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Effects of Water Reducer Admixtures on Concrete Strength and Durability

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14. Supplementary Notes

15. Abstract

The objective of this research was to determine the effects of water-reducing admixtures on the strength and durability of concrete. Four brands of water reducers that are commonly used in the State of North Dakota were selected for study. Brett, GRT, Grace, and Master Builders supplied the admixtures. Each company sent two different water reducers along with an air-entraining admixture. Batches of concrete were prepared using each product.

One water reducer supplied by each company was used to produce two concrete mixes with targeted water reduction percentages of 5% and 8%, and the other was used to produce two concrete mixes with targeted water reduction percentages of 8% and 12%. Thus a total of sixteen different concrete mixes were prepared for this research using eight different water-reducing admixtures. In addition, a control mix was prepared without water reducer for comparison purposes. The control mix was designed based on the *NDDOT's Standards and Specifications for Road and Bridge Construction, 1997, Volumes 1 and 2.*

Results from the strength tests done on the control and water-reducer mixes appear to be generally consistent with results obtained from previous research. Compressive and flexural strengths were consistently higher than the control mix and the strengths tended to increase as the w/c ratio of the concrete decreased.

Results from freeze-thaw tests done for this study indicate that all of the concrete mixes that contained water-reducing admixtures had lower freeze-thaw durability compared to the control mix. These results do not agree with results obtained from previous studies.

Results from the deicer scaling tests obtained for this study generally indicate scaling in the moderate to moderate/severe range. Previous studies reported results from deicer scaling tests in the slight/moderate to moderate range.

Results from rapid chloride ion permeability tests obtained for this study were in the moderate range for the control and most of the water-reduced mixes. Two of the water-reduced mixes exhibited permeabilities in the high range.

Results from air void analyses indicate that the control mix and all of the water-reduced mixes had characteristics within acceptable limits for adequate freeze-thaw resistance. All of the air-void specific surfaces measured for the control and the water reduced mixes were greater than 600 sq in./cu in. and all of the air-void spacing factors measured were less than 0.008 inches. The average air-void spacing factor and specific surface measured for all of the water-reduced mixes were 0.0054 inches and 858 sq in./cu in. respectively.

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