Development of a state-of-the-art report about testing methods for bondline characterization in civil engineering field

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Relevant Working Groups: WG2

Objectives / Description / Main outcomes

The main objective of the STSM was a development of a state-of-the-art report about testing methods for bondline characterization in civil engineering field. This report was intended to be used further as a contribution to a review paper summarizing methodologies of bond line characterization in different industries such as aerospace, wind energy, civil engineering, automotive and marine.

In civil engineering industry, fiber-reinforced polymers (FRPs) are used to build new construction and for strengthening of existing structures. The application of FRP is widely used for concrete structures, however, it finds also an implementation for other structural materials such as masonry, timber, steel and structural glass. Although new projects that utilize FRP are still rare, however, nowadays they find their way to be accepted as a common practice. In case of strengthening of existing structures, two most common strengthening techniques are used: external bonded reinforcement (EBR) and near surface mounted (NSM) reinforcement. The EBR involves bonding a laminate or textile onto the surface of a structural element, whereas the NSM consists of placement FRP reinforcement into the groves pre-cut in the element. Both techniques use high-strength adhesives (or resins) to bond the external FRP reinforcement to the element or embed FRP bars into the groves. Regardless of the position of the reinforcement (EBR or NSM), the main factor that governs the design of FRP applications is the debonding of the FRP. This generally initiates before the tensile strength of the FRP reinforcement is reached and therefore this phenomenon has been of special interest of researchers. To study this phenomenon, different experimental techniques have been employed, however, a standard procedure has not been defined yet.

Common experimental test setups for adhesively bonded composite joints reported in literature are shown in Fig. 1. These can be divided into two groups: shear test (single and double) and beam bending test. There is no common understanding regarding displacement rate or length/area of bondline, however, some tendencies can be found (EBR: bondline area from 20×250 mm^2 to 50×300 mm^2, NSM: bond length from 20 to 300 mm, displacement rate from 0.12 to 1.2 mm/min – for both EBR and NSM).

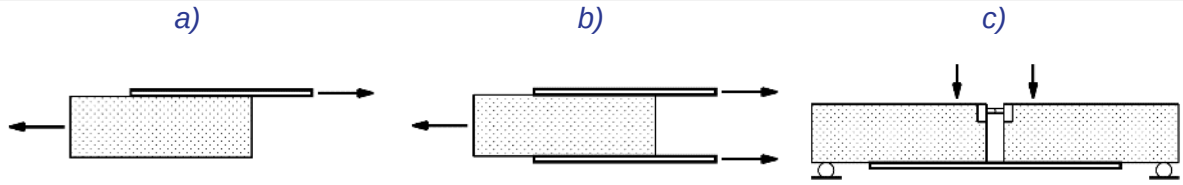

Figure 1: *Test setups for assessing NSM and EBR FRP bond behaviour: a) single-shear test, b) double-shear test setup, c) bending test setup.*