World Academy of Science, Engineering and Technology
International Journal of Structural and Construction Engineering
Vol:17, No:07, 2023

Fire Performance of Fly Ash Concrete with Pre-Fire Load

Authors : Kunjie Fan

Abstract : Fly ash has been widely used as supplemental cementitious material in concrete for decades, especially in the ready-mixed concrete industry. Addition of fly ash not only brings economic and environmental benefits but also improves the engineering properties of concrete. It is well known that the pre-fire load has significant impacts on mechanical properties of concrete at high temperatures, however, the fire performance of stressed fly ash concrete is still not clear. Therefore, an apparatus was specially designed for testing “hot” mechanical properties of fly ash concrete with different heating-loading regimes. Through the experimental research, the mechanical properties, including compressive strength, peak strain, elastic modulus, complete stress-strain relationship, and transient thermal creep of fly ash concrete under uniaxial compression at elevated temperatures, have been investigated. It was found that the compressive strength and the elastic modulus increase with the load level, while the peak strain decreases with the applied stress level. In addition, 25% replacement of OPC with FA in the concrete mitigated the deterioration of the compressive strength, the development of transient thermal creep, and the nonlinearity of stress-strain response at elevated temperatures but hardly influenced the value of the elastic modulus and the peak strain. The applicability of Eurocode EN1992-1-2 to normal strength concrete with 25% replacement of fly ash has been verified to be safe. Based on the experimental analysis, an advanced constitutive model for stressed fly ash concrete at high temperatures was proposed.

Keywords : fire performance, fly ash concrete, pre-fire load, mechanical properties, transient thermal creep
Conference Title : ICCSGE 2023 : International Conference on Concrete, Structural and Geotechnical Engineering
Conference Location : London, United Kingdom
Conference Dates : July 24-25, 2023