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Performance of selected South African cements based on solar chamber, pycnometer, chemical and physical tests

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Abstract

The performance of cement in concrete can be argued to include strength, durability, economy, aesthetics as well as workability. In this research report, various local South African cements as well as a cement from Germany and Pakistan have been studied for various aspects such as strength, durability and hydration characteristics. Three curing regimes have been investigated. The curing regimes included curing in water, air and in a solar chamber to determine the strength and durability performance of the cements under study. The chemical performance of certain cements has been assessed in terms of sulphur, chloride and insoluble residue contents. Pycnometers have been utilised to determine whether the hydration characteristics can be followed for different grades of cements and mixes containing fly ash. X-ray fluorescence studies on hardened mortar have also been investigated on the mortar mixes from the pycnometer study in order to assess whether the technique may be useful to assess the hydration characteristics of the various mixes. On the whole, the strength and durability results show the importance of moisture in curing even though discrepancies were encountered. The chemical performance of the cements were found to perform satisfactorily with respect to standard codes of practice. The pycnometers may be a useful technique to assess the hydration of various mixes but require careful procedural processes. The x-ray fluorescence portion of the study revealed that the technique is not useful to assess the hydration characteristics of mortar over time.

Key words: Cement, concrete, hydration, solar chamber, pycnometer, strength, durability.