INVESTIGATION OF DRYING SHRINKAGE OF CONCRETE IN LOCAL CONDITIONS

D.P.T.L.D. Nimalsooriya, T.G.P.L. Weerasinghe *

Department of Civil Engineering, University of Moratuwa, Moratuwa

Drying shrinkage of concrete is a commonly occurring phenomenon after the concrete hydration process that affects the stability and long-term performance of the concrete. This occurs due to the volume reduction of the concrete in the drying process. This leads to various problems with construction causing shrinkage induced cracking. These problems affect the performance of various elements such as slabs, floors, walls, pavements and beams leading to cracks and strength reduction. While numerous studies have been conducted in temperate regions, limited research exists on drying shrinkage behaviour under tropical climatic conditions, such as those found in Sri Lanka. This study investigates the drying shrinkage characteristics of concrete exposed to local conditions.

In this study, the effect of the water cement ratio, grade of concrete and type of concrete were compared. Concrete specimens were prepared using three mix designs to evaluate the effect of the change of the grade (C30/37, C25/30, C20/25) of concrete to the drying shrinkage. The effect of change from the w/c ratio (0.48, 0.52, 0.55) was evaluated from the same mix design samples. Also to compare the effect of cement materials to the drying shrinkage of concrete both Portland Composite Cement and Ordinary Portland Cement were used. Sample preparation and test were carried out following the BS ISO 1920-8.

This paper investigates the drying shrinkage behaviour of concrete with Portland Composite Cement (PCC) and Ordinary Portland Cement (OPC) for the concrete grade of C30/37, C25/30, 20/25 considering local environmental conditions and construction practices. An attempt has been made to propose suitable modifications to the Eurocode 2 recommendations, if necessary, to enhance the accuracy of predicting drying shrinkage under local conditions.

Keywords: Drying shrinkage, Sri Lankan conditions, Eurocode 2, Portland Composite Cement, Ordinary Portland Cement

* *Correspondence: pasinduw@uom.lk*

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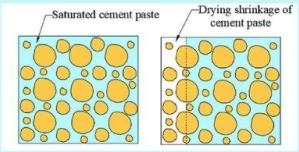
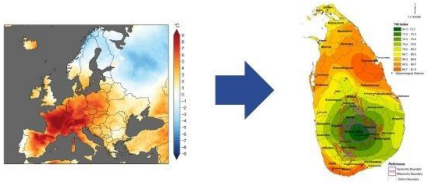
Drying shrinkage of concrete

- Drying shrinkage of concrete refers to the reduction in volume that occurs when moisture gradually evaporates from hardened concrete under unsaturated environmental conditions. It is a time-dependent process that begins after the concrete has set and hardened, typically after the end of the curing period.

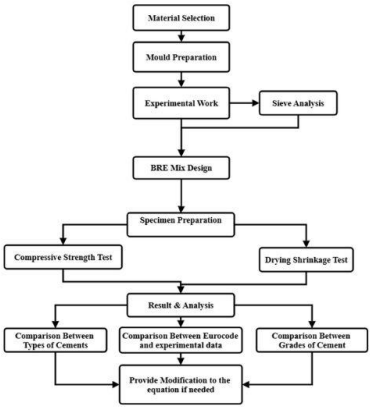


Research Gap

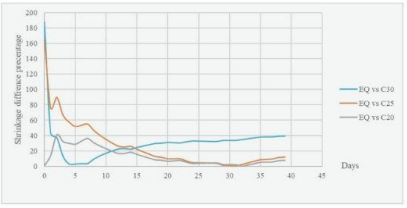


This research aims to evaluate and mitigate the limitations of the Eurocode 2 drying shrinkage prediction model when applied under Sri Lankan environmental conditions, by identifying discrepancies caused by climatic differences and proposing adjustments to improve its local applicability.

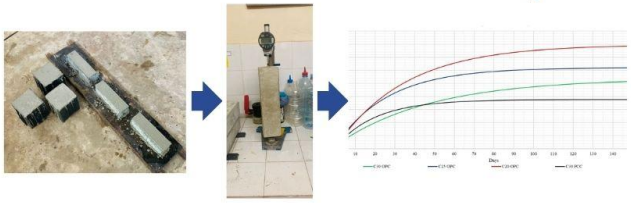
Experimental Procedure



Results



Grade 30 and 25 initially show higher deviation from experimental shrinkage, but over time, Grade 25 aligns with Grade 20 while Grade 30 continues to behave differently.



Under Sri Lankan conditions, high-grade concrete such as C30/37 shows distinct early-stage shrinkage behaviour due to its lower water-to-cement ratio and denser microstructure, resulting in reduced long-term shrinkage and deviation from Eurocode predictions compared to lower grades.