

# Earthquake Risk Transfer for Vietnam

## Overview

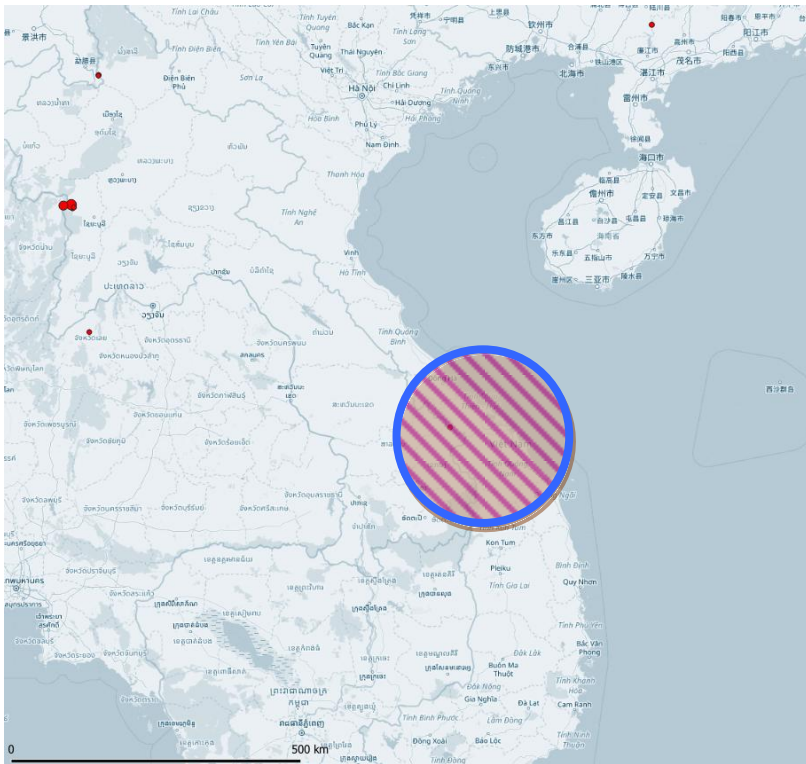


Figure 91. Vietnam undercover regions in late 2019.

Vietnam is located in the Eurasian Plate close to the Andaman-Sumatra-Myanma plate boundary. Due to the lack of historical records, the establishment of the local site factors and the design seismic response spectrum for major cities in Vietnam was found problematic.

Several major potential seismic sources capable of generating large magnitude earthquakes (M8) have been



identified in the region surrounding Hanoi, within a radius of about 250km in recent studies.

Earling preparedness network continuously is monitoring Hanoi and South of Vietnam by distinguishing everyday ground shakes from patterns that may cause an earthquake. As a result, Earling was able to issue preparedness alerts for two of the latest minor earthquakes for the regions two days before the earthquakes happen.

How great is the earthquake risk for Vietnam, given that it sits on active faults? According to Vietnam's Ministry of Natural Resources and Environment, the country as a whole experienced 134 earthquakes in the 20th century, including two that were between M8.0 and M9.0. In recorded history, two earthquakes with estimated magnitudes of M5.0–6.0 are known to have shaken Hanoi in 1278 and 1285, an M6.5 quake occurred in the lower section of the Ma River in 1635, and an M6.0 temblor struck on the Ca River in 1821. In the past 100 years, there have been two major earthquakes of M6.0–7.0 near the province of Dien Bien in 1935 and 1983. Seismic hazard in Vietnam is mainly attributed to the Red River fault system (AIR Worldwide, 2019). As Earling was able to detect even minor earthquakes in the region, hopes arose to issue EPA for major ones.



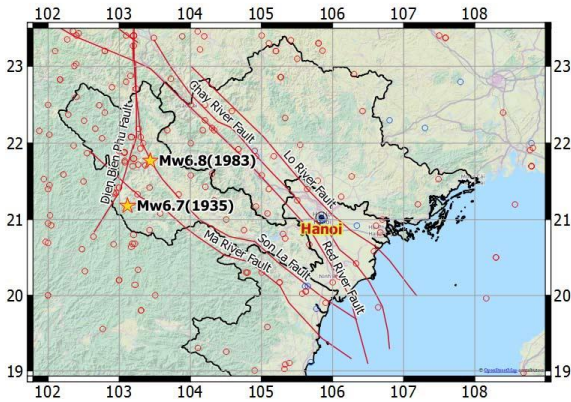


Figure 92. Historical seismicity in northern Vietnam ( $M_w \geq 4.5$ ). Blue dots indicate earthquakes that occurred before 1900; red dots indicate earthquakes that occurred after 1900. The 1935  $M_w 6.7$  and 1983  $M_w 6.8$  earthquakes are marked by stars. Red curves represent active faults (AIR Worldwide, 2019).

### EPA Effect on Probable Maximum Loss

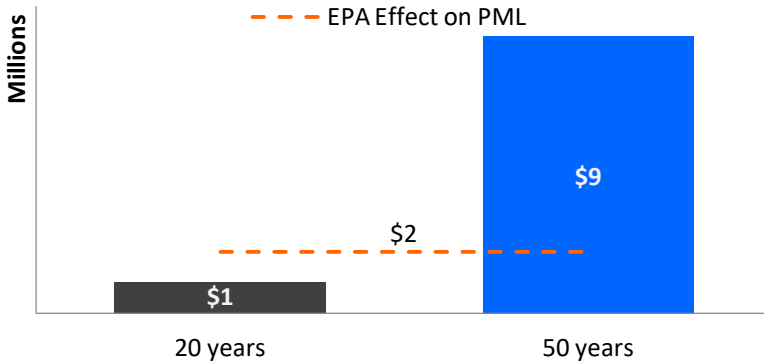


Figure 93. Probable Maximum Loss (PML) - Mean return period in years (Viet Nam Disaster & Risk Profile, 2014). Vietnam earthquake Average Annual loss is \$3.95. EPA can help to extend the earthquake insurance penetration rate.

