

SEISMIC ZONES IN CENTRAL AMERICA

The isthmus of Central America, a strip of continental territory of approx. 522,000 km² bordering Mexico, Colombia, the Caribbean Sea and the Pacific Ocean, is located in a highly seismic zone, where earthquakes produced either by the interaction of tectonic plates or by volcano activity in the interior parts of the isthmus, have produced in the last 50 years many human losses with up to the 37 thousand victims and material damages that exceed the 47,000 millions USD.

Seismic design codes in Central America use different nomenclature to refer to the seismic hazard of a specific zone. In order to contribute to a general overview of the seismic hazards of the region, two following main parameters are presented:

The Seismic Zone Factor (Ao), a measure of the peak acceleration to be used for a specific site and corresponds to a design earthquake that has a 90% probability of not being exceeded within 50 years. In order to obtain a uniform map for the region, which respects the zones defined by each country, specific extrapolation criteria were used. Corresponding results are depicted in fig. 2.

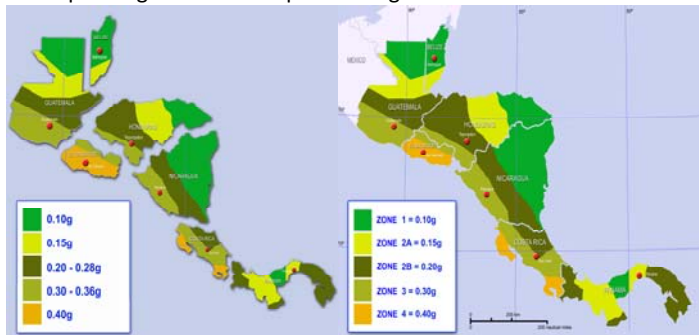


Fig. 2. Seismic Zones in Central America.

Left: Seismic zones, as defined by each individual country. Some zones have been slightly reduced (case for Honduras territory bordering El Salvador). As observed in the map, seismic zones in most countries reflect the influence of the subduction trench created by the interaction of the Coco's plate and the Caribbean plate.

Right: Proposal for seismic zone unification for the region, obtained through graphical extrapolation criteria, taking into account the seismic zones defined by each individual country. Ao-values are grouped into a maximum of five zones, following the UBC format.

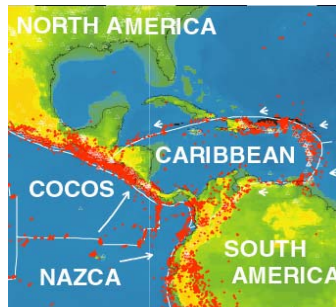


Fig.1: Continental Plates in the region of Central America. Red: seismic activity.

Elastic Response Spectra, which are the basis for computing design displacements and forces in systems that are expected to remain elastic and to develop design forces and displacements in systems with inelastic response. The Elastic Response Spectra shown in fig. 3 were calculated for each country of Central America, using rocky soil, elastic behavior and the greatest seismic zone factor of the country. The obtained graphs are compared to their equivalent obtained for UBC zone 4. As an important conclusion for the region, the use of individual country codes generally leads to more cost efficient seismic designs, as the use of UBC zone 4 design parameters provides rather overestimated seismic design loads.

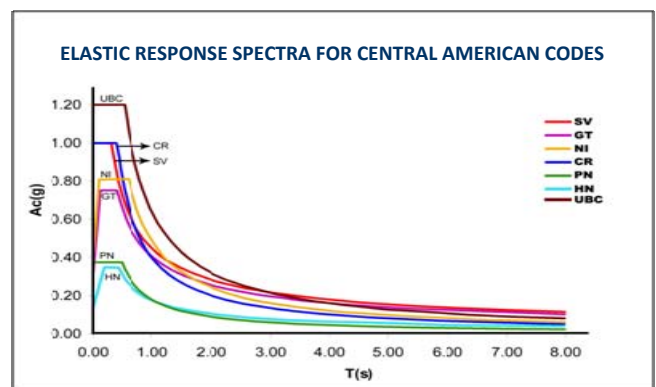


Fig. 3 Elastic response Spectra, illustrated as maximum acceleration A_c (expressed in g) vs. wave periods T (in seconds) for El Salvador (SV), Guatemala (GT), Nicaragua (NI), Costa Rica (CT), Honduras (HN), Panama (PN). UBC: Corresponding values according to UBC for seismic zone 4.

PROJECT HIGHLIGHT

EC has completed the structural design of the World Trade Center III expansion, including the "Torre Futura", one of the tallest buildings in San Salvador. The WTC complex, with a total construction area of 64'000 m², is located on the slopes of the San Salvador volcano, one of the highest seismic hazard zones of Central America. EC provided the structural design in accordance with the highest international seismic design standards and is presently performing as the structural supervisor of this project.



Fig. 4: Overview of the WTC III expansion project, including Torre Futura and adjacent buildings.

Torre Futura, a 20 level, approx. 90 m high building with 5 underground parking levels, rests on a foundation slab. The structural design is based on concrete frames combined with high strength concrete shear walls.

Completion of the civil/structural works, with an approx. Concrete volume of 32'000 m³, is due by the end of 2008.