

## ***Shrinkage Characteristics of Modified High-Volume Fly Ash Concrete***

T.M.D.P. Thennakoon, S.P.D.D.Y. Jayawardhana, K.C. Chandrasiri\*

*Department of Civil Engineering, University of Peradeniya, Peradeniya, 20400, Sri Lanka*

*\*cchandrasiri@eng.pdn.ac.lk*

This research investigates the drying shrinkage characteristics of high-volume fly ash concrete (HVFA) modified with slag, which are industrial by-products with significantly lower carbon footprints than cement. Motivated by the growing significance of supplementary cementitious materials (SCMs) in sustainable construction, this research seeks to enhance the environmental and mechanical performance of concrete. Despite the known benefits of SCMs, challenges remain, particularly concerning the drying shrinkage properties of modified concrete. A comprehensive literature review was conducted to synthesize the existing knowledge, identify gaps, and lay the groundwork for experimental investigations. Experiments were carried out separately for mortar and concrete, modifying the mixes by replacing 70% of the binder with fly ash and slag, thereby reducing the cement content to 30%. Tests were conducted to collect data on shrinkage (up to 90 days), compressive strength (up to 90 days), porosity and mass variation. For the mortar samples, six different mixes were used: one control mix, one with 70% fly ash, and four with varying slag content (5%, 10%, 15%, and 20%) while maintaining fly ash at 65%, 60%, 55%, and 50%, respectively. For the samples made for compressive strength and shrinkage testing, alkali-activated slag finer than 45  $\mu\text{m}$  and 75  $\mu\text{m}$  was used respectively and the samples were cured under different environmental conditions. Three different mixes were used for the concrete samples: one control mix, one with 70% fly ash, and one with 15% slag while maintaining fly ash at 55%. Slag addition helped to mitigate the reduction of early-age compressive strength of mortar. For studies like this, it is vital to ensure the quality and the fineness of the raw materials before using them, to achieve reliable results. The findings are expected to contribute to the advancement of environmentally conscious construction practices.

**Keywords:** Drying Shrinkage, High-Volume Fly Ash Concrete, Slag Modification, Supplementary Cementitious Materials, Sustainable Construction