TSUNAMI HAZARDS: IMPACT MITIGATION BY BIO-SHIELDS

By

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ABSTRACT

In the consequences of the Indian Ocean tsunami in 2004 and subsequent alerts in 2005 and 2007, the protection offered by bio shields such as sand dunes, coral reefs and coastal vegetation became evident in many countries affected and the role of coastal green belts in mitigating tsunami impacts has now been clearly recognized. In this research, exploring the effectiveness of bio shields as an environmental friendly and cost effective measure of tsunami impact mitigation was mainly concerned. The preliminary experimental and numerical model studies in investigating of resistance offered by coastal vegetation to tsunami overland flow were expanded to determine the energy dissipation characteristics and reduction in inundation extent in detail, in order to assess the effectiveness of coastal green belts in tsunami impact mitigation.

The resistive forces offered towards the flow which depend on the characteristics of an individual plant and characteristics of the vegetation as a whole, have been assessed. For an individual plant, the inundation of the stem of plants without the aerial root system, and branch structure perhaps representing the most common type of coastal vegetation, was considered in the tests as well as the vegetation as a whole can be characterized by its location from the shoreline, extent of spread, density or spacing between plants, distribution pattern and the size of plants. Detailed experimental studies were conducted to assess energy dissipation characteristics in which the vegetation was represented by geometrically similar small scale models (approximately 1:100). Similar to preliminary studies, this study was also conducted in a hydraulic flume. The energy dissipation of flow through vegetation was determined under steady flow conditions and reduction in inundation extent was assessed under unsteady flow conditions where mass of water was released over a sloping surface.

Reduction levels in energy dissipation were obtained in the range up to 48 % and the levels of reduction in inundation extent were obtained nearly up to 35 % in the experiments, which indicates the possibility of achieving significant levels of energy reduction of tsunami inundation by coastal green belts. The dependence of the level of inundation reduction on the level of energy dissipation was also investigated.

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T.D.H.M. Hemanthi

DECLARATION

This thesis is a report of research carried out in the Department of Civil Engineering, University of Moratuwa, between August 2009 and July 2012. Except where references are made to other work, the contents of this thesis are original and have been carried out by the undersigned. The work has not been submitted in part or whole to any other university. This thesis contains 62 pages.

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