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Assessing Building Vulnerability to Tsunami Hazards using Very High Resolution Satellite Imagery (Case : Cilacap, Indonesia)

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The big tsunami disaster occurring on 26 December 2004 has destroyed many cities along the Indian Ocean rim and killed approximately 300,000 people and destroyed buildings and city infrastructures making it the deadliest tsunami as well as one of the deadliest natural disasters in recorded history. Furthermore, there are large numbers of world's cities located near coastal lines prone to tsunami hazard. Anticipation measures and disaster mitigation must be taken in order to minimize the negative impacts that may hit those living and built in the cities. The assessment of building vulnerability is an important measure in order to minimize disaster risks to the city.

Measuring vulnerability for large number of buildings using conventional method is time consuming and costly. This paper offers a comprehensive framework in assessing building vulnerability by combining field assessment and remote sensing techniques. Field assessment was based on quantitative and qualitative building structural analysis and remote sensing technique was undertaken using object-oriented classification. Very high resolution satellite imagery (quickbird) and elevation data were employed in the remote sensing technique. Each building in the study area was classified automatically into 4 classes (Class A, B, C and Vertical Evacuation) based on their level of vulnerability to tsunami hazard using parameters extracted from remotely sensed data.

This paper presents results from Cilacap City, South coast of Java, Indonesia. The research work was performed in the framework of the GITEWS project. The results show that remote sensing and GIS approaches are promising to be applied to measure building vulnerability to tsunami hazards. Outcomes of the research consist of : new concepts in assessing urban vulnerability to tsunami hazard, new algorithm for extracting information from very high resolution satellite images, map of building vulnerability and recommendations concerning to urban vulnerability reduction.

Keywords : tsunami hazard, remote sensing, GIS, building vulnerability, very high resolution satellite imagery