

Experimental Investigation of the Role of Entrapped Air on Solitary Wave Forces on a Coastal Bridge Deck

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3:00-3:30 pm Coffee Hour

3:30-4:30 pm Seminar

Abstract

The collapse of bridge structures during tsunami and storm surge events, most recently the Tohoku (2011) and Indian Ocean tsunamis (2004), and hurricanes Katrina (2005) and Ivan (2004) has highlighted the need for a better understanding of the mechanisms that cause this failure in order to improve design and prevent future catastrophe. Storm surge is the temporary rise in sea level during a major storm or hurricane. During a tsunami event, large volumes of water may propagate onshore at high speeds. Many coastal bridges, such as those located on the islands of Hawaii, are close to shorelines and at elevations very near the water surface, making them particularly vulnerable to wave forces and effects of trapped air during a tsunami or storm surge event. Many coastal bridges, if damaged or destroyed during such an event, may limit access of emergency services to many communities adding to the loss of life. By performing a series of experiments on a 1:35 scale bridge model with varying percentages of trapped air, this study focuses on the role trapped air has on forces on a bridge structure compared with a structure where air is allowed to escape. This study concludes that uplift forces are significantly reduced when air is allowed to escape. These results have very important implications on the design of coastal bridges, and it is recommended that design regulations stipulate that bridges must have adequately sized air relief openings on the decks or between girders to allow the air to escape to reduce the wave loads.

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