Statement No. 21

Arkansas Department of Transportation

Transportation Research Committee

RESEARCH PROBLEM STATEMENT

DATE: 09/12/2017 | **PROJECT AREA:** Materials

TITLE: Accelerated Curing of Silica Fume Concrete

PROBLEM STATEMENT:

According to the Cement Association of Canada, one form of curing that has become popular at precast prestressed concrete plants is accelerated curing. This type of curing is advantageous where early strength gain in concrete is important or where additional heat is required to accomplish hydration, as in cold weather. Concerns with accelerated curing include the potential for increased moisture loss during the curing process and the possible detrimental effect of high temperatures on long-term concrete properties. Accelerated curing has been shown to be effective in producing high-performance characteristics at early ages in silica fume concrete. However, the heat from the high temperatures greatly increases the moisture loss from exposed surfaces, which tends to cause more shrinkage problems and a reduction in the ultimate strength. Therefore, when using accelerated curing with silica fume concrete, the minimum amount of heat necessary for the required strength gain should be used, and the concrete should be allowed to attain initial setting prior to commencing accelerated curing.

Florida Department of Transportation (FDOT) has implemented specifications allowing 7 to 9% silica fume replacement of cementitious material, together with the usage of high range water reducing admixture. Typically, silica fume is used in higher concrete classes for increased strength and durability. The FDOT Standard Specifications for Road and Bridge Construction specify extended moist curing requirements for silica fume concrete. The moist curing must continue for a minimum of three days, immediately after which two coats of curing compound must be applied. The surfaces must then be left undisturbed at least seven days.

The process may be sped up through employing accelerated curing techniques for silica fume concrete. ASTM C 684 accelerated curing methods involving elevated temperature water or a high temperature and pressure method are not convenient for large precast prestressed elements. However, steam curing silica fume concrete is convenient, and could result in cost savings to ArDOT. With a maximum probable steam curing time of 24 hours, precast concrete products could be turned around much more quickly and, thus, less expensively. Further, steam curing could ensue in more complete hydration of the pozzolanic materials, which increases the strength gain of concrete. The increased cost of the curing process is offset by the savings in curing time and extra productivity.

OBJECTIVES:

The objective of this study is to verify whether it is feasible to steam cure Silica Fume concrete. Researchers would investigate (1) the possibility of speeding up the curing process of such concrete through steam curing, and (2) the effect of such curing on several desired properties of hardened concrete, such as compressive strength, permeability, shrinkage, and susceptibility to cracking.

FORM OF RESEARCH IMPLEMENTATION:

Implementation could include draft performance specifications for steam cure silica fume concrete.

Estimated Project Duration: 24 **months**

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Standing Subcommittee Ranking	Advisory Council Ranking	Statement Combined with Statement Number(s)
9 / 12	35 / 44	