



Mechanical Behavior of Hybrid Connectors for Rapid-Assembling Steel-Concrete Composite Beams

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Abstract

In order to achieve a kind of shear connector suitable for rapid-assembling steel-concrete composite beams, a new type of hybrid shear connectors is proposed, in which the concrete slab with prefabricated circular holes and the steel beam with welded studs are installed and positioned, and then epoxy mortar is filled in the prefabricated hole to fix the studs. To study the mechanical behavior of these hybrid connectors, test on 18 push-out specimens with different prefabricated circular holes are carried out. ABAQUS finite element software is adopted to verify the relationship between the numerical simulation and experiment, influences of the epoxy mortar strength and prefabricated circular holes diameter are studied. The results show that filling epoxy mortar in the prefabricated hole is beneficial to improve the stiffness and bearing capacity of the specimen; the change of epoxy mortar strength has a certain impact on the bearing capacity and stiffness of the hybrid connector; In the case of the same strength of the filling material, the size of the prefabricated circular holes diameter directly affects the stiffness and bearing capacity of the shear stud. The shear capacity equations proposed by considering the epoxy mortar strength and prefabricated holes diameter, and it has a wide applicability.

Keywords: Rapid-Assembling; Hybrid Connectors; Strength of Epoxy Mortar; Prefabricated Circular Hole.

1. Introduction

Steel-concrete composite structures take advantages of using steel and concrete materials. It overcomes some limitations of material characteristics of sole material-based bridge structure performance, such as the low tensile strength of concrete and easy buckling of steel members under compression. The connection between steel and concrete significantly determines the overall performance of the composite structure. The treatment of the connect surface is the core in the design and construction of steel-concrete composite bridge.

Metallic connectors are traditionally used in steel-concrete composite bridge to connect the concrete slab and the steel beam. Shear connectors can resist the longitudinal shear force between concrete slabs and steel beams, and also resist the vertical lifting force between concrete slabs and steel beams [1-3].

Precast concrete deck system is very attractive for rapid replacement of the deteriorated concrete deck as well as new construction of composite bridges. Owing to the benefits of combining the two construction materials, it presents higher span-to-depth ratio, reduced deflections, and higher stiffness ratios than traditional steel or concrete beam structures. Because the precast deck system needs no framework in place and can save construction time, it can be applied especially

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