Cyclic Behaviour of Prefabricated High-Strength Concrete Composite Beam-to-Column Joints

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Summary

Prefabricated high-strength concrete composite beam-to-column joints were widely used in civil engineering. Six full scale cruciform type test samples with different parameters (thickness of steel joint plate and reinforcement ratio of column) were constructed and tested under cyclic lateral loading to study on the hysteretic behavior. The load-displacement curves, failure mode, stiffness degradation and energy dissipation capacity were presented. It was found that the strength and stiffness are less influenced by the steel joint plate thickness, but more influenced by the reinforcement ratio of the column. Failure modes were transformed from brittle shear in the column diagonals to a ductile one in the beam region, more ductile behavior and slower stiffness degradation were observed for the specimens strengthened by CFRP materials. The findings from the analysis were of guiding significance to the design and construction of the composite joint.

Keywords: Beam-to-column joint, Hysteretic behavior, Stiffness degradation, Energy dissipation capacity, Failure mode

1. Introduction

Steel-concrete composite structures, owing to their high capacity for prefabrication and rational use of materials can provide high levels of performance in terms of ductility and dissipation energy, while at the same time containing construction costs. Therefore, prefabricated high-strength concrete composite beam-to-column joints were widely used in civil engineering, such as building, parking lot and bridge. Experimental investigation on composite joints began in the seventies. The most important works on the subject up to 1989 were revised by Zandonini [1] and summarized by Simoes da Silva [2]. The behavior of composite joints is influenced by the degree of shear connection in the composite beam, the type of steel joint (composite partial, extended or flush end plate connections, or flange and web cleat connections), the slab rib direction and the amount of reinforcement. Leon [3] and Nakashim [4] conducted full-scale tests under cyclic loading to examine the interaction composite action between the steel beam and the RC floor slab. Kim [5] and Vasdravellis [6] carried out an experimental study on full-scale sub-assemblages to investigate the contribution of the RC slab. Gil [7] carried out an experimental program to test and characterize an innovative design for internal and external semi-rigid composite joints. Salvatore[8] illustrated

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