SELECTION OF GROUND MOTION PREDCTION EQUATIONS FOR PROBABILISTIC SEISMIC HAZARD ASSESSMENT

BACKGROUND

Development of site specific ground motions for use in subsequent engineering evaluations often requires a probabilistic approach named probabilistic seismic hazard assessment. The main steps involved in this process are the following: characterization of the seismic sources, characterization of the ground motion attenuation, conduct the seismic hazard analysis, development of the design response spectra for a reference site conditon and development of the design time histories for a reference site condition. Estimates of ground motion attenuation at a given distance from an earthquake of a given magnitude are usually in the form of equations and are called attenuation relationships or ground motion prediction equations. They express the ground motion as a function of magnitude and distance (and occasionally other variables). Ground motion attenuation relationships maybe determined in two different ways: empirically (using previoulsy recorded ground motions) or theoretically (using seismological models to generate synthetic ground motions). There is an overlap, however, since empirical approaches often fit the data to a functional form suggested by theory, and theoretical approaches often use empirical data to determine some parameters.

PURPOSE AND EXPECTED RESULTS

The seismologic assessment of the Izmit Bay Bridge in Turkey, carried out outside of COWI in 2010, was based on the ground motion prediction equations developed in California for Western United States. However very recently Dr. Gülerce, from Ankara University, based on newly available database of regional ground motion recordings has proposed and published a regionalized version of these equations, applicable to Turkey. Additionally, new ground motions prediction equations have been developed in California. The proposed activity, using the case study of the Izmit bridge, for which seismic loads are driving the design, will evaluate the seismic actions (design spectra and design earthquakes) based on the two newer groups of prediction equations.

The difference in the results between the old seismic assessment and the results obtained using the regionalized version of ground motion prediction equations is expected to show that using regional equations leads to less severe seismic actions and therefore a more economical design therefore allowing saving for the contractor. The comparison between the results obtained using the regional equations and the new equations developed for Western United States will show to which extent these are suitable for use outside of this region.

This activity will show the possibility for a more effective seismic hazard assessment and the potential for saving in the construction/design of new large infrastructures in Turkey and in other earthquake prone regions. The activity will also increase COWI experience in the field of engineering seismology and seismic hazard assessment.