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Experimental Research on Concentrated Load Transfer between Steel and Slender Reinforced Concrete Slabs by High Performance Saw-Tooth Connectors

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Abstract

This paper presents the results of an experimental study on saw-tooth connectors. One main application of these connectors is in hybrid structures, where they connect steel struts or cables to slender concrete decks. In these connections huge and concentrated forces are transferred from steel into concrete. According to the structural system, these connections may occur in the middle or on the edge of the reinforced concrete deck. Depending on the location within the main structure the rc-deck itself is exposed to compression or tension. Therefore, four different build-in situations are being investigated on slender rc-slabs. The presented experiments assess the distribution of the shear force along the connector. A preliminary FE-analysis based on the elasticity theory is compared with the observed load-bearing behavior. The tests show that the loading of the rc-slab in compression or tension has a high impact on the load capacity. All the tests show brittle failure in the concrete. This issue is addressed and investigated during this study.

Keywords: composite structures; concrete; steel; slabs; bearings; joints; bridges; buildings; fatigue; testing

1 Introduction

Composite structures out of steel and concrete are very efficient and suit the nature of the applied materials as long as efficient connection elements are being used. Therefor a special high-performance connection is proposed and experimentally researched at the TU Berlin. The so-called saw-tooth connection qualifies especially for concentrated load transfer of high longitudinal forces from steel struts or cables into slender concrete slabs. Possible applications are at cable stayed bridges or suspension bridges to tie cables to the deck or in hybrid truss bridges to connect steel struts to the concrete deck (Figure 1). The forces are being widespread from the saw-tooth connector into the concrete slab through compression struts within the concrete (Figure 2).

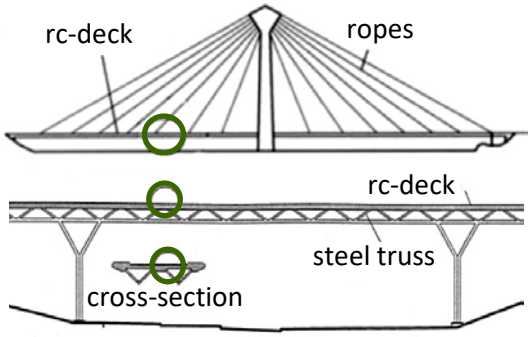

Figure 1. Applications for saw-tooth connectors

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