Numerical analyses of joint with steel endplates, headed stud anchors and concrete cross-beam in continuous steel-concrete composite girder bridges

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Abstract

Short and medium span continuous steel-concrete composite (SCC) girder bridges are becoming more and more popular. The problems caused by the negative bending moment in the continuous SCC girders cannot be ignored. In order to investigate the performances of the continuous joints between adjacent SCC girders, consist of steel endplates and headed shear stud connected to concrete cross-beam, the finite element model was built by using ABAQUS software, of which the accuracy was verified by experimental results. The parametric analyses were carried out to investigate the influences of the strength and reinforcement ratio of the concrete slabs in SCC girders, and the diameters of the horizontal headed shear studs on the performances of the joints. The ultimate moment capacity of the joint increases with the increase in the strength and reinforcement ratio of concrete slab and the diameters of the horizontal headed shear studs.

Keywords: Steel-concrete composite girder bridges, continuous joints, steel endplate, headed shear stud, concrete cross-beam, negative bending moment, finite element model, ultimate moment capacity.

1 Introduction

Steel-concrete composite (SCC) girders have been increasingly used in bridges for many years, especially for small and medium span bridges, because of the advantages, such as the large stiffness, excellent ductility, economic benefits and short construction times [1-3]. The overview on the recent development of the SCC girder bridges can be found in many papers [4-6]. The proportion of the SCC girder bridges in developed countries, such as France, Japan and USA, are 85%, 41% and 35%, respectively [7]. The simply supported SCC girder bridges can enable full application of the mechanical properties of the steel girders and concrete slabs under the positive bending moment. In comparison with the simply supported SCC girder bridges, the continuous SCC girder bridges are widely used due to the advantages of the higher span to depth ratio, less deflection, noise

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