Shear Strengthening of Structures with CFRP

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Abstract: *Rehabilitation and strengthening of concrete structures have become more common during the last 10–15 years, partly due to a large stock of old structures and partly due to concrete deterioration. Also factors such as lack of understanding and the consequences of chloride attack affect the need for rehabilitation. In addition, more traffic and heavier loads lead to the need for upgrading. Existing externally bonded strengthening systems using fiber-reinforced polymers (FRP) and epoxy as bonding agents have been proven to be a good approach to repair and strengthen concrete structures. However, the use of epoxy bonding agents has some disadvantages in the form of incompatibilities with the base concrete. It is, therefore, of interest to substitute epoxy with systems that have better compatibility properties with the base concrete, for example, cementitious bonding agents. This paper presents a study on reinforced concrete beams strengthened in shear with the use of cementitious bonding agents and carbon fiber grids, denoted as mineral-based composites (MBC). In this study it is shown that the MBC system has a strengthening effect corresponding to that of strengthening systems using epoxy bonding agents and carbon fiber sheets. Different designs and material properties of the MBC system have been tested. An extensive monitoring setup has been carried out using traditional strain gauges and photometric strain measurements to obtain strains in steel reinforcement, in FRP, and strain fields on the strengthened surface. It has been shown that the use of MBC reduces strains in the steel stirrups and surface cracks even for low load steps as compared to a nonstrengthened concrete beam.*