

Mechanical Behaviors Analysis on a Arch Rib Segment of Yongjiang Bridge in the Eastern-Outer-Ring of Ningbo City

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Summary

Based on Yongjiang Bridge in the eastern-outer-Ring of Ningbo City, a reduced scale-model with the reducing proportion of 1/4 of its arch rib segment was produced, then a loading test on which is conducted to understand the local unstability mechanism and actual bearing capacity of the arch rib. The result shows that the arch rib is designed rationally and will work safely.

Keywords: yongjiang bridge; arch rib segment; reducing scal-model; analysis of mechanical behaviors; local buckling.

1. Introduction

With the development of related theories of steel arch bridges and the improvement of steel material quality, steel arch bridges are developing towards the long-span bridges[1]. In long-span steel box arch bridge, the irregular shaped box section of arch rib is often used instead of normal one, due to the mechanical behaviors of the latter couldn't meet the requirement. The irregular section is named "odd-shaped section" for its large difference from the normal section. For example, The reversed convex shaped section is applied in the arch rib of Lupu Bridge in Shanghai, while Yongjing Bridge(Mingzhou Bridge), located in the Eastern Outer-Ring of Ningbo City, uses the box section of convex shape in its ribs.

However, there is no existing rule for the stiffening girder design and the pressive strength considering local buckling of odd-shaped section, which is largely different. Few studies are about the steel box with odd-shaped section except a parametric analysis on the ultimate bearing capacity of steel octagon columns made by a Japanese man named Adati Masakazu[3]. Yongjiang Bridge is designed according to the specifications for highway bridges, part II: steel bridge[2], published by Japanese highway association, whose designing way for stiffening girder of normal box girder and standard for pressive strength are brought into designing Yongjiang Bridge to guarantee the local stability of odd-shaped section. Therefore, it needs more researching work to determine if the calculated pressive strength of odd-shaped section from the normal section is close to the real value, and if the design of the odd-shaped section is rational.

In this paper, based on a real engineering, Yongjiang Bridge in eastern outer-ring of Ningbo City, a test on a reducing scale-model of arch rib segment is conducted, in order to understand the mechanical behaviors of steel arch rib with odd-box-shaped section, including its local instability mechanism and actual bearing capacity. The ration of designing for Yongjiang Bridge can be verified resultly.