Experimental study on anti-collision device using titanium steel and recycle tires

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Abstract

Anti-collision devices can reduce the damage of bridge columns under ship collision, and a new device is proposed in the paper using a combination of titanium steel and recycle tires. The proposed device effectively improves the performance of buffering energy dissipation and durability under strong impact load. A 0.6 scale test specimen was designed and tested to investigate the behavior of the device under impact load; finite element models were conducted to analyze and compare with the experimental results. The performances of different types of the anti-collision device are compared, and the failure mechanism is studied.

Keywords: recycled tire; impact force; energy dissipation; anti-collision device

1 Introduction

Collisions between a ship or vessel and a bridge sometimes occurred due to various reasons (such as loss of control of the ship, yaw, heavy fog, etc.). Dolphin protective structure, artificial island and guiding structure are currently widely used in bridge design to resist ship impact [1-3]. However, these structures have some disadvantages including high cost, huge construction difficulties and inability to float on the water. Arranging anti-collision devices around columns of bridge structures is a direct and effective way to protect bridge columns. Such anti-collision devices energy dissipation capacities [4]; the impact energy of ships is absorbed by the plastic or elastic deformation of the anti-collision devices [5], so that the ship impact force is reduced to an acceptable level or within the design requirements. The anti-collision devices of bridges can generally be divided into active anti-collision devices and passive anti-collision devices [6]; passive anti-collision devices are divided into direct device and indirect device depending on whether they are connected to the bridge columns. The cost of indirect devices is relatively high, and they have a large effect on the environment when damaged; direct devices rely on the horizontal resistance of bridge columns, and the

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