Bond Behavior at the Interface in Concrete Elements Strengthened with NSM Bars and Strips

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Summary
The paper presents the results of monotonic Single Shear Tests (SST) on concrete prisms externally reinforced with basalt, glass and carbon bars and strips according to the NSM technique. The experimental tests are a part of wide Round Robin Test programme involving several worldwide research laboratories. The tests are aimed to define the ultimate load and characterize the bond behaviour of different NSM strengthening systems at varying several parameters (material, geometry, surface treatment).

Keywords: Bond Test, FRP NSM external reinforcement, Bars, Strips, Debonding.

1 Introduction

Innovative Fiber Reinfoced Polymer (FRP) materials for strengthening of existing Reinforced Concrete (RC) structures are becoming a common repairing technique in the practical applications due essentially to their high mechanical properties, lightness and inertia to corrosion phenomena. Moreover, fast and simple application procedures reduce the installation time with short or without any interruption of the construction functionality that makes the strengthening techniques with FRP materials very advantageous for repairing infrastructures. Therefore the reduced installation time can be a determinant factor to choose FRP materials joined to their high corrosion resistance under the aggressive conditions typical of this type of constructions. Among the strengthening techniques with FRP materials, the use of Near Surface Mounted reinforcements (NSM technique) seems to be particularly efficient. This technique consists of cutting grooves into the concrete cover on the tension side of RC elements, put the FRP reinforcement (bars or strips) therein and bond with a filler (typically epoxy paste or cement grout). It seems a valid alternative to the External Bonded Reinforcement (EBR) technique, in order to mitigate the risk of premature debonding failure [1]. However the design indications are still lacking due both to the wide variety of FRP reinforcement (materials, geometry, surface treatments) and the few experimental and numerical studies available.

This paper presents the results of bond shear tests on concrete specimens strengthened with the NSM technique using various types of reinforcement; the experimental program was carried out within the framework of an European Round Robin Test.

2 Bond behaviour in NSM systems

The main parameters influencing the local bond-slip behavior of NSM systems [1, 2, 3, 4, 5] are the mechanical properties of the material, the surface treatment of the FRP reinforcement and the grooves, the geometry of the strengthening system (bars or strips), and the epoxy cover – to – bar diameter ratio, k.

https://doi.org/10.2749/222137810796024835