Design and Optimization of A Long Span Concrete Filled Steel Tubular Arch Bridge

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Summary

The Taiping Lake Bridge is a concrete filled steel tubular (CFST) arch bridge located in Anhui, China. In order to ensure the safety and durability performance of this bridge for construction and operation stages, finite element method is used to optimize the detailed design of arch spring, as well as the construction plan. Ultimate Load Carrying Capacity (ULCC) is also analyzed to obtain the real collapse process of this bridge. The results show that the weak sections of Taiping Lake Bridge are always at the vault and the 1/8 sections during the symmetric loading processes. The ultimate load carrying capacity is determined by these key sections.

Keywords: CFST arch bridge; construction plan optimization; ultimate load carrying capacity; finite element method.

1. Introduction

The Taiping Lake Bridge is a concrete filled steel tubular (CFST) arch bridges in Anhui province. The bridge is a half-through CFST basket-type arch bridge with main span of 336m, and the width is 30.8m (see Fig. 1).

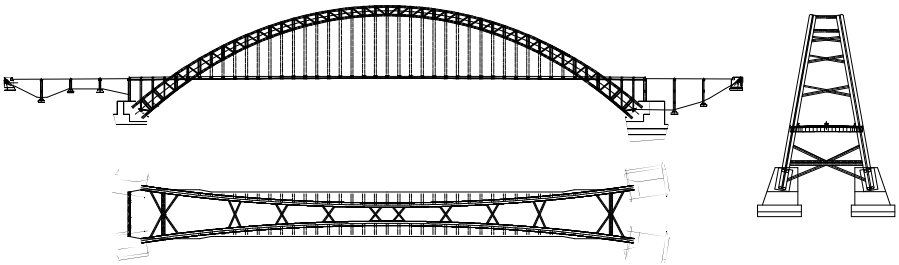

Fig. 1: Overall layout of Taiping Lake Bridge

The form of the main arch rib is catenary. The ratio of rise to span is 1/4.94, and the arch axis coefficient is 1.55.The width of arch rib is 3.0m constantly, but the height gradually changes from 11.28m at the spring to 7.28m at vault .The axis of arch rib is 10.008° intilted. The steel tubes of the main chord change its section from 1280×20mm(vault) to 1280×24mm(arch springing) by subsection. The material of the steel tubes is Q345D, and the whole weight is about 3500T. There are two main arch ribs, and every rib has 22 lifting segment, the maximum weight of which is 87.7t. The steel tubes of the main chord are filled

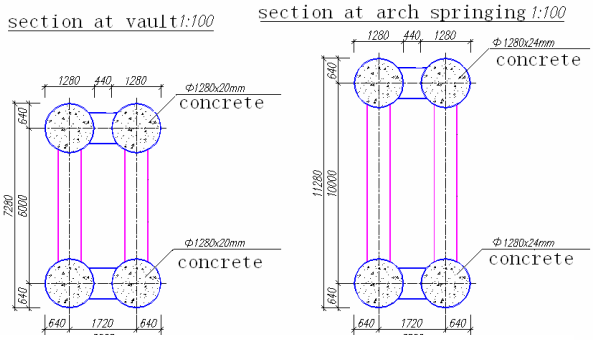

Fig. 2: The rib sections at arch springing and at the vault

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