



Texas Aggregates and Concrete Association

Position Statement #6

Is Air Content Over Specified in Texas?

Relationships Between Performance Based Durability and Specification

When discussing the necessity of air content in concrete to create freeze-thaw resistance, very few specifiers ask two critical questions: 1.) Is the structure actually in an environment that is exposed to enough freeze-thaw cycles to cause damage, and, 2.) If air content is not a measure of actual durability performance, then what is?

According to ASTM C33, “Standard Specification for Concrete Aggregates, the figure below, provides guidelines for weather severity.



As an example, according to ASTM C33, industry accepted standards, and geography, the Dallas/Ft.Worth metroplex (including Waxahachie, which some design professionals may even consider in the Negligible Zone) lies comfortably within the moderate (and is to many design professional considered mild due to the limited number of actual freeze thaw cycles per year) exposure conditions region. Further South than DFW, the remainder of Texas is in the “negligible” zone.

ASTM C94, “Standard Specification for Ready-Mix Concrete,” Table 1 below, states that for a moderate exposure condition, with a 1” aggregate, the target air content is 4.5%. Within the ASTM C94 specification, Section 7.2 states,

“The air content of air-entrained concrete when sampled from the transportation unit at the point of discharge shall be within a tolerance of ± 1.5 of the specified value.”

This means that the target design should be 4.5%, with a tolerance of 3% to 6% for concrete correctly designed moderate zone conditions.

Further, ACI 211.1-91, Table 6.3.3, below also indicates that for moderate exposure conditions, with 1” aggregate, the target air content is 4.5%. Based on the sampling tolerance allowed by ASTM C94, this again supports that the air content range should be between 3% and 6%.

Based on these standards as outlined within the commercial contract documents, there should be no cause for concern regarding durability of concrete whose air content is between 3% and 6%. This means that there is only a 1.5% actual difference between the design air content, and the air content within the mix design.

A specified air content range higher than 3% to 6% is outside of the code recommendations and standard industry practice for a moderate zone, and certainly for a negligible zone.

There are no additional benefits in performance or durability by increasing the air content above the normal range in these two zones. In fact, by increasing the air content, the cementitious content is being driven higher to accommodate the loss in strength, and quite possibly decreases the value of the concrete.

When considering the durability of the concrete, a specifier needs to consider what influences exist that decrease durability Are they physical or chemical? What proper performance tests should be run? Permeability (ASTM C1012)? Durability factor (ASTM C666)? Shrinkage (ASTM C157)? All of these are performance related and, when properly specified, can create a higher value concrete both in terms of economy, structural integrity, and durability.

This position statement from the Texas Aggregate and Concrete Association is presented for reader interest by the editors. The opinions expressed are not necessarily those of the “magazine”. Reader comment is invited.

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