help?
 - Take first aid and CPR classes
 - <http://www.redcross.org>
 - Plan for back-up if family needs life-saving medical equipment.
 - What is in your home first aid kit?



But what can I do?

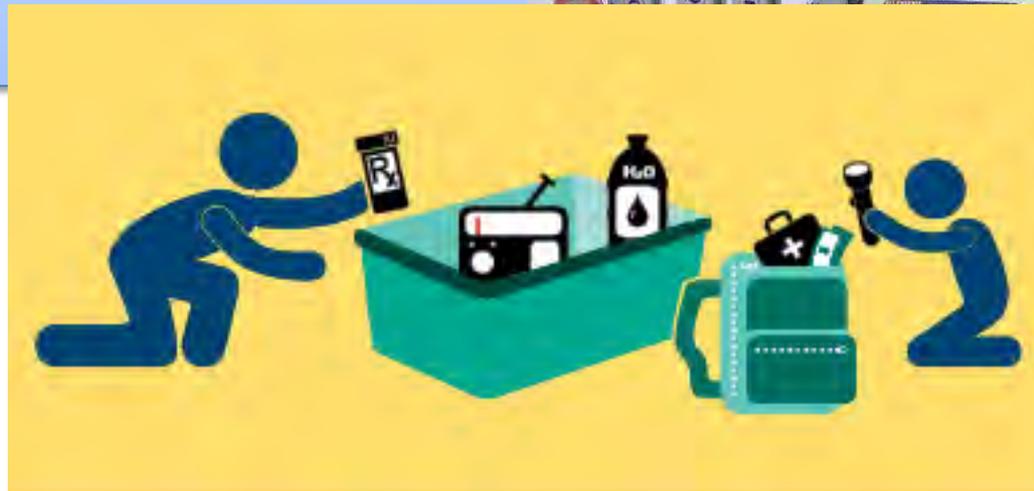
–How will I pay for things?

- Have cash on hand
- ATMs/Plastic cards will likely not work



3- Organize disaster supplies

- * Personal/Office
- * Household
- * Car



Personal disaster supplies kits

- Go-Kit – minimum of 72 hours
- Car – 7 to 10 days
- Home – 3+ weeks



<http://www.ready.gov/america/getakit/>



4- Minimize financial hardship

- **Minimize financial hardship by organizing important documents, strengthening your property, and considering insurance.**



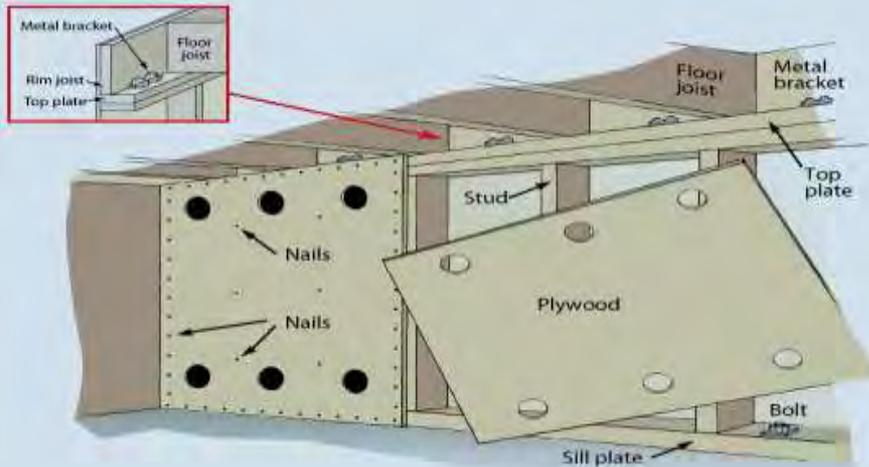
Important documents

- **Organize Important Documents in a "Grab and Go" Bag**
 - Copies of **identification**.
 - Copies of **insurance cards**.
 - List of **emergency contact numbers**.
 - **Photos of belongings** in your home. (This will help you file an insurance claim)



Common building problems

- Inadequate foundations
- Un-braced cripple walls



Earthquake Safety Guide for Homeowners

<http://www.fema.gov/media-library/assets/documents/1017?id=1449>



For those who rent

- Ask your landlord these questions:
 - What retrofitting has been done on this building?
 - Have the water heaters been strapped to the wall studs?
 - Can I secure furniture to the walls?



If you live in a mobile home...

- Look under your home.
- If you only see a metal or wood "skirt" on the outside with concrete blocks or steel tripods or jacks supporting your home, you need to have an "engineered tie-down system" or an "earthquake-resistant bracing system" (ERBS) installed.
- An ERBS should have a label on the bracing that says, "Complies with the California Administrative Code, Title 25, Chapter 2, Article 7.5."



More Ways to Protect Yourself Financially:

- Earthquake Insurance
- Flood Insurance in U.S. Covers Tsunami



5- Protect yourself during earthquake





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Be a SMALL Target

Body Position

- On knees
- Protecting neck/head
- Hold onto furniture
- Curl into a ball



Face Position

- Turn away from windows
- Close eyes



During the Shaking

If Inside, Stay Inside

- Classroom
- Gymnasium
- Band Room

If Outside, Stay Outside

Get away from buildings, trees, light poles, power lines, utilities



In a Car or Bus

- Pull over to a safe location
- Stop & stay there
- Keep seat belt on
- After shaking stops, assess your situation



Wheel Chair Bound

- Roll into area with structural protection
- Apply brakes
- Cover head and eyes to best of ability
- **Be Advised:** rescuers need to drop, cover, and hold on, too!



3 Common MISTAKES

- ***DO NOT***
run out of
the building!

Run



- ***DO NOT***
get in a
doorway!

Doorway



- ***DO NOT***
believe the
triangle of
life!

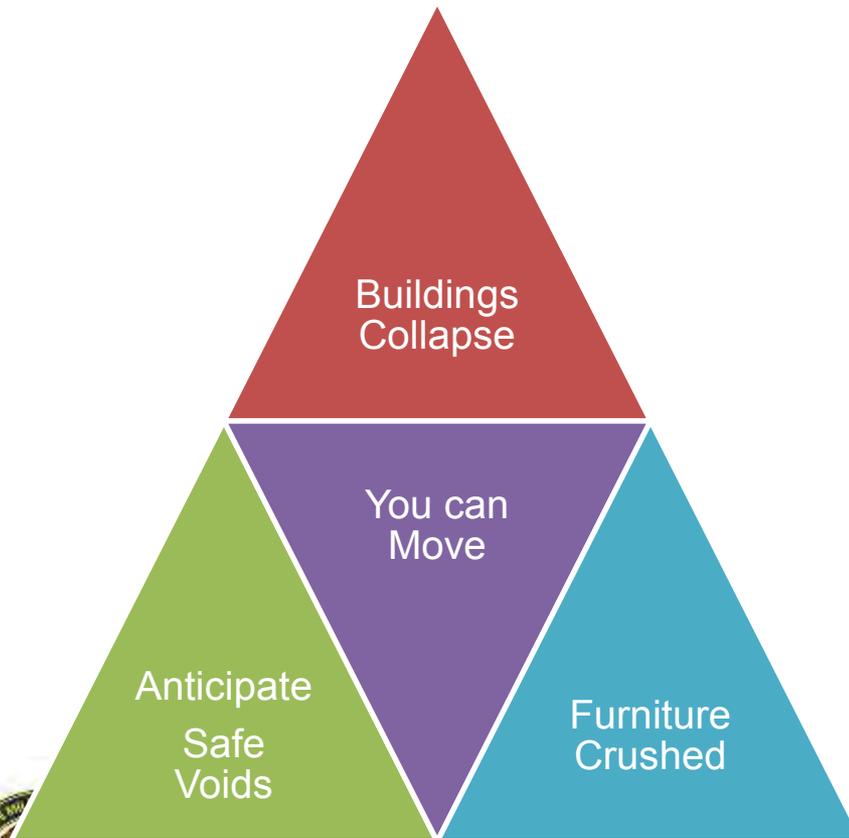
**Triangle
of Life**



The Triangle of Life MYTHS

MYTHS

TRUTH



1. **Collapse:** Most buildings do not collapse
2. **Moving:** Strong shaking makes moving very difficult and dangerous
3. **Voids:** The direction of shaking and unique structural aspects of the building make this impossible.
4. **Furniture:** People DO survive under furniture or other shelters.



6- Improve safety

Improve safety immediately after an earthquake by **evacuating if necessary**, **helping the injured** and **preventing further injuries or damage**.



After the Earthquake

Assess

- Glass
- Dust
- Fire
- Darkness

Protect

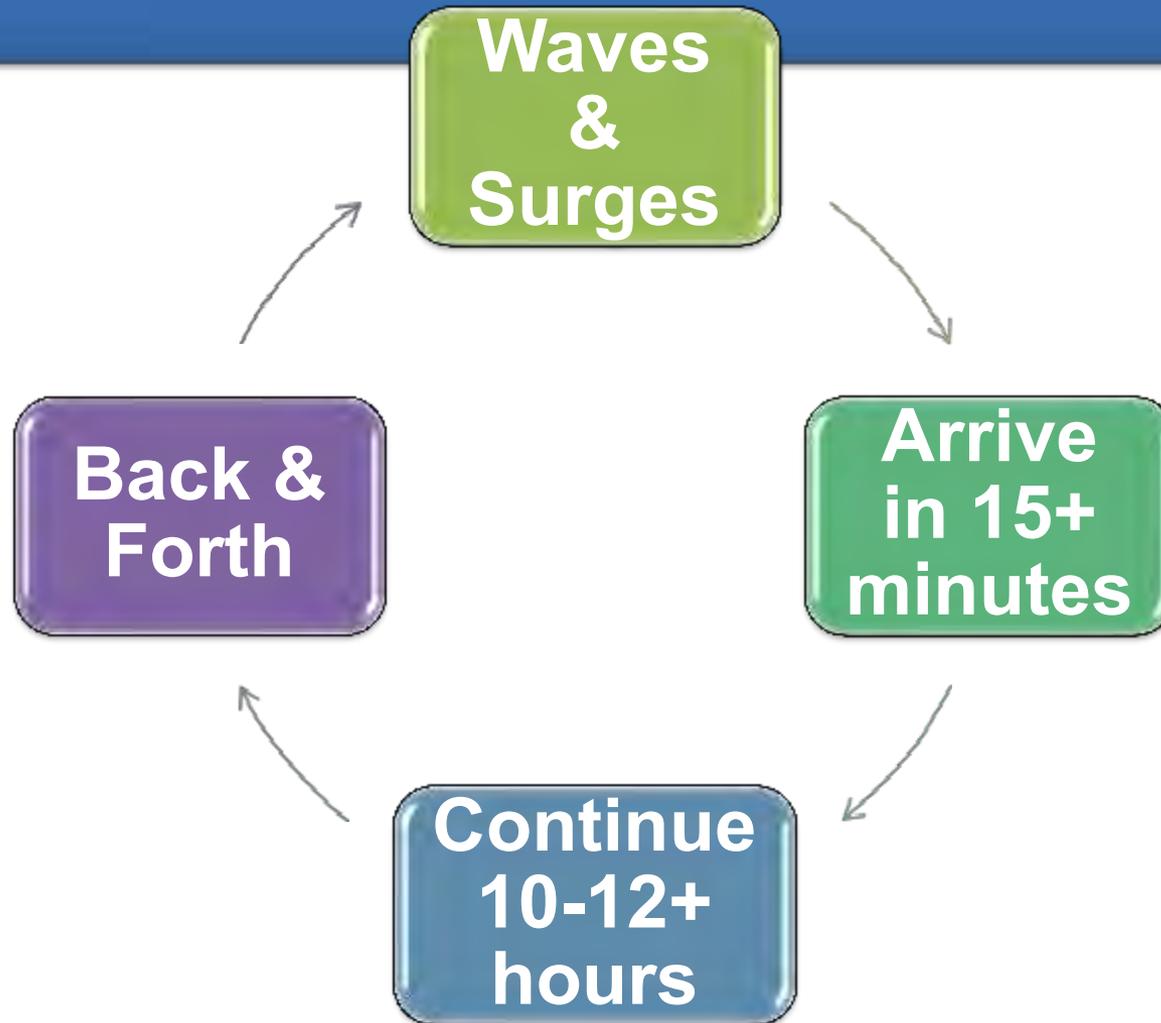
- Gloves
- Mask
- Flashlight

Evacuate

- Obstacles
- Routes
- Assistance



Local (Cascadia) Tsunami



Escape the Tsunami

- Tsunami zones
- Evacuation Routes
- Safe Areas

Learn

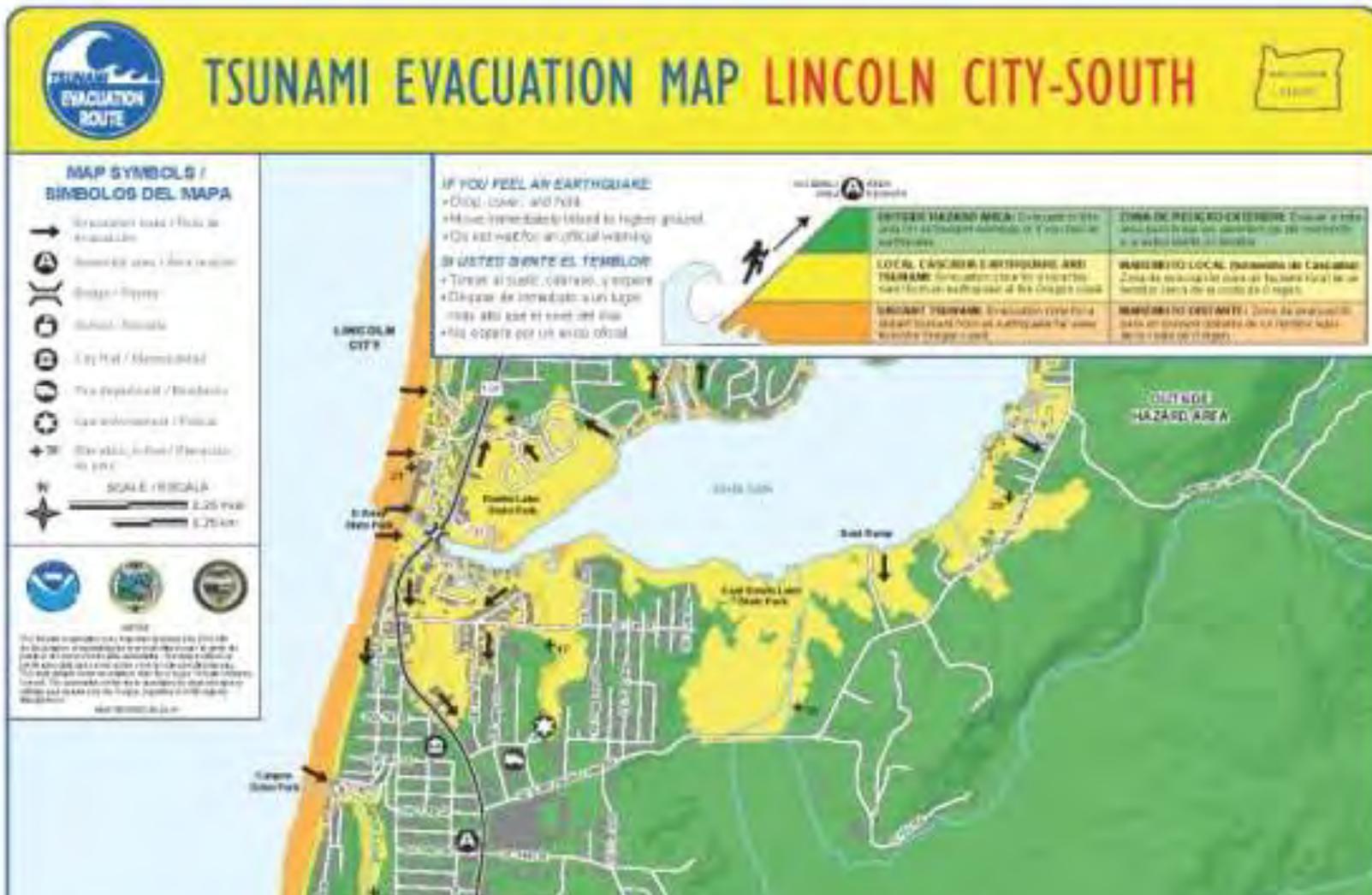
Practice

- Go on Foot
- Assist Others
- Consider Options

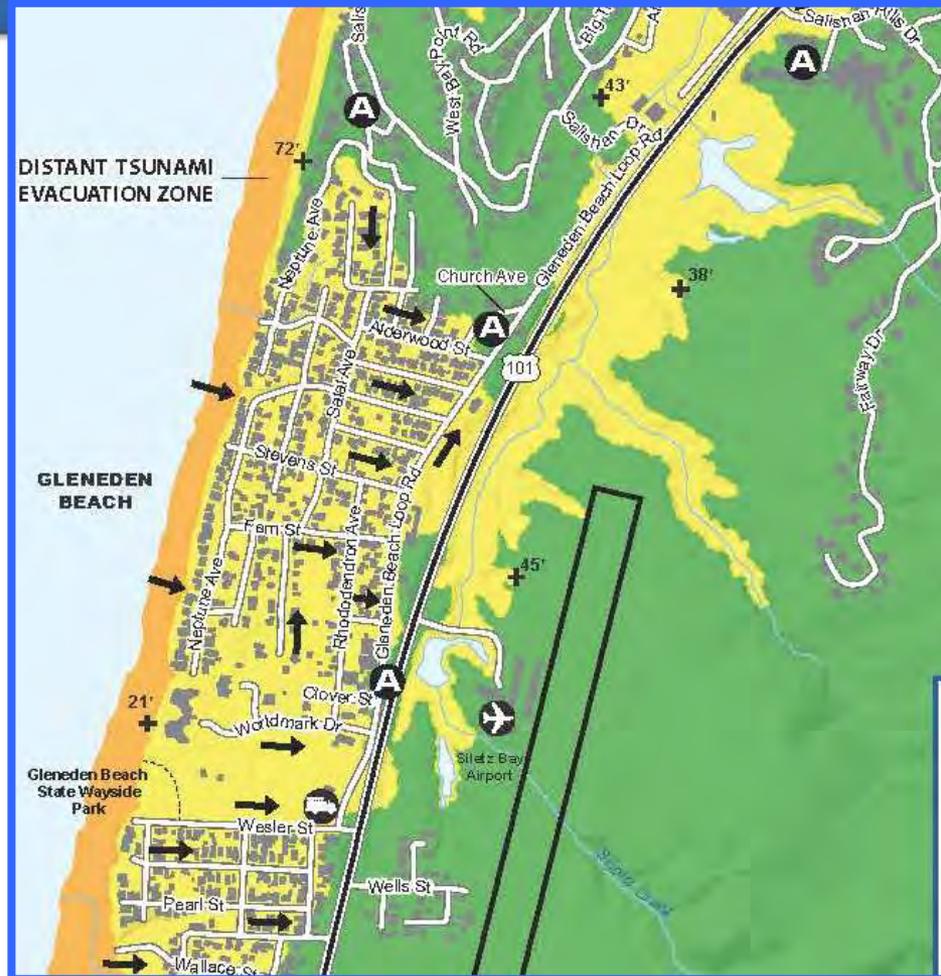


Know the Zones

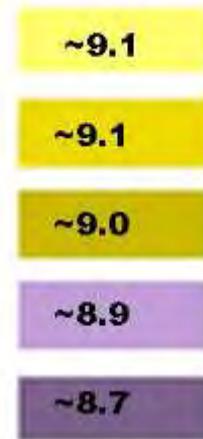
Tsunami Evacuation Maps



Mobility Challenges?



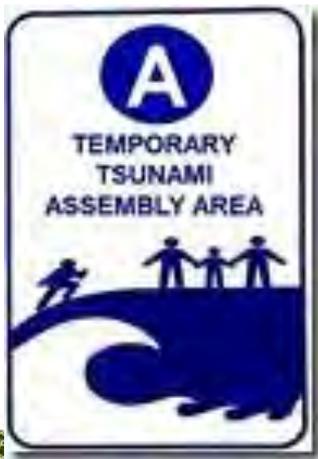
Don't Give Up!



Identify High Ground



- Signs
- Evacuation Routes
- Safe Areas
 - Temporary Assembly Areas
 - Vertical Evacuation Options



Practice



**Go On
Foot**



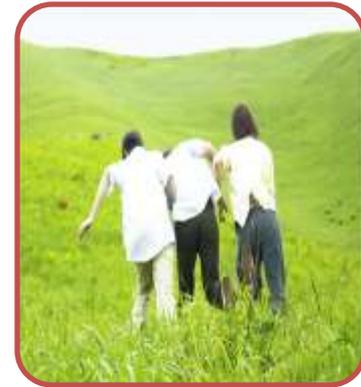
**Assist
Others**



**Consider
Options**



To Carry or Not To Carry Supplies



Situation

Ability

Time

Distance



The Discipline to STAY PUT!

WHEN DO YOU RETURN to the Tsunami Hazard Zone?



Distant Tsunami

Earthquake Far Away

You won't feel the ground shake

4+ hours before waves arrive

Limited Inundation



Know the “Distant” Zone

- Beaches
- Harbors
- Rivers, Inlets
- Other low-lying areas



Tsunami Alert Messages

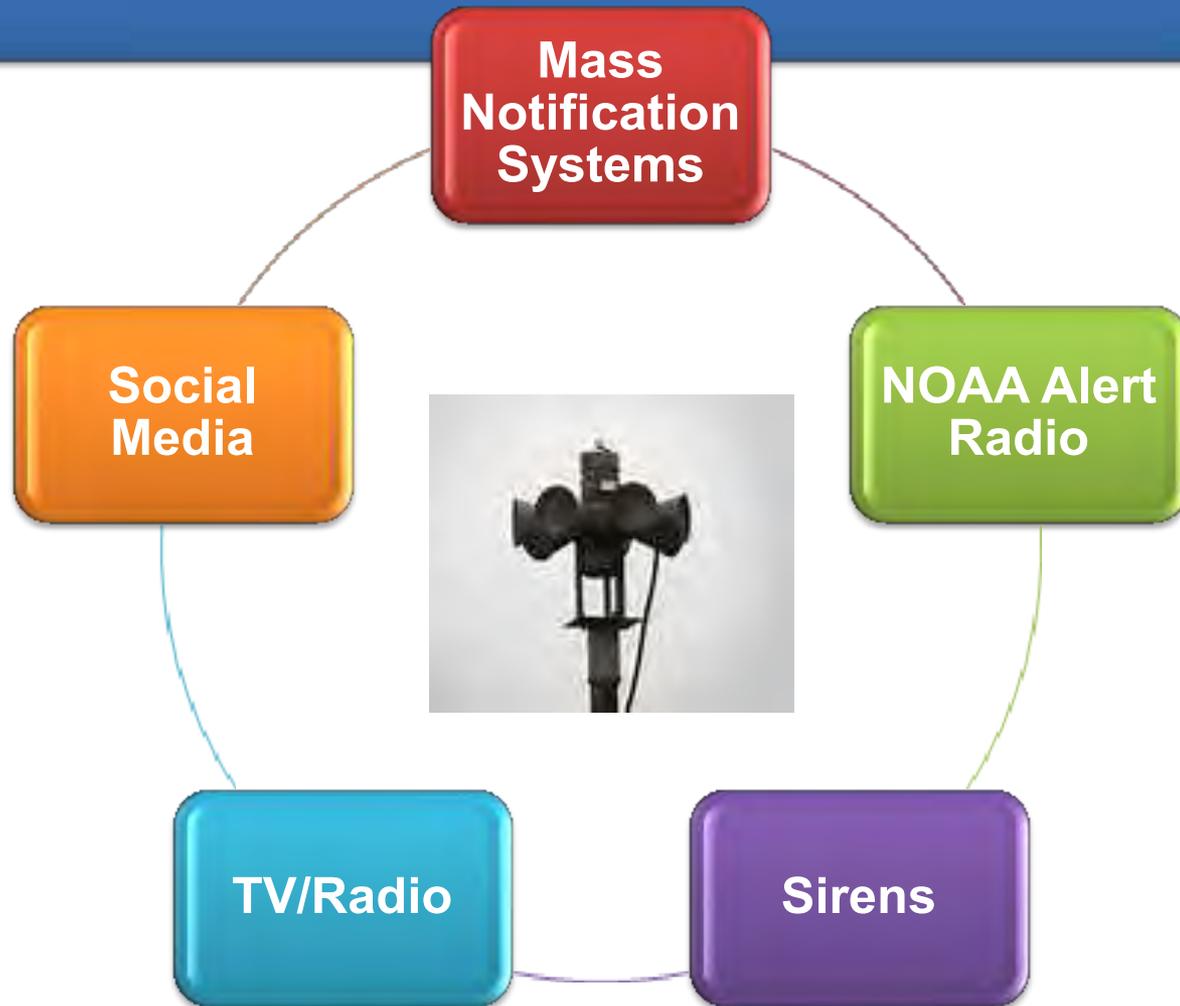
National Tsunami Warning Center

Alert Level	Threat	Action
Information Statement	Minor waves at most	No action suggested
Watch	Danger level not yet known	Stay alert for more info
Advisory	Strong currents likely	Stay away from the shore
Warning	Inundating waves possible	Full evacuation suggested



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Distant Tsunami Notification



Evacuation Before a Distant Tsunami



- **WHO:** Only those in the distant tsunami zone
- **HOW:** Probably by car
- **WHERE:** ???



Re-entry After a Distant Tsunami

- Cancellation Message
- Re-enter with Caution
- Damage
 - Harbors
 - Beaches
 - Low-lying areas
 - Roads, Bridges
- Clean up



SHOULD ANYONE

DIE

FROM A DISTANT TSUNAMI?

NO



7- Reconnect and Recover

Restore daily life by reconnecting with others, repairing damage, and rebuilding community.



The first days after the earthquake...

- Take pictures of any damage to your property and home.
- Contact your insurance agent or company right away to begin your claims process. Keep records of any repair or cleaning costs.
- Check on the condition of your neighbors, especially those who are seniors or disabled.



Thank you!

**You can't prevent an Earthquake,
but you can prepare for one, so do ONE thing
today to be better prepared ...**

Building a culture of prevention is not easy because the cost of prevention has to be paid in the present, while its benefits lie in the distant future. Moreover, the benefits are not tangible; they are the disasters that did not happen.

(to paraphrase Kofi Annan)

