

Researches on changes of riverbed deposition during caisson construction

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Summary

The local deformation on the river bed around the pier is called local scour around piers. The caisson could be regarded as bridge piers with large dimensions. The local scour will affect the caisson construction obviously. According to the hydrological geological data of the bridge site, river model test was conducted to analyze the local scour state during caisson sinking. A empirical formula was proposed. According to the research results, the owner chose proper floating and embedding time for the caisson. The monitoring data indicated that the model test data agreed with the actual scour state in general.

Keywords: underwater caisson; local scouring; empirical formula; model test; engineering verification.

1. Introduction

High turbulent fluctuation and high flow speed is generated when the local flow is choked by piers. The local deformation on the river bed around the pier is called local scour. The water flow around the pier forms circumfluence. The speed and direction of the flow change sharply, which leads to vortex, spreading and developing to the downstream area, generating huge bed shear stress[1], and forming the scour pits. Researches on local scouring around piers had been developed abroad for a long time, such as the first paper named "About local scour at the bridge pier" was published by Durand Claye in 1873, more than 130 years ago. A lot of model tests of local scour around piers had been conducted by many scholars from different countries since 1950. A large quantity data from model tests were obtained and formulas were proposed to estimate the local scouring depth around bridge piers. A.J.Raudkivi draw the structure of water flow near piers in 1986[2].

The caisson could be regarded as bridge piers with large dimensions. Impeded by the caisson, the water flow forms strong vortex around the caisson. So the scour pits are formulated surrounding the caisson near the upstream face. The researches on local scour near piers in China have been started since 1958 and two formulas are proposed [3]. However, the establishment and verifications of the formulas are basically based on the middle and small scaled bridge pier, lacking verifications of large or extra-large bridge piers.

2. Hydrological geological condition

Later this year China's Taizhou Bridge over the Yangtze River is set to open to traffic. The bridge is a multi-span crossing, with each of its two consecutive main spans stretching to more than 1km in length. On completion it will be the world's longest three pylon suspension bridge. The middle pylon lies in the center of the river. The water flow is affected by dynamics of radial flows and tides simultaneously [4]. Flood tide could last for more than 3 hours, and ebb tide could last for more than 8 hours. Flood season is from May to October in a year, and dry season is from November to April in the next year. Tide level may change a lot in a year. The minimum grain diameter of the