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Influence of Girder Connection Type on Mechanical Performance of Multi-span Semi-integral Abutment Bridge

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ABSTRACT

The deck expansion devices installed at the abutment can be eliminated by using the concept of the semi-integral abutment bridge (SIAB) to improve the serviceability and durability of the bridge. The mechanical performance of the girders in the SIABs with continuous structure or continuous deck between adjacent girders could be different. To investigate the different response of the two bridge typologies, a SIAB built in China was chosen as a case study. A finite element model (FEM) established by using the MIDAS-Civil software was used to compare the mechanical performance of the continuous structure SIAB or continuous beck SIAB under different load cases. The influence of different girder connection types and bridge lengths on the mechanical performance of a multi-span SIAB was studied. The results showed that the influence of the girder connection types on the internal force of the girder of a two-span SIAB is significant. Compared with the continuous structure SIAB, the absolute bending moments of the girder at the pier top, end diaphragm and mid span of the girder in continuous deck SIAB are lower, however, the shear forces of the girder at the pier top and end diaphragm are higher. With an increase in the bridge length, the continuous structure SIAB is more sensitive to the temperature variation than the continuous deck SIAB. The maximum lengths of the multi-span continuous structure SIAB and the multi-span continuous deck SIAB is 26 m (two-span) and 52 m (four-span), respectively.

Keywords: semi-integral abutment bridge; continuous structure; continuous deck; finite element model; maximum length.

1 INTRODUCTION

The bridge deck expansion devices are easily damaged due to the environment effects and the traffic load. The maintenance is time- and cost-consuming (Kelly et al. 2019; Xu et al. 2018). The deck expansion devices can be eliminated by using the concept of jointless bridge resolving the vulnerability of the deck expansion devices and increasing the driving comfort and traffic safety (Briseghella et al. 2021; Chen et al. 2022). There are three types of jointless bridges, which are

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