

Principal results of the Portoviejo seismic microzoning project

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After the 2016 Mw7.8 earthquake of Jama-Pedernales caused heavy damage in Portoviejo, the Local Government contracted a study of seismic microzoning. The city is located in the sedimentary basin of the Portoviejo River, characterized by soft quaternary deposits of fluvial-marine origin, surrounded by outcrops of shales. The high seismic hazard (0.38 g PGA for 475 y. return period) is mainly produced by the subduction of the Nazca plate beneath the South American continent, although minor local faults were identified. Geotechnical information was obtained by means of 19 drillings of 30 m, one reaching seismic basement at 160 m depth. To determine Vs30, data from 300 seismic profiles using ReMi technique were used and integrated with analysis of the topography outside the urban area. A detailed image of Vs profiles and sedimentary thickness was obtained by the analysis of 5 seismic refraction profiles, 20 deep ReMi profiles, more than 250 ambient noise and 670 gravimetric measurements, applying several inversion techniques. The parameter mainly used to divide the resulting 5 microzones was the Vs30 spatial data distribution. The depth of the seismic basement, characterized by Vs > 1400 m/s and interpreted as consolidated layers of shale or sandstone, ranges between 100 and 200 m. Vs30 varies between 155 and 360 m/s, which correspond to clayey and silty material. In the city center the depth of the sedimentary basin is 50 m, increasing towards NE. Linear equivalent analysis of response from 7 accelerograms at type sites based on the geophysical and geotechnical soil parameters was performed for each microzone to derive adjusted and smoothed average spectra with recurrences of 50, 475 and 2475 years, aimed to replace the corresponding spectra of the building code. For rigid soils, the plateau is 53% higher than the class C spectra of the code; for long periods the demands of the new spectra are about half of the code regulations. As the first 30 m of the soil softens, the values of the plateaus decrease, although they are greater than those of the code spectra. The liquefaction potential is high, especially close to the alluvial plain of Portoviejo river due to lateral spread. The landslide hazard from earthquakes is small in dry conditions, with the exception of extreme events (2475 years return period). The damage observed after the 2016 earthquake is thought to be due to both, the characteristics of the buildings, especially for tall buildings, and the soil response due to the generally soft soil.

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