

Construction and risk evaluation of a water distribution network under seismic hazard in central Chile

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Abstract

Water distribution is of critical importance under regular conditions, and more so in times of an emergency induced by a large natural event, which also stresses the performance of other lifelines and critical infrastructure. Being able to compare the network operation in normal conditions with, that during an extreme event, is useful for decision makers in defining investment priorities for mitigation plans. This work aims to perform risk analysis under seismic hazard on the water network of a large conurbation in central Chile formed by the cities of Valparaíso and Viña del Mar. A hydraulic network model of the water network was developed first considering the physical properties of network elements and their estimated head losses. Herein, the methodology for the network construction is described, which combines datasets available in official repositories. As a first attempt, damage scenarios are generated using peak ground acceleration maps constructed using a ground motion prediction model. Pipeline failure is evaluated using fragility functions available in the literature; hydraulic analyses are then carried out on the damaged network. The performance of the network is measured in terms of connectivity (loss) and percentage of unsupplied demand. Finally, a seismic risk analysis on these two indices is presented to enable identification of the relevant characteristics of the constructed network.

Keywords: Seismic risk; Water system network; Connectivity loss.