

Study on Temperature effect of Single Expansion Joint Bridge

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Summary

In this paper a new type of single expansion joint bridge (SEJB) was proposed to deal with the problems associated with expansion joint. To investigate the mechanical characteristic of SEJB under temperature action, theoretical formulas for internal force and deformation were derived. A 280m long SEJB was verified to be reliable. Moreover, taking the different types of bearing and cushion material, different lengths of pavement and different temperature into account, parameter analysis was performed.

Keywords: single expansion bridge; temperature effect; stress and deformation; theoretical formula; parameter analysis.

1. Introduction

In traditional bridgeworks, main girders are connected with pavements by expansion joints at the abutment. Due to the change of stiffness at the boundary, the corrosion, the effect of impact load, the creep of concrete, the unequal settlement and the fatigue, the expansion joints are easy to damage and laborious to maintenance.

In order to solve such problems, a special fully jointless bridge-approach system with no expansion joint on the bridge deck and approach pavement was developed by the research team from Hunan University ([1-3]). A short-span jointless bridge is mainly composed of continuous bridge deck or continuous beams bridge, integral abutment or semi-integral abutment, special accessory members behind the abutment including approach slab (slab for short below) across the back wall of abutment and the continuous reinforcement concrete pavement (pavement for short below). All the thermal deformation of girder is transferred through slab to pavement and accommodated by limited displacements and micro-cracks of pavement. So the maintenance problems induced by corrosion, creep and fatigue at connection elements such as expansion joints can be effectively solved. Fully jointless bridges have been successfully applied in some provinces in China, including GuangXi, Guangdong, HeNan, YunNan and NingXia, etc. These projects have less initial construction costs, long-term maintenance expenses, and good long-term serviceability. But this kind of bridge is suitable for middle or short-span bridge whose total length is no more than 100m.

To apply the integral or semi-integral abutment bridge to large and middle-span bridge, based on fully jointless bridge, a new type of single expansion joint bridge (SEJB) is herein proposed; different with conventional bridge, only one expansion joint is required at original temperature centre in SEJB (for conventional bridge, the temperature centre locates normally at the geometrical centre of the bridge). In SEJB, expansion devices adopted by traditional bridge between abutment and the end of girder are eliminated, also the ones between slab and highway ([4-5]). The only one expansion joint in SEJB, located at original temperature centre, isn't subjected to the impact of