Structural stress analyses of long-span railway extradosed cable-stayed bridge based on reasonable construction state

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Abstract

The system of the extradosed cable-stayed bridge constantly changed during construction. In order to obtain the reasonable finished dead state and ensure the structural safety during construction, it is necessary to deeply investigate the construction stages. A finite element model of a real long-span railway extradosed cable-stayed bridge built in China was established by using MIDAS/Civil finite element software to analyze the stress and deformation of the bridge based on reasonable construction state. The results show that it should be paid attention to the longitudinal displacement at the top of the tower after the middle-span closure stage, and the vertical displacement of the girder in the longest single cantilever stage. The maximum compressive stresses of the tower appeared after the cable tensioning and the girder appeared when the bridge is in the longest single cantilever state are less than the design compressive strength of concrete C55. The maximum tensile stress of the girder appeared when the bridge is in the longest double cantilever state is less than the design tensile strength of concrete C55.

Keywords: extradosed cable-stayed bridge; finite element analysis; reasonable finished dead state; reasonable construction state.

1 Introduction

Extradosed cable-stayed bridge is a hybrid typology between the continuous girder or rigid frame bridge and the cable-stayed bridge [1-4]. Extradosed cable-stayed bridge has the advantages of large structural stiffness, excellent span capacity, convenient construction, good economy and beautiful shape [5-6]. The tower height in the extradosed cable-stayed bridge is low, which is beneficial for the control of the transverse displacement at the top of the tower and the girder deformation. The extradosed cable-stayed bridge has been widely used for railway bridges [7].