

Strength development of concrete containing coal fly ash under different curing temperature conditions

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Abstract

Concrete containing fly ash (FA) has been investigated in order to determine the effect of temperature curing conditions on the early age strength. Trial concrete using Portland cement only and concrete containing FA with cement replacement levels of 15%, 30% and 45% and varying water/binder ratios have been investigated under standard 20 °C curing. For a given water/binder ratio, the 3, 7 and 28 day strength was observed to be lower when using fly ash to replace cement. A concrete with target mean strength of 70 N/mm² was then designed using Portland cement and FA concrete, with different water/binder ratios required to achieve 28day target mean strength of 70 N/mm². The strength development of Portland cement and FA concrete with the target mean strength of 70 N/mm² at 28 days has been investigated under isothermal (10 °C, 30 °C, 40 °C, 50 °C) curing regimes and compared to the strength development using standard curing conditions. At 10 °C and 20 °C, the strength development of FA concrete with target 28-day strength of 70 N/mm² was found to be equivalent to that of Portland cement concrete. At an elevated curing temperature all concrete samples were observed to gain strength more rapidly than at 20 °C and had higher 32-day strength with increasing levels of FA. However, the longer term strength is detrimentally affected by the higher curing temperatures, with Portland cement concrete being more detrimentally affected than FA concrete.