

Reasonable Construction Procedures and Control Methods for a Concrete-Filled Steel Tube Arch Bridge Erected with Low Buckle Towers

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Summary

For the erection of an arch bridge with the method of inclined cable-stayed buckle, differently from high buckle tower scheme, the remarkable characteristic of low buckle tower scheme is that buckle cables near the vault have small horizontal inclinations and can provide minor vertical component forces. Take the Mengdonghe Bridge of Zhangjiajie-huayuan Expressway in Hunan Province of China as the engineering background, reasonable construction procedures and control methods were gained by mechanism analysis and numerical calculation of Finite Element Method under different construction procedures. The results show that: i) buckle and anchor cables should be loosen and removed before the pumping of filled concrete, ii) the order of the pumping of filled concrete should be from top chord steel tubes to bottom chord ones, iii) the loading sequence of spandrel constructions should be symmetrical from vault to skewback in classification with strips.

Keywords: Concrete-Filled Steel Tube Arch Bridge; method of inclined cable-stayed buckle; low buckle tower; reasonable construction procedure; control principle.

1. Introduction

Since steel strand was first used as buckle cable and anchor cable (also called back cable or balancing cable) in Yongjiang Bridge, which is located in Nanning, Guangxi Province, China, and is an arch bridge reinforced with concrete-filled steel tube with a span of 312 m, the method of inclined cable-stayed buckle by jack control has widely applied in the erection of arch bridge [1~5]. In mountainous area, restricted to terrain and water carriage, the lifting position of arch rib components usually needs to be set between the crane tower and the buckle tower and the buckle tower are separated from the crane tower, such as Zhijing River Bridge [6] in Hubei Province and Meixi River Bridge in Chongqing [7], China. In this case, the arch rib components need to be lifted up and transferred over the tip of the buckle tower. For the sake of saving the materials of crane towers and buckle towers, reducing the costs of temporary structures, a low buckle tower scheme is suitable. In a low buckle tower scheme, the horizontal inclinations and the vertical component forces of buckle cables near the vault must be small. This characteristic has significant effects on the selection of construction procedures and the stress status of structure at each construction stage.