

Spatial Evaluation of Potential Tsunami Vertical Evacuation: A Case Study of the Western Coastal Belt in Sri Lanka

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On December 26, 2004, a massive tsunami resulted to recode extensive damages in the Indian Ocean. The recorded death toll was more than 35,000, and approximately one million people were affected in Sri Lanka. Lack of awareness was the main reason for massive damage. After this tsunami incident, Sri Lanka was also categorized as a tsunami-vulnerable country. Several past studies have contributed to introducing proper mechanisms that would minimize the damages from the next tsunami incident. Most tsunami-vulnerable areas have been covered by horizontal tsunami evacuation after 2004, and people need to travel great distances to reach tsunami evacuation centers due to the lower elevation profile of the coastal area. The purpose of this study was to spatially evaluate the potential for tsunami vertical evacuation in the western coastal belt in Sri Lanka. The western coastal belt selected by considering the existing urban structure and tsunami vulnerability. Several criteria and assumptions have been computed to achieve the goal of the study. In this analysis, three tsunami scenarios 4 m, 8 m, and 12 m were used to identify potential vertical evacuation sites. According to the results of the inundation ratio, the category of critical buildings can be increased to 1.7% and 67.0% in 4 m and 12 m scenarios, respectively. It was indicated that the 12 m scenario consisted of more damage than the other two scenarios. Tsunami evacuation sites were selected based on the three tsunami scenarios and 220, 232 and 122 sites were selected for the 4 m, 8 m and 12 m tsunami scenarios, respectively. According to the calculations of the capacity of each site, the selected 220 sites will facilitate 17,594 people during the 4 m tsunami scenario. The selected 232 sites will accommodate 25,677 people during the 8 m scenarios. All selected sites are capable of accommodating the affected population in both the 4 m and the 8 m scenarios. However, the selected evacuation sites are not sufficient for accommodating the affected population in the 12 m scenario. In the 12 m scenario, 12,221 people are affected. However, the evacuation sites can only accommodate 10,165 people. The finding of vertical evacuation by considering the existing urban structure of the city is essential to save human lives during the next tsunami incident. The adopted methodology can be used as an example for other lowland coastal cities to select vertical evacuation to protect human life.

Keywords: tsunami scenario, building volume, vertical evacuation, tsunami , Sri Lanka