Numerical Simulation and Experimental Validation of an Integrated Sleeve-Wedge Anchorage for CFRP Rods

The tensioning of carbon fibre-reinforced polymer (CFRP) rods for prestressed concrete applications or post-tensioning repair and strengthening has met with mixed success. This is primarily due to limitations inherent in the use of traditional wedge anchors typically used for steel tendons. Recently, an integrated sleeve-wedge anchorage has been successfully developed specifically for CFRP rods. This paper in turn presents a numerical simulation of the newly developed anchorage using ABAQUS. The three-dimensional finite element (FE) model, which considers material non-linearity, uses hexagonal elements for the barrel and CFRP rod and tetrahedral elements for the integrated sleeve-wedge. The simulated barrel surface strains are shown to compare well with optically measured strains, however, the numerical results are shown to be sensitive to the mechanical properties of the anchorage and CFRP rod and especially the transverse elastic modulus of the CFRP rod. Finally, the simulated strain distributions throughout the anchorage as well as the distribution of CFRP rod confining pressure are presented. Such strain and pressure distributions enable insights into the inner workings of the anchorage to be achieved.

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