



Flexible Protection Technology of Bridge Pier against Ship Collision

Wang Y.G., Yang L.M., Zhou F.H.

Key Laboratory of Impact and Safety Engineering (MOE), Ningbo University, Ningbo 315211, China

Chen G.Y.

Shanghai Marine Steel Structure Research Institute, Shanghai, 201204, China

Lu Z.L., Zhuang D.L.

Department of Bridge Engineering, Tongji University, Shanghai, 200092, China

Contact: wangyonggang@nbu.edu.cn

Abstract

Bridges across navigation channels are under the threat of accidental ship collisions. Many research works have been conducted to investigate the crashworthy device against ship-bridge pier collisions. However, the existing bridge pier protection facilities, mostly based on absorbing ship kinetic energy, are large structures with high strength, resulting in large collision forces that may cause ship damage. In this paper, flexible anti-collision technology is developed, which protects the bridge pier based on the ship's course guidance principle, hence taking away the huge kinetic energy of the ship in the process of collision. The pier flexible crashworthy device has a compact structure and can greatly reduce the impact force of ships, protecting both the bridge and the ship. The reliability and effectiveness of the technology have been verified through off-shore impact tests.

Keywords: ship-bridge collisions; flexible crashworthy device; ship guidance.

1. Introduction

With the development of land transportation, many bridges were built. However, bridges hinder the ship's navigation on the waterway. With the increase in the number, the tonnage and the speed of the ships, the accidents of ship collisions with bridges have become more frequent and severe. Those accidents may cause disastrous social and economic consequences such as bridge collapse, ship-sinking, casualties, environmental pollution, and interruption of the land and water

transportation. Therefore, more attention should be paid to developing the techniques that avoid the increasingly severe accidents due to ship-bridge collisions [1-3]. Many people investigated vessel-bridge collision responses through impact tests [4, 5], analytical models [6] and numerical simulations [7-10]. The key issue in these investigations is how to correctly understand the dynamic process of ship-bridge collision. Only based on such knowledge can efficient crashworthy devices be designed [4].