Mechanical performance of skewed deck-extension bridge

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Abstract

The deck-extension bridges is the most widely used jointless bridges in China due to the simple structure and convenient construction. The mechanical performance of skewed bridges is more complex than that of right bridges. To understand the difference between the skewed deck-extension bridge (SDEB) and the skewed jointed bridge (SJB), a SDEB built in China was chosen as a case study. The girders and approach slabs longitudinal displacements were monitored. A finite element model (FEM) was implemented by using the MIDAS-Civil software, of which the accuracy was verified by monitoring results. The mechanical performance of the SDEB and SJB under different load cases was compared. The influence of different skew angles on the mechanical performance of the SDEB was studied. The results indicated that the mid-span bending moment of the SDEB was slightly smaller by 5% than that of the SJB. Compared with the SJB, the mid-span torque of the girder in the side span and axial force at the girder end in the SDEB were significantly larger, which should be paid special attentions to during the design. The in-plane rotation of the girder in the SDEB was limited by the approach slab; therefore, the lateral displacement of the SDEB was significantly smaller than that of the SJB, especially for the skew angle of 30°. Bearing unseating and deck cracks may be improved in SDEB.

Keywords: jointless bridge; deck-extension bridge; skewed bridge; mechanical performance; finite element model.

1 Introduction

To meet the requirements of road alignment, bridge location and terrain, skewed bridges are often used. With the development of highways and urban expressways in China, the number of skewed bridges can reach up to 40~50% of total bridges in one route [1]. The deck joints in the skewed bridges were easily damaged, which affected the bridge durability and traffic safety [2-3]. Deck-extension bridge is one type of jointless bridge. The expansion joints between the girders and abutments are retained, however, the deck joints are eliminated. Therefore, the longitudinal expansion and contraction deformation of girders can be transferred to the connections between the approach slabs and pavements [4-7]. The skewed deck-extension bridge (SDEB) can not only resolve the vulnerability problems of deck joints but also

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