

Multidisciplinary Approach for a Tsunami Reconstruction Plan in Coquimbo, Chile

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Abstract : Chile is located along the subduction zone of the Nazca plate beneath the South American plate, where large earthquakes and tsunamis have taken place throughout history. The last significant earthquake (Mw 8.2) occurred in September 2015 and generated a destructive tsunami, which mainly affected the city of Coquimbo (71.33°W, 29.96°S). The inundation area consisted of a beach, damaged seawall, damaged railway, wetland and old neighborhood; therefore, local authorities started a reconstruction process immediately after the event. Moreover, a seismic gap has been identified in the same area, and another large event could take place in the near future. The present work proposed an integrated tsunami reconstruction plan for the city of Coquimbo that considered several variables such as safety, nature & recreation, neighborhood welfare, visual obstruction, infrastructure, construction process, and durability & maintenance. Possible future tsunami scenarios are simulated by means of the Non-hydrostatic Evolution of Ocean WAVEs (NEOWAVE) model with 5 nested grids and a higher grid resolution of ~10 m. Based on the score from a multi-criteria analysis, the costs of the alternatives and a preference for a multifunctional solution, the alternative that includes an elevated coastal road with floodgates to reduce tsunami overtopping and control the return flow of a tsunami was selected as the best solution. It was also observed that the wetlands are significantly restored to their former configuration; moreover, the dynamic behavior of the wetlands is stimulated. The numerical simulation showed that the new coastal protection decreases damage and the probability of loss of life by delaying tsunami arrival time. In addition, new evacuation routes and a smaller inundation zone in the city increase safety for the area.

Keywords : tsunami, Coquimbo, Chile, reconstruction, numerical simulation

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