The Importance of Aggregate Correction Factors in Air Content of Freshly Mixed Concrete (ASTM C231 and AASHTO T 152)

By Megan Karr, Quality Analyst
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> *"It was understood that aggregate correction factors, as described in Section 6 of ASTM C231, had not been determined for the aggregates."*

Does this nonconformity look familiar?
Of the approximately 1,200 laboratories that performed ASTM C231 during the 35th CCRL inspection tour, about 20 percent received at least one finding for this test. Of those findings, about 85 percent were a result of aggregate correction factors not being determined. Another common nonconformity is using the factor incorrectly in the calculation of the actual air content.

Importance to a Testing Laboratory
All aggregates in concrete, even those that are relatively dense, contain air. Therefore, an aggregate correction factor must be determined to account for this air when performing air content by the pressure method. By not accounting for aggregate correction factors, the air content is being reported at a higher percent than what is actually present in the concrete.

Although the aggregate correction factor is often small, the use of it could be the difference between a conforming and nonconforming product. For example, a job requires 4.0-6.0% air in the concrete. Field testing on this concrete without the use of the aggregate correction factor shows an air content reading of 4.0%, and the concrete is reported as meeting specifications. However, in reality this concrete may or may not meet specifications because even a very small correction factor would result in this concrete having a lower air content. Let's say for this example that the aggregate has a correction factor of 0.3%, which results in an actual air content of 3.7%; then this concrete would fail to meet the specifications.

Importance of Air in Concrete
According to the Portland Cement Association, every cubic foot of concrete contains billions of microscopic air voids. The air space allows hardened concrete to better accommodate the pressures caused from expansion and contraction of freeze-thaw cycles, helping to prevent fracturing. This is why knowledge of the precise amount of air in concrete is especially important in cold weather environments. Air can also increase workability of the concrete; however, too much air can reduce the strength of the concrete. Therefore, it is important for the concrete air content to meet the job specifications.

Determining the Aggregate Correction Factor
An aggregate correction factor must be determined for concrete being tested by the laboratory. The procedure for determining the factor can be found in both ASTM C231 and AASHTO T 152. Use a combined sample of fine and coarse aggregate from the same source as that being used in concrete testing. Approximately the same moisture condition, amount, and proportions occurring in the mix design should be used to determine the correction factor. Before adding the aggregate to the measuring bowl, first determine the mass of fine aggregate and the mass of coarse aggregate using the batch information on the mix design and following the calculation in the standard. When determining and reporting the air content of concrete, the applicable aggregate correction factor must be subtracted from the apparent air content of the sample tested.

Avoiding this Nonconformity
Aggregate correction factor determination should be a part of routine testing, just like correction factors determined for ignition oven testing (AASHTO T 308/ASTM D6307). The first step to avoiding this nonconformity is to ensure that the laboratory's training program contains procedures and training guidelines for this process. If this finding is noted on your CCRL report and you need to resolve it for the AASHTO Accreditation Program (AAP), you must submit evidence that the aggregate correction factor has been performed in accordance with the ASTM or AASHTO test method. You must also submit a plan to monitor the performance of these correction factors, as well as evidence that you have taken steps to ensure that aggregate correction factors are always determined.

Common Misconceptions
Some common misconceptions include (1) assuming that these factors are not required for the type of pressure air meter being used, (2) believing that the aggregate correction factor is zero or negligible, and (3) presuming that an aggregate correction factor is not required by a certain project or location.
Although often ignored, aggregate correction factors are an important aspect of concrete testing. A pressure air content test is not valid without applying this correction factor. Aggregate correction factors vary from region to

region, source to source, and mix design to mix design. Ensuring this process is accounted for in testing can be vital to the life of the concrete.

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Sources

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Editor's Note: This article was updated in June 2016 to ensure the more accurate information is presented.