CE 890 Graduate Seminar

SPEAKER: Lisa Beck, M.S. graduate student
(Advisor: Dr. Kyle Riding)

TOPIC: "Permeability and Resistance to Deterioration from Freezing and Thawing of Optimized Ternary Concrete Mixture Blends"

DATE: April 6, 2011

TIME: 4:00 p.m. (refreshments at 3:45 p.m.)

PLACE: 2144 Fiedler Hall

ABSTRACT

Corrosion of reinforcing steel is one of the most serious causes of reinforced concrete deterioration. Once corrosion begins in the reinforcement, expansion of corrosion products can lead to cracking, spalling and significant section loss. While corrosion is normally inhibited by a passive layer that develops around the reinforcing steel due to the high pH environment of the surrounding concrete, chlorides will break down this protective layer, leading to reinforcement corrosion. Decreasing the permeability of the concrete would slow the ingress of chlorides into concrete, and is one of the most economical ways to slow concrete deterioration due to reinforcement corrosion.

Optimized mixtures blending Portland cement and supplementary cementing materials (SMCs) have become popular throughout the construction industry in order to increase strength and workability and decrease bleeding. It has been shown that use of Type F fly ash, silica fume and slag in binary concrete mixture blends can result in a significant reduction in concrete permeability. This study investigates the ability of Type C and ternary concrete mixture blends to aid in permeability reduction. In order to study the effect of incorporation of SCMs into concrete, mixtures containing Types C and F fly ash, silica fume and ground granulated blast furnace slag were tested for permeability following the ASTM C 1556 procedures. Structure life cycles were then modeled using this data and a commercially available life-cycle analysis software. In order to determine a possible correlation between permeability and deterioration due to freezing and thawing, samples were also tested for ability to resist deterioration from freezing and thawing cycles using ASTM C 666 Procedure B.

Results show that the use of Type C fly ash yields only marginal service life improvements as compared to the Portland cement control mixtures, while ternary mixture blends performed significantly better than the control mix and equal to or better than the binary SCM mixtures tested. Freeze-thaw tests showed all mixtures to be equally resistant to deterioration due to cyclical freezing and thawing.