

CO₂ SEQUESTRATION IN NO-FINES CONCRETE

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ABSTRACT

The objectives of this project were to sequester carbon dioxide (CO₂) in concrete and study the effects of carbonation on the properties of concrete made with or without fly ash. Class C fly ash was used for partial replacement of cement. In this research, no-fines concrete was used. Three types of curing environments were used with varying relative humidity and CO₂ concentration: 100 % relative humidity and 0.15 % CO₂ concentration, 50 % relative humidity and 0.15 % concentration, and 50 % relative humidity and about 5 % CO₂ concentration. Two series of no-fines concrete mixtures were produced. They contained 0 and 16 % cement replacement with fly ash. Each series of no-fines concrete included three mixtures with identical mixture proportions. Each of these three identical mixtures was cured in a different curing environment. Compressive strength, splitting tensile strength, and flexural strength tests were performed on both types of concrete. A method to study the degree of carbonation of no-fines concrete by visual analysis was developed for this research.

As expected, for better strength development of concrete, sufficient initial curing was necessary. Also, as may be expected, relative humidity and CO₂ concentration in the curing environment were very important factors affecting the rate of carbonation in concrete. It was found that the rate of carbonation in concrete increased considerably at relative humidity of about 50 % and high CO₂ concentration of about 5 %. Using such accelerated carbonation conditions, a much higher rate of carbonation in concrete could be achieved. Up to seven-day age, carbonation did not show significant effects on the physical properties of the no-fines concrete with or without fly ash but showed slight improvement in strength levels at 28-day age. Rate of carbonation in concrete containing fly ash was higher compared to the concrete without fly ash at lower relative humidity in the curing environment; and the rate of carbonation of fly ash concrete increased with increase in the percent of cement replacement with fly ash.