Investigation of the load-bearing behavior of composite joints in cross-section supplements for concrete structures

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Abstract

The strengthening with cross-sectional supplements made of reinforced concrete is already of great importance in building, bridge, and industrial constructions and will be further developed in the future because of the increasing demands on existing structures [1]- [3].

As part of an ongoing research project at the Institute of Structural Concrete at RWTH Aachen University, funded by the German Federation of Industrial Research Associations (AiF), a correlation between the method of surface treatment of the old concrete, the measured roughness, the type of concrete supplementation, and the load-bearing capacity of the composite joint has to be derived by means of new systematic test series. As a result, a database, and a possible practical guide on the load-bearing capacity of different combinations of old concretes, surface treatments, supplementary concrete layers, and bonding conditions will be developed. This paper will present the initial findings from this research project.

Keywords: composite joints, shear friction, shear test, strengthening, roughness; adhesive bond

1 Introduction

The high age of many existing structures, in combination with the greater stresses and deferred maintenance investments from the past, has led to a significant deterioration in the condition of many structures and their load-bearing capacity in recent years. For time and economic reasons, expensive rehabilitation work or reconstructions of structures with insufficient load-bearing capacity cannot always be implemented immediately, so that the load-bearing capacity and serviceability of existing structures must be ensured by subsequent repair and strengthening measures [3].

The strengthening of concrete structures can be implemented, for example, by placing additional reinforcement in supplementary concrete layers or by increasing the total concrete cross-section. Strengthening measures established in construction practice include horizontal supplementary concrete layers on slabs, vertical supplements in columns and walls, and cross-sectional supplements on inclined surfaces with concrete [4]- [7].

In the case of subsequently applied concrete layers, composite joints are created between the old concrete surface and the supplementary concrete layer. Thus, a friction-locked connection of the concrete layers must be ensured. For Germany, the dimensioning and execution of the composite joints are regulated in DIN EN 1992-1-1 (EC2) [8] and the National Annex for Germany (NA(D)) [9]. According to these regulations, force transmission in the joint is ensured by adhesion, friction, and composite joint reinforcement. The surface structure of the old concrete has a significant influence on the load-bearing capacity of the bonded joint.

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