



Effects of Tsunami Measures for Bridges

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Abstract

The massive tsunami after the Great East Japan Earthquake in 2011 caused immense damage to people's lives and industries; some superstructures of long-span bridges were washed away. Even now, nearly four years after the tsunami, many people are still forced to live in temporary housing and other makeshift facilities. Because the major bridges had been on important roads in the tsunami-stricken areas, their loss caused significant delays to relief and restoration work. Taking measures to protect bridges from tsunamis is extremely important, as there are concerns that similar tsunami damage to bridges could occur in other areas of Japan. However, reliable technologies have yet to be established for protecting bridges from tsunamis. The authors' recent experiments have verified the effects of employing fairings, fairings with slits, and slabs with air holes as measures against tsunamis. This paper describes the outline of experiments, experimental results, and discussions on these experiments, as well as conclusions.

Keywords: Tsunami; bridge; measurement; experiment; fairing; slit; slab with air hole

1 Introduction

The massive tsunami after the Great East Japan Earthquake in 2011 caused immense damage to people's lives and industries; some superstructures of long-span bridges were washed away. Even now, nearly four years after the tsunami, many people are still forced to live in temporary housing and other makeshift facilities. Because the major bridges had been on important roads in the tsunami-stricken areas, their loss caused significant delays to relief and restoration work. Taking measures to protect bridges from tsunamis is extremely important, as there are concerns that similar tsunami damage to bridges could occur in other areas of Japan. However,

reliable technologies have yet to be established for protecting bridges from tsunamis.

To study the behavior of tsunamis and the forces exerted on bridges, the authors carried out experiments of tsunamis using 1:50-scale bridge models and an experimental waterway with a tsunami gate. In the experiments, the tsunami's forces including horizontal forces, vertical forces, and moments were measured. Wave velocities and heights were also measured simultaneously, and the side view movies were recorded. Examining the results on tsunami forces produced several ideas for measures for protecting bridges. Several experiments were conducted to evaluate their effects, and as a result, fairings, fairings with slits, and slabs with air holes were verified as