AUTOGENOUS SHRINKAGE INDUCED STRESS OF ALKALI ACTIVATED SLAG AND FLY ASH CONCRETE UNDER RESTRAINT CONDITION

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Autogenous shrinkage is an important engineering property for construction materials since it can induce internal tensile stress and consequent micro- or macro- cracking of the concrete. Alkali activated slag and fly ash (AASF), as a promising alternative to ordinary Portland cement (OPC), has shown many interesting properties such as high early age strength, good durability and fire resistance, but it also shows high autogenous shrinkage in the meantime, which hinders a wider application of this eco-friendly binder material. However, high autogenous shrinkage doesn't necessarily mean high stress of the material under restraint condition, since there are creep and associated stress relaxation happening simultaneously. Therefore, the creep of AASF needs to be considered in order to better understand the stress induced by autogenous shrinkage. In this study, the autogenous shrinkage induced stress of AASF concrete (with a liquid/binder ratio of 0.5) under restraint condition is measured by Thermal Stress Testing Machine (TSTM). The free autogenous shrinkage of a twin specimen is measured by Autogenous Deformation Testing Machine (ADTM). The elastic modulus of AASF concrete is tested on prisms. The creep coefficient of AASF concrete is calculated based on the stress, free autogenous shrinkage and elastic modulus. It is found that the creep coefficient of AASF concrete is much higher than that of OPC concrete, and creep plays an important role in relaxing the shrinkage induced stress and thus reducing the cracking potential of AASF concrete.

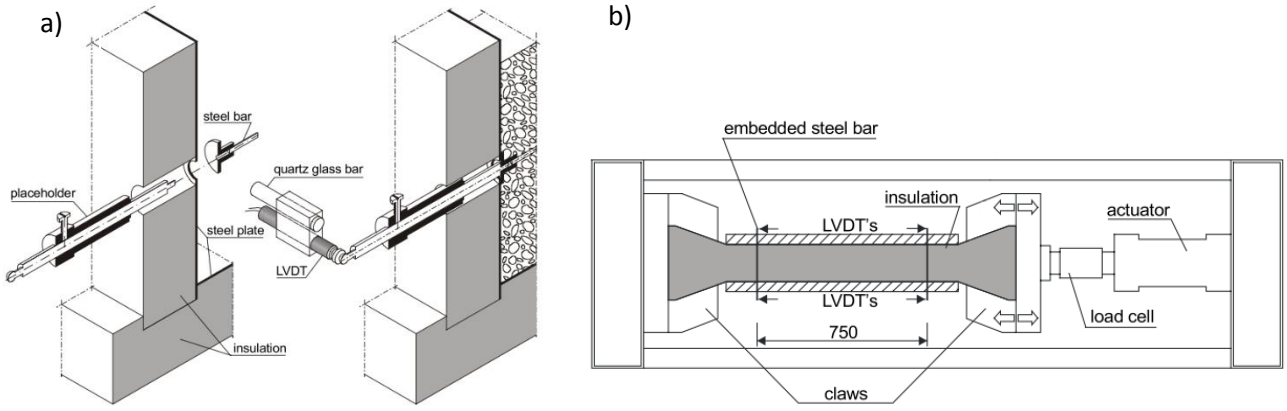

Figure 1 – (a) Detail of experimental setup for the measurement of the free deformations of concrete (ADTM) and (b) top view of experimental setup for the determination of stress development in concrete (TSTM)