IABSE Symposium 2019 Guimarães
Towards a Resilient Built Environment - Risk and Asset Management
March 27-29, 2019, Guimarães, Portugal

Bond behaviour of chemically prestressed textile reinforced concrete

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Abstract

The bond behaviour of concrete specimens with carbon textile reinforcement was investigated in the presented research programme. Pull-out specimens were cast from self-compacting concrete with expansive admixtures and in this way chemical prestress was introduced. The aim of the research was to compare bond behaviour between prestressed specimens and non-prestressed control specimens. During pull-out tests, the pull-out force and notch opening were measured with a load cell and laser sensors. Further, bond - slip and pull-out force - crack width relationships were drawn and compared for prestressed and non-prestressed specimens. Chemically prestressed specimens reached 24% higher bond strength than non-prestressed ones. It can be therefore concluded, that chemical prestressing positively influences the bond behaviour of concrete with textile reinforcement and thus better utilisation of its properties can be provided.

Keywords: chemical prestressing, carbon textile reinforcement, non-metallic reinforcement, bond behaviour, pull-out test.

1. Introduction

Chemical prestressing is a concept of using expansive concrete to achieve compressive stresses in structural elements. Expansion of such concrete is restrained by internal reinforcement and in such a way stresses are introduced in the rebars and transferred to the concrete matrix [1, 2]. Our research is aimed at proving that concrete members with textile reinforcement can be efficiently chemically prestressed. In particular, this paper presents an experimental programme designed to check how chemical prestress influences the bond behaviour. The question is what is the relation of the bond stresses of prestressed and non-prestressed specimens and if the full bond stresses can be achieved for the textile reinforcement.

2. Test concept

The bond behaviour of the textile reinforcement in concrete is commonly determined in tensile tests [3]. Promising methods of determining the bond properties of structures with textile reinforcement in a way that is appropriate and reliable is currently demonstrated by the two-sided test setup for asymmetrical tensile tests [4, 5, 6]. This experimental setup is thus set here as the basis for the experimental investigation (cf. Fig. 1). An adaptation of specimen dimensions was necessary because a larger textile reinforcement grid is used. As the specimens are larger, the bond lengths are also increased. The basic shape of the test specimen is maintained, and the thickness and width of the specimens are also adjusted to maintain the scale. Such modification of the test specimen should ensure a targeted, one-sided pull-out failure of the textile reinforcement.

https://doi.org/10.2749/guimaraes.2019.0297
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