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Research on the anti-cracking ability of large composite girder cable-stayed bridge

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1 Abstract

Recently, composite girder cable-stayed bridge is widely used in the world. Since the existing design method takes less focus on the principal stress of the top and bottom slab, the cracking problem of the concrete bridge deck has not been solved perfectly yet. Based on the spatial grid model, this paper takes Guan He Bridge in Jiangsu province as an example to analyze this kind of structure. Monitoring the principal stress of the concrete bridge deck is proposed for the first time to study the effect of diagonal crack. The principal stress of the concrete deck in the middle span, the quartile span, one-eighth of the span, the side span, the bridge tower, and the auxiliary pier are observed respectively. Comparing the theoretical values with the measured value, the results show that the actual stress state of the whole concrete bridge deck during construction is in accordance with the theoretical calculation. For composite girder cable-stayed bridge, the concrete bridge deck is prone to crack, so it is very significant to control the quality in the construction stage, which can provide a guarantee for the safety and durability of the structure.

Keywords: composite structure; complete checking stresses; spatial grid model; principal stress monitoring; overloading analysis

2 Introduction

The steel-concrete composite bridge is a combination of concrete and steel, working, bearing force and deforming together. Because it gives full play to the excellent performance of steel and concrete, it has significant economic and social benefits, which makes the composite structure bridge be widely promoted all over the world [1-3]. In 1982, German scholar professor Leonhardt [4] firstly proposed the design concept of modern composite beam cable-stayed bridge that the concrete bridge deck participates in load-bearing and bears the axial force of the composite beam. With the development of the cable-stayed bridge with a composite beam, there are several common diseases at the same time [5]: (1) through cracks in a direction across the bridge. (2) diagonal cracks in the junction of cable and bridge deck; (3) radial cracks in the junction of cable and bridge; (4) cast-in-place cracks in the longitudinal joint. Among them, in Annacis, Canada, it appeared a large number of cracks without normative permission in, cable-stayed bridge of steel-concrete composite girder built in less than two years. Second types of

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