Study on Measures to Improve Natural Vibration Characteristics of Three-Towers and Four-Span Suspension Bridge During Construction

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Abstract

In this paper, we take the suspension bridge of Oujiang Beikou bridge in Wenzhou, as the engineering background, the effects of a full rigid connection between segments, adding restraint cables between the stiffening beam and bridge tower, and adding restraint cables between the main cable and bridge tower, addition underwater auxiliary pier and the combination of the above measures on the natural vibration characteristics of the structure are studied and compared, especially the influence of torsional frequency and vibration mode. The calculation results show that when the hoisting quantity of stiffening beams is small, setting cables or a combination of the rigid connection of the beam and setting cables can improve the torsional frequency of the structure. When the hoisting quantity of stiffening beams is large, setting cables or combination setting auxiliary pier and rigid connection of beam

Keywords: three-tower and four-span suspension bridge; construction stage; natural vibration characteristics; measure.

1 Introduction

Unlike two-tower suspension bridges, the main cables of three-tower ground-anchored suspension bridges are vertically supported by saddles at the mid-tower, so the boundary conditions of the main cables at the mid-tower are weaker and the overall stiffness of the suspension bridge will be reduced[1]. Some studies have been done on the static and dynamic characteristics of three-tower ground-anchored suspension bridges. Shen et al. [2]investigated the effects of connection form of tower and girder, connection form of cable and girder connection, and cable system arrangement form on the static characteristics of the structure for a three tower-four span suspension bridge with different main span diameters. Cheng et al.[3]derived the reasonable value range of the longitudinal stiffness of the rigid middle tower. Jia et al.[4]established FEM model to perform a parametric analysis on tower stiffness, sag-span ratio, and side–main span ratio. Liang et al. [5] discuss the mechanical behavior differences between the two-tower and three-tower suspension bridges. Cao et al.[6]propose an analytical model for predicting the structural responses of three-tower suspension bridges with a central buckle under vehicle loads and examines the

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