Temperature Effect of Flat Steel Box Girder in Suspension Bridge

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Summary

Based on case engineering Runyang Bridge, the temperature gradient of flat steel box girder in suspension bridge was continuously observed. According to the analysis of measured datum, the temperature gradient on flat steel box girder was proposed. With three temperature gradient models (JTG D60-2004 specification in China, EuroCode 1 and the temperature gradient which was proposed in this paper), the control sections stress was calculated by finite element program ANSYS. The calculated result indicates that the temperature gradient that was put forward in JTG D60-2004 specification and EuroCode 1 for calculating stress of flat steel box girder is not suitable to apply to flat steel box girder and inclines to be unsafe. The temperature gradient on flat steel box girder which was proposed in this paper was reasonable.

Keywords: suspension bridge; flat steel box girder; temperature gradient; stress

1. Introduction

Flat steel box girder has advantage of light weight, high intensity, easy construction, etc., and has become the preferred form of main beam of long span highway bridges. There is a great effect of the temperature on the internal forces of long span steel bridges. In addition to the overall movement and deformation of the bridge in response to changes in the effective bridge temperature, stresses are induced due to changes in temperature gradient within the cross-section. Such thermal loading influences not only the design of movement joints but also the design of other structural elements.

The Chinese specification（JTGD60-2004) [2] issued in 2004 was modified and referred to the temperature gradient curve in the AASHTO specification. Among the existing bridge specifications in all countries, the United Kingdom Bridge Specification (EuroCode 1) [3] is on the most detailed provisions of the temperature effect, taking into account daily shade temperature, solar radiation, inverse radiation factors and seasonal changes in temperature effects. However, the specification in Britain and other countries is not entirely for flat steel box girder structure, and the climate in these countries and China is different. Obviously the specification in Britain and other countries has a greater gap between the actual [5].

This paper took Runyang Yangtze River Suspension Bridge as an engineering background, and conducted a number of steel box girder temperature field tests. Based on the actual measured data and the long-term health monitoring system monitoring data, a kind of temperature gradient mode is presented for the flat steel box girder. A FE model of steel box girder was established. Stress analysis of flat steel box girder was carried out under different temperature gradients.

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