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Investigation on the effects of mix water temperature on High-Early strength cement concrete properties – An experimental work and a case study

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ABSTRACT

Considering the cold weather concreting techniques, using concrete additives and High Early strength cement (Type HE) are by far the most commonly prescribed approaches as well as heating the components. However, the optimum temperatures for heated components and in particular the temperature of mixing water is under skepticism. In this respect many experimental research works and field data showed difficulties in this regards. To address the reported controversies, the present study examined the effects of mix-water temperature on some of the performance and mechanical properties of concrete made with High-Early strength cement. The experimental program included the tests for both fresh (or plastic) and hardened concrete with various water temperature in the range of 5° to 90°C. Based on the experimental results and field-practices' observations it could be concluded that the optimum mixing water temperature range is 50±5°C when using High-Early strength cement. In addition to the examined compressive strength, bleeding and optimum slump of mixtures were observed within the same temperature range. The higher temperature of mixing water out of this range resulted in higher bleeding, segregation, and further relative failures in this study.

Keywords

High Early strength cement (Type HE); mix-water temperature; Compressive strength; Bleeding; Segregation.

1. Introduction

In many constructional and particularly paving projects, cold weather is considered as one of the obstacles to continuous concreting in cold climates. In particular, in some regions, there are only a few days in a year that can be counted as appropriate weather for placing concrete. Nevertheless, concrete can be placed even during the coldest weather as long as the appropriate precautions are taken. ACI 306 R [1] defines cold weather as a period of three or more consecutive days during which the average daily outdoor temperature drops below 4°C and/or