Earthquake Preparation and Safety Tips

Washington Earthquakes
Although the earth feels solid as we walk upon its surface, it is only partly so. The earth is divided into three main layers…a hard outer crust, a soft middle layer and a central core. The crust is broken into massive irregular pieces called “plates”, which have been moving very slowly over the earth’s surface for billions of years, driven by energy deep within the earth. The movement has shaped the physical features of the earth…its mountains, valleys, plains and plateaus. Earthquakes occur when these moving plates grind against one another. This process gives rise to three types of Washington earthquakes.

Subduction Zone Earthquakes
Normally, the colliding edges of plates are locked together. As the relative motion of one plate continues to push against one another, huge stresses build up until the locked joint snaps and a subduction zone earthquake occurs.

Washington is located on the boundary of two plates, the Juan de Fuca plate and the North American plate. The fault boundary is commonly referred to as the Cascadia Subduction Zone. As this plate pushes downward it melts under Washington, which is part of the North American plate. This pushes materials to the surface farther inland, creating the Cascades and their active volcanoes, including Mount St. Helens.

The Cascadia Subduction Zone has physical characteristics resembling those of other subduction zones in southwestern Japan and South America (southern Chili and Columbia). Both Japan and South America have experienced large shallow earthquakes. Even though there have not yet been large historic subduction earthquakes in the Pacific Northwest since European settlement began in the early 1800s, it is believed that the Cascadia Subduction Zone may be storing strained energy to be released rapidly in future, very large earthquakes. A similar subduction zone quake occurred off the coast of Alaska in 1964, resulting in a devastating magnitude 9.2 quake, and a tsunami wave. 119 people lost their lives.

Researchers say the stresses they observe off the coast of Washington could cause an earthquake measuring up to 9.5 on the Richter scale. Such an earthquake would last about three minutes, and significantly damage most buildings, bridges and pipelines.

Deep Earthquakes
Deep earthquakes occur within the Juan de Fuca plate as a result of the stress that builds up as it pushes under the North American plate. The 1949 Olympia and the 1965 Seattle-Tacoma earthquake both occurred due to this sinking plate. Future deep earthquakes can be up to a magnitude 7.5. The resulting ground shaking would be widespread and could last for 20 seconds.

Shallow Crustal Earthquakes
Shallow crustal quakes are the result of accumulated pressure in the North American plate. Shallow earthquakes occur in the crust at the top of the North American Plate. They occur in the Puget Sound, along the western side of the Cascades, and throughout eastern Washington. Bigger crustal earthquakes (west of the Cascades) are generally expected in magnitude from 5.7 to 6.3, with an expected shaking duration of 10-20 seconds. Shallow quakes originate between the surface and depths of 0-19 miles.

Large crustal (shallow) earthquakes appear to have occurred in Washington’s North Cascades (1872, estimated magnitude 7.5). The St. Helens Seismic Zone in the southern Washington Cascades is thought to be capable of producing a magnitude 7.0 earthquake. In general, crustal earthquakes have the potential for higher accelerations and longer durations than for the deeper lower-plate earthquake event, such as the 1949 Olympia quake. Crustal earthquakes are usually associated with aftershocks.

Evidence now points to a crustal shallow fault beneath Seattle. A similar fault exists in Tacoma. The two may be connected, in essence either end of a large shell, that is capable of as much as a fifteen foot vertical displacement.

Earthquake Risk
The risk of earthquakes is high throughout Washington, but it is not the same in all areas. Site conditions and the types of soil or rock affect the amount of shaking and the potential for damage. Solid rock or bedrock does not increase the shaking. However, soft materials such as mud, artificial fill, and layers of sand and clay will make the consequences of ground shaking much worse. This is because they increase or amplify the effects of an earthquake. Many steep slopes will experience landslides, and floodplains and areas with artificial fill will be prone to liquefaction (in those area the ground will literally turn to water). This can result in local areas experiencing severe damage, where the ground fails under buildings, pipelines, or bridges.
The past few decades have been unusually quiet in Washington. Major earthquakes with magnitudes between 6 and 7.5 can be expected every 30 to 50 years. However, earthquake prediction is not an exact science. What we do know is that anyone spending half their life in Western Washington should expect to live through a major earthquake.

**Safety Tips for Earthquakes**

During an earthquake the "solid" earth moves like the deck of a ship. This movement however, is seldom the direct cause of injury. Most casualties result from falling objects and debris from buildings. Earthquakes may also trigger landslides, cause fires, and generate huge ocean waves called “tsunamis.”

**Common Causes of Injury**

Injuries are commonly caused by:

Building collapse or damage caused by toppling chimneys, falling bricks, veneers or parapets, falling plaster, light fixtures and pictures, overturned bookcases, fixtures, furniture and appliances, flying glass, fire from broken chimneys or gaslines, fallen power lines, and drastic human actions resulting from fear.

**What Can You Do?**

**Before an Earthquake:**

Strap water heater and gas appliances to the wall. Install flexible connectors between the appliance and the rigid pipe.

Know where and how to shut off electricity, gas and water at main switches and valves. Keep a wrench stored near the gas meter. Share this knowledge with every family member.

Place large and heavy objects on lower shelves. Anchor shelves and top heavy objects to walls.

**During an Earthquake:**

If you are indoors, stay indoors. If outdoors, stay outdoors. Most injuries occur as people are entering or leaving buildings. If indoors, take cover under or next to a heavy desk or table, or duck and cover next to the arm of a couch or kitchen cabinet. Standing or crouching in a doorway or adjacent to an inside wall is also an option. Stay away from windows. Do not dash for exits. Never use an elevator.

If outdoors, move away from buildings and overhead wires. The greatest danger from falling debris is just outside doorways and close to outer walls. Porch roofs often collapse in an earthquake. If in a car, stop as quickly as safety permits, but stay in the car. If you drive on after the shaking stops, drive extremely carefully, avoiding downed wires, bridges and undermined roadways. Keep your distance from masonry buildings which may collapse into the street.

**After an Earthquake:**

Be prepared for aftershocks. Although most of these are smaller than the main shock, some may be large enough to cause additional damage.

Check for injuries. Do not attempt to move seriously injured persons unless they are in immediate danger of further injury. Check utilities. Earth movement may have broken gas, electrical and water lines. If you smell gas, shut off the gas valve at the meter, open windows, and leave the building. Report the leak to authorities.

If electrical wiring is shorting out, shut off the main breaker in the panel. If water pipes are damaged, shut off the main valve. Emergency water may be obtained from hot water tanks, toilet tank reservoirs, and refrigerator ice cubes.

Check chimneys for cracks and damage. Avoid lighting fires until the chimney is inspected. Approach chimneys with extreme caution.

Do not touch downed power lines or objects touched by downed lines. Immediately clean up spilled medicines, drugs and potentially harmful materials. If power is off check your freezer and plan meals to use foods which will spoil quickly. Stay out of severely damaged buildings. Aftershocks can shake them down.

**Personal Conduct**

Remain calm. Think through the consequences of any action you take. Don’t use your telephone except for genuine emergencies. Don’t spread rumors; they often do great harm after disasters. Never go sightseeing. Your presence could hamper emergency relief efforts and you could put yourself in danger. Cooperate fully with public safety officials. Respond to requests for volunteer assistance from police, fire fighting, emergency management and disaster relief organizations, but do not go into damaged areas unless your assistance has been requested.

You may see City of Tacoma, Damage Assessment Teams, looking at structures in the immediate aftermath of an incident. Our teams are tasked with posting informational placards, based on a rapid assessment of the structural condition of the building. Red tags indicate danger of collapse, keep away. Yellow tags will have a written statement of which portions of the structure may be used, often subject to conditions. Green tags indicate the structure appears sound. The teams will likely be stretched thin. Their primary task is to find suitable shelter for people in inclement weather, and to alert people to dangerous structures. We will appreciate your cooperation with these teams.

For more information, contact: City of Tacoma Planning and Development Services

http://www.cityoftacoma.org, (253) 591-5030

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