

DEICING SALT SCALING RESISTANCE OF HIGH-VOLUME FLY ASH CONCRETE USING VARIOUS SOURCES OF FLY ASH

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Report No. CBU-1995-16

ABSTRACT

The primary objective of this investigation was to evaluate salt scaling resistance of concrete incorporating large amounts of Class C fly ash obtained from several sources. Two series of laboratory investigations (Series 1 and Series 2) and one field investigation (Series 3) were carried out. The Series 1 investigation involved mixtures having fly ash from one source and varied the fly ash to cementitious materials ratio from 0 to 74%. The Series 2 investigation used mixtures having Class C fly ash from three additional sources and developed mixes with a fly ash to cementitious materials ratio of 0%, 40%, 50%, and 60%. Each concrete mixture was tested for compressive strength, and salt scaling resistance. The Series 3 investigation consisted of four separate studies (study 3A, 3B, 3C, and 3D), which involved mixtures incorporating Class C and Class F fly ash. The Series 3 investigation evaluated mixtures for compressive strength and laboratory salt scaling resistance as surface scaling of field test pavements. The effect of entrained air content on these properties for Series 1 mixes was also evaluated. The Series 1 mixture having a fly ash to cementitious materials ratio of 74% exhibited poor resistance to deicer salt scaling. Test data showed that high-strength concrete with excellent salt scaling resistance can be manufactured with up to a 45% fly ash to cementitious materials ratio. Series 1 test results also indicate that it is possible to produce structural grade concrete with Class C fly ash (up to a fly ash to cementitious materials ration of about 56%) having adequate resistance against salt scaling. The Series 2 mixtures with a fly ash to cementitious materials ratio of up to approximately 50% exhibited salt sealing resistance, which was either comparable or superior to the control mixture without fly ash. The mixture with a fly ash to cementitious ratio of about 40% exhibited the best resistance to salt scaling amongst all the mixtures tested, including the no-fly ash concrete mixture. The laboratory evaluation of the Series 3 mixtures showed that as the fly ash content in the mixture increases (fly ash to cementitious materials ratio), the salt scaling resistance will decrease. However, some mixtures with up to 50% Class C fly ash exhibited adequate salt scaling resistance. Concrete mixtures containing Class F fly ash had lower salt scaling resistance than that of mixtures with a comparable amount of Class C fly ash.