Research on the Connected Effect of Separated Bridges Based on a Large-Span Continuous Rigid Frame Bridge

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Abstract

Prestressed concrete continuous rigid frame bridge is one of the main types of long-span bridges due to its mature construction technology and low cost during construction and operation. The corresponding design theory and construction technology were focused on the control and prevention technology of cracking and deflection. Based on an actual bridge inspection, obvious connected effect of separated structures was found that additional deformation and stress increase of the amplitude structure induced by the influence of the central transverse connection (diaphragm, central guardrail consolidation base, etc.) can not be ignored. Suggestions including raising safety coefficient or adopting refined analysis model are provided.

Keywords: prestressed concrete continuous rigid frame bridge; connected effect of separated structures; spatial grid model.

1 Introduction

Prestressed concrete rigid frame bridge is one kind of the common structural system in construction of long-span bridges due to its mature construction technology and low cost during construction and operation period. It plays an important role in the construction of bridges with a span of 100m~300m crossing waterways and mountainous areas[1].

This type of bridge structural system integrates the force characteristics of continuous beam bridge and T-shaped rigid frame bridge, with a continuous beam which is fixed with the piers. Based on the difference of pier thrust stiffness, the rigid frame system or continuous rigid frame hybrid system can be selected flexibly. The stress characteristics of the superstructure are essentially the same as those of the continuous beam, but the bending moment in the main girder can be adjusted through reasonable pier stiffness. Compared with the continuous beam, the positive moment of continuous rigid frame bridge is smaller than that of continuous beam bridge under live load, and their negative moments are close; under the action of the dead load, their bending moments are also closer. The piers and the girders are fixed together, which can reduce construction and maintenance cost of large-tonnage bearings, and improve the mechanical performance of the structure under horizontal load (such as seismic load). Therefore, this kind of bridge has been widely used all over the world[2][3].

According to the long-term engineering practice and operation tracking, there are some common and prominent defects of long-span PC continuous rigid frame bridges. The most typical defects are structural crack and midspan deflection, which also limit the widespread application of this type of bridges. In the past 20 years, the above problems have become the research hotspots in the

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