MRP ENGINEERING IN CHILE AFTER THE 2010 M8.8 EARTHQUAKE

On February 27, 2010, a devastating M8.8 earthquake struck off the central coast of Chile, 105 kilometers north of Concepción, the second largest city in Chile. The earthquake occurred at a depth of 35 kilometers along the subduction zone where the Nazca plate under the Pacific Ocean slopes eastward and downward beneath the South American continent. The rupture zone extended almost 500 kilometers parallel to the Chilean coast, triggering a tsunami along the fault rupture area. Strong ground shaking lasted for over two minutes and caused structural damage to modern structures in Santiago (over 300 kilometers from the epicenter). Over 16 aftershocks of magnitude 6.0 or greater followed the main event, including a M6.9 aftershock on March 11, 2010. The earthquake and tsunami were responsible for more than 500 deaths and destroyed half a million homes. MRP Engineering visited Santiago and Concepción following the earthquake to document earthquake impacts and extent of damage.

SANTIAGO, CHILE

The capital city (with a population of over three million) is located more than 300 kilometers from the earthquake epicenter. Significant ground shaking lasted about 40 seconds and affected modern structures, highway bridges, historically significant buildings, and other critical facilities (airport, hospitals, etc.) as depicted in the images below. The ground motions levels approached design forces. The Chilean building code is comparable to mid-1990s US standards; however, the current Chilean reinforced concrete construction requirements include some significant differences.






CONCEPCIÓN AREA, CHILE

The city center is located on the east bank of the Bío Bío River as it empties into the Pacific Ocean just north of the city. A significant increase in high-rise construction (15 to 20-story office and residential towers) has occurred within the last few years. Significant industries (petro-chemical, chemical, cement, steel, and fishing) are located just north of Concepción near Talcahuano. The region is also home to forestry products facilities. The earthquake impacts were significant and included:

- Modern high-rise buildings (structural damage)
- Bío Bío River crossings (bridge damage due to soil failures)
- Industrial facilities (infrastructure and structural damage resulting in significant business interruption)
- Fishing industry (tsunami damage)
- Nonstructural and building contents damage







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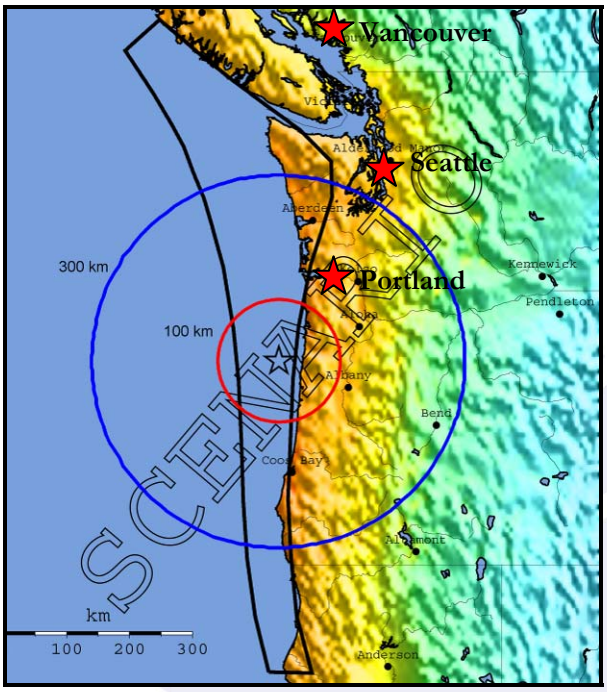
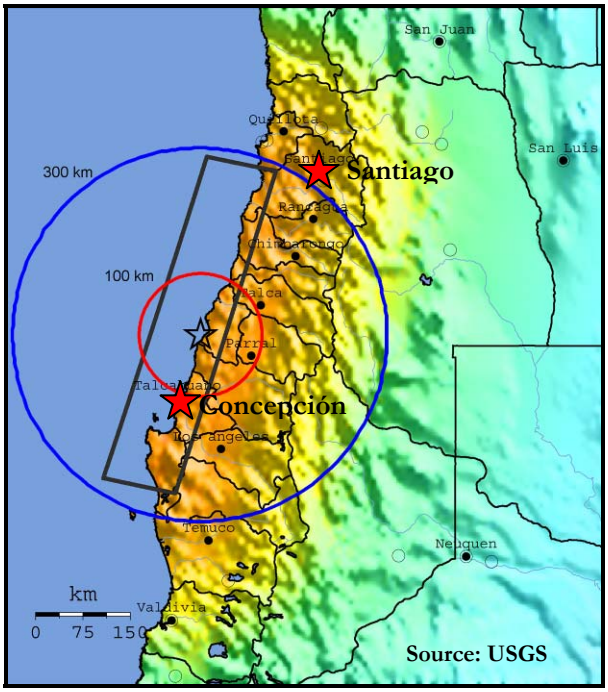
SUBDUCTION ZONE EARTHQUAKES COMPARED



M9.0 Cascadia Subduction Zone scenario



M8.8 Offshore Maule, Chile earthquake

Stronger shaking →

The earthquake in Chile has significant relevance for residents and business owners in the Pacific Northwest. This region is also located along the boundary of two tectonic plates, a geological structure known as the Cascadia Subduction Zone. One of the tectonic plates, the Juan De Fuca plate, forms the ocean floor, slides beneath (subducts) the North American plate, and is slowly driven into the earth's mantle. This seismic source is considered capable of generating M9 events every 300 to 500 years, with long duration ground shaking, multiple aftershocks, and tsunamis. The most recent event on this source occurred in 1700. In addition to affecting Pacific Northwest coastal communities, a M9 subduction zone earthquake would impact the metropolitan areas of Portland, Seattle , as well as Vancouver (British Columbia).

MRP ENGINEERING SERVICES

MRP Engineering is a structural engineering and risk analysis firm (based in metropolitan Seattle, WA) and provides proactive risk analysis for natural hazards, damage investigation, and upgrade design. We assist clients to protect their business operations from risks to physical assets resulting from extreme events such as earthquakes and hurricanes. Our philosophy is to listen to your needs and then provide you with practical and cost-effective structural engineering-based risk reduction solutions.

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