Title:	**Impact of an Earthquake on the Infrastructure of the Nicoya Peninsula, Costa Rica**	
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Hazard examined:	Earthquakes (ground acceleration, liquefaction and landslide potential, permanent ground deformation)	
Study emphasis:	Disaster preparedness, mitigation and recovery strategies.	
Summary:	Offers a set of GIS-based maps detailing seismic hazards, typical soil profiles at selected sites and spatial distribution and degree of expected damage to infrastructure.	

Vulnerability Indicators: Expected degree of damage

Economic Development, Disaster Preparedness, Disaster Response and/or Disaster Reconstruction Application: Identification of highly vulnerable sections of highways, critical bridges, schools and hospitals for disaster preparedness and rehabilitation plans to be executed by National Emergency Commission and Ministry of Public Works

Data Requirements: Maps (topography, geology), seismological parameters of sources, attenuation laws for chosen parameters, geotechnical and geophysical surveys, inventory and classification of exposed infrastructure, fragility curves for typical structures, acceleration records or intensities of previous earthquakes in the region, data of damage caused by previous earthquakes to similar infrastructure types

Output: Maps of seismic hazards (ground acceleration, liquefaction potential, landslide potential, permanent ground deformation, site effects) , typical soil profiles at selected sites, spatial distribution of expected damage on roads, bridges, schools and hospitals, lists of critical facilities with expected degree of damage, GIS with database of all roads, bridges and critical facilities for further use and display

Results of Application at Case Study Site: Maps of seismic hazards (ground acceleration, liquefaction potential, landslide potential, permanent ground deformation, site effects), typical soil profiles at selected sites, spatial distribution of expected damage on roads, bridges, schools and hospitals, lists of critical facilities with expected degree of damage, GIS with database of all roads, bridges and critical facilities for further use and display.

Note: Actual application of results of case study still in process by institutions involved in preparedness and rehabilitation of infrastructure.

Lessons Learned: Use of GIS is adequate for seismic hazard analysis but requires uniform quality of input. Uncertainties of data and estimations should be properly characterized by statistical parameters. Attenuation laws should be calibrated with local records of ground motion. For the case study, maps with scales 1:50,000 and 1:200,000 were suitable for modeling spatial distribution of ground motion but they were not optimum to clearly define zones of liquefaction and landslide potential. Methodologies for assessment of liquefaction and landslide potential should be improved. For assessment of site effects, separate studies of soil response have to be done before the results can be included in the GIS. Assessment of vulnerability of infrastructure requires a (laborious) thorough inventory of facilities, and their design and construction standards, and a careful selection of fragility curves. Fragility curves developed for other design and construction standards must be well adapted to local conditions (main shortcoming of methodology used) or calibrated with data from previous earthquake damage.