Numerical analyses on flexural performance of prefabricated UHPC link slab

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Abstract

The expansion joints in the multi-span simply supported bridge can be eliminated by using the link slab. The ultra-high performance concrete (UHPC) with high tensile strength and crack resistance is an effective material for the link slab. However, the cast-in-situ UHPC link slab need to be cured with steam curing. Therefore, the construction processes are complicated and the construction quality is difficult to guarantee. In this paper, the prefabricated UHPC link slab which can be assembled on site to simply the construction process, accelerate the construction speed and reduce the labor cost was proposed. Finite element models of the prefabricated and cast-in-situ UHPC link slabs under bending were built by using ABAQUS. The ultimate bearing capacity of the prefabricated link slab was nearly the same of the cast in situ and the crack resistance slightly lower. Finally, the influence of the bolt (used to connect the prefabricated link slab) number and the distance from the bolt to the edge of the link slab on the crack resistance and ultimate bearing capacity of the prefabricated link slab were obtained.

Keywords: ultra-high performance concrete, link slab, prefabricated, cast-in-situ, finite element model, flexural performance

1. Introduction

Expansion joints are one of the most vulnerable elements in multi-span simply supported bridges [1-3]. In order to improve the bridge durability due to the expansion joints, the concept of jointless bridge has been widely used [4-5]. The link slab can be used to connect adjacent girders and so to eliminate the expansion joints without changing the static scheme [6]. A debonding layer is usually set between the link slab and girder [7]. However, under the long-term thermal variation and cyclic traffic load, many defects such as concrete cracking, spalling of concrete cover, corrosion of rebars, and so on, can be found in the reinforced concrete (RC) link slab.

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