

## **AN ABSTRACT OF A THESIS**

### **OPTIMUM AIR CONTENT RANGE IN THE PLASTIC AND HARDENED STATE FOR TDOT CLASS D PORTLAND CEMENT CONCRETE**

Gregory Allen Browning, II

Master of Science in Civil Engineering

Tennessee Department of Transportation (TDOT) questioned whether the air content range for their Class D mix in TDOT specification 604.03 are adequate to ensure maximum durability. There are Tennessee concrete producers that believe that higher air contents will be detrimental to obtaining the specified 28 day compressive strength of 4000 psi required for a TDOT Class D mixture. It has also been speculated that the plastic and hardened air content may not be the same as the air content increases.

There were 50 mixes created in five air content ranges both inside and outside current TDOT 604.03 specifications for their Class D mixture. The plastic and hardened properties for each mixture were tested for their strength and durability. This was done to determine the optimum air content range. The optimum air content range is the range that provides adequate resistance to rapid chloride permeability and maintains the required compressive strength.

The test results showed that air content had little to no impact on the permeability of the concrete as measured by rapid chloride permeability testing (RCPT). Air content did however play a significant role in the compressive strength and modulus of elasticity of the concrete. It was shown that higher air contents were detrimental to both. For each 1% air increase there is roughly a 6% reduction in strength for concrete at 28 days and 56 days. A similar pattern is observed for the static modulus of elasticity. For each 1% air increase there is roughly a 2.5% reduction in static modulus of elasticity at 28 days and 56 days. The results indicate that TDOT air content specifications for their Class D mix are the optimum.