Research on the Collision Force between Ships and the Piers of Fengjie Yangtze River Bridge

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Summary

In this paper, the accidents of ship striking against bridges and the current collision force calculation models have been introduced firstly, then based on Fengjie Yangtze River Bridge, the different model results are compared, which provide guild for the future research as well as design.

Keywords: accident; collision; force;

1 Introduction

With the implementing of transportation infrastructure in China, building bridges on river with busy shipping has significantly increased the risk of collision between ships and bridge piers. On June 15, 2007, one ship struck the Jiujiang River Highway Bridge in Guangdong province in China, the damaged bridge surface region reached 200 square meters. Another example is that, on May 26, 2002, since the captain suffered disease suddenly, the tugboat is out of control, which lead the barge striking against the Arkansas River highway bridge, and 17 cars sunk into the river, thus 17 people were killed in that accident. Because of its huge economic losses, casualties and bad social effects, the collision against bridge by ships has focused people's widespread concern both at home and abroad. The bearing capacity of bridge piles has been taken into account by engineering designer, as well as the mandatory provisions of national norms. However, there has still been a large gap on the research in this area between China and the advanced countries. The specification requirements of code in China can not afford the needing of construction. Special researches on the collision between ships and bridge piers are needed for some important bridges.

Based on the Fengjie Yangtze River Bridge in Chongqing, the collision force is calculated through the existing empirical formula and finite element analysis in this paper, and then the calculation results are compared with the numerical simulation result.

2 Project Overview

Fengjie Yangtze River Bridge is located 1km downstream of Fengjie County, 2 km away from Kuimen, which is not only the landmark project to Fengjie, but also the largest span pre-stressed cable-stayed bridge with two towers at present in Chongqing. The main bridge is 893.7m totally, five spans with main span of 460m. The span layout is 30.4m +203m +460m +175m +25.3 m. The horizontal layout is 0.25 (railings) +1.5 (sidewalk) +1.0 (Cable area) +15.0 (bidirectional 4 lanes) +1.0 (Cable area) +1.5 (sidewalk) +0.25 m (railings), totally 20.5m of bridge deck width. The upper structure is double A-type towers, two cable-plane and pre-stressed concrete girder. The tower is divided into five parts: upper pylon pillar, beams, the middle Pylon pillar, cover slab, and the lower pylon pillar.The height of the south pylon above the foundation slab is 206 meters, while the north one 211.606 meters. The longitudinal width of lower pylon pillar vary from 7m to 10m,starting from the bottom of the pylon, the rest are 7m. The upper, middle pylon pillar and the beam are single-box single-chamber cross-section. The lower pylon is a single- box and three- chambers cross-section. A diaphragm with thickness of 0.6m is located at the position where the longitudinal

https://doi.org/10.2749/222137810796024952