



Negative Bending Fatigue Damage on the Steel Fiber Reinforced Concrete Composite Girder

Chen Xu, Boyu Zhang, Qingtian Su

Tongji University, Shanghai, China

Hiroshi Masuya

Kanazawa University, Kanazawa, Ishikawa Prefecture, Japan

Contact: sqt@tongji.edu.cn

Abstract

The tensile concrete crack in the negative flexural region is a critical factor to the safety and durability of steel-concrete continuous composite girder which can be used in mega bridge structures. This crack can be ameliorated by the steel fiber reinforced concrete (SFRC). Since the fatigue study on the mechanical behavior of the SFRC composite girder is rare, a series of fatigue negative bending tests on SFRC composite girders and fatigue push-out tests on stud connectors in SFRC were executed. The test results showed that the fatigue slip in the SFRC composite girder was smaller than the normal concrete composite girder, and the fatigue life of stud in SFRC was longer than the one in normal concrete. Meanwhile, according to the comparison between the stud fatigue live evaluations and test results, the AASHTO-based evaluations were comparatively conservative, and JSCE was close to the test results but had smaller safety redundancy.

Keywords: Steel fiber reinforced concrete; Composite girder; studs; Fatigue test

1 Introduction

In medium-span bridges, it can decrease height of beam and saving cost to use steel and concrete composite beam, in which advantages of both materials are fully utilized. Composite beams are usually in the form of continuous beam, in order to increase stiffness and guarantee smooth of roads. The tensile concrete crack and compression bucking of steel plate are the critical factors to the mechanical performance of composite beam. Several common methods, like prestress and increasing reinforcement ratio, are used to alleviate the concrete crack. Besides, steel fiber

reinforcement concrete (SFRC) is considered as a way to solve the problem, because of its high tensile strength¹. With SFRC applied to negative flexural region, prestress reinforcement is massively reduced, and construction process can be simplified.

Connecting between steel and concrete is of vital importance to the composite beam. Slip feature is regarded as an index to measure composite effect. At present, SFRC has few application, due to insufficient research in slip performance in the negative flexural region^{2,3}, the slip feature in the negative flexural region of SFRC composite beam and fatigue life of studs in SFRC were studied.