Study on temperature field effects on RC high-pier bridge

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Abstract

Temperature is one of the essential factors that cause dynamic characteristics changes in concrete bridges. However, the study of temperature-induced structural frequency changes relies on a large number of measured data to establish a frequency-temperature mathematical model. The selection of temperature variables is arbitrary. This paper takes a concrete high-pier rigid-framed bridge under construction in China as the research object. Based on the continuous 120-day measured weather data at the bridge site, the finite element method (FEM) is used to simulate the bridge's temperature and frequency history without considering the crack and other damage conditions. A regression analysis model of frequency and temperature variables was established. The study found that the selection of temperature variables and mathematical models influences the frequency-temperature mathematical relationship; for high-pier bridges. Establishing a multiple linear regression model with air temperature and point temperature of the main girder and piers as variables can obtain an ideal fitting result.

Keywords: concrete bridge; temperature variables; mathematical model; regression analysis.

1 Introduction

Structural temperature changes can affect the frequency of bridges, which will even conceal changes caused by structural damage[1]. Suppose a mathematical model of the relationship between bridge mode frequency and temperature can be established.

Generally, the influence mechanism of temperature changes on the dynamic characteristics of bridges is very complicated.

To simplify the above problems, Xia et al.[2] assumed that the mass and boundary conditions remain unchanged, so the n -order bending vibration frequency of an undamped single-span or multi-span rectangular beam is as follow:

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