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INTERACTION OF CONCRETE AND ADHESIVE MORTAR CREEP EFFECTS ON BONDED ANCHORS SYSTEMS

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ABSTRACT

Bonded anchors long term behavior has become a crucial topic in fastening systems because of their complex creep behavior. Better insight on their long-term performance plays a central role regarding their safe and efficient design. A bonded anchor system is typically comprised of a steel threaded bar (also rebars or ad hoc designed geometries are used), embedded in a concrete member and bonded to it through a thin layer of adhesive mortar. The creep behavior of bonded anchors is normally attributed to the adhesive mortar layer. In order to quantify it, extrapolation using the Findley power law is performed on data obtained typically from confined configuration tests of bonded anchors. The system creep, though, depends on the adhesive mortar creep, concrete creep, and their interaction. In this study, the effect of the separated concrete and adhesive mortar creep behaviors, are going to be compared with the combined creep behavior of the system. In this investigation, a model that couples hydration, diffusion, and heat transport with the concrete creep response was calibrated on internally generated experimental results on concrete material. Also, short term tests were performed on concrete and bonded anchors system to be able to calibrate the system short term response and material properties. In order to calibrate the adhesive mortar layer viscoelasticity, confined long term tests on bonded anchors were used. Once the calibration of the model was completed, the model was validated on unconfined long-term tests with different geometries. Therefore, a comparison between numerical and experimental results having different stress states along the threaded bar can be carried out. The study shows that the two creeping materials have competitive effects on the long-term stress redistribution in bonded anchor system, i.e. the viscoelasticity of the adhesive layer redistributes uniformly the bond stress in course of time, while the concrete creep leads to progressively increasing bond stresses.