Concrete Property Test

Air Entrainment 3-2: Air Content (Plastic Concrete, Pressure Method)

National Concrete Pavement Technology Center
www.cptechcenter.org

Purpose – Why Do This Test?

Entrained air is essential to the long-term durability of concrete pavements that are subject to freezing and thawing. Air content is a commonly specified parameter in paving specifications. It is usually measured at the point of placement using a pressure meter (normally a type B meter). Although this test does not provide air system parameters, it is quick, easy to run, and has worked very well for years as a quality control tool.

Principle – What is the Theory?

The fresh concrete is fully consolidated in an airtight container. Pressure from a fixed-volume cell is applied to the sample in the container. Air in the sample is compressed, and the reduction in pressure in the cell is directly related to the volume of air in the sample. The air content of the sample is thus read directly from the gauge of a properly calibrated meter.

Test Procedure – How is the Test Run?

The test is described in ASTM C 231. A sample of fresh concrete is fully consolidated in the air meter and struck off level-full. A known volume of air at a known pressure is applied to the sample in an airtight container. The air content of the concrete is read from the gauge on the pressure meter apparatus.

Test Apparatus (figure 1)

- Measuring bowl and airtight cover (type B meter) for holding the sample and measuring the air content.
- Tamping rod/vibrator and mallet for consolidating the sample.

Test Method – Refer to ASTM C 231 for Comprehensive Guidance

1. Consolidate the concrete in the measuring bowl using a tamping rod or vibrator and mallet.
2. Strike off the concrete in the measuring bowl so that it is level with the top rim.
3. Clean the edge and rim of the measuring bowl and clamp the cover on to form an airtight seal.
4. Pump air into the air chamber until the gauge needle is stabilized on the initial pressure line.
5. Open the valve between the air chamber and the measuring bowl.
6. Tap the measuring bowl with the mallet to ensure that pressure is equalized.
7. Tap the gauge lightly if necessary to stabilize the needle indicator.
8. Record the percentage of air content indicated on the gauge.

Output – How Do I Interpret the Results?

Air content of the fresh concrete mixture is read directly from the gauge of a calibrated type B pressure meter.

This is a measure of the percentage of total air content in a concrete mixture. Both entrained air and entrapped air are measured.

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Figure 1. Air content test equipment (pressure meter)

The results are compared to the specified limits and should be plotted on control charts for ease of identifying significant changes in air content (figure 2).

Construction Issues – What Should I Look For?

Air content should be monitored regularly during paving (minimum one test every 500 yd^3). Additionally, samples should be taken behind the paver for air content testing at least once per day.

Generally, air contents greater than 4.5 percent in the in-place concrete (depending on exposure and aggregate size) provide adequate protection from freeze-thaw conditions. However, the use of an AVA is recommended for quality control purposes for Level A projects to be sure that proper bubble spacing and bubble size are present.

High air contents are less worrisome than low air contents, unless the strength is reduced to critical levels due to the high air content.

Air content can be affected by many factors, ranging from cement and admixture chemistry to mixing time and aggregate grading.

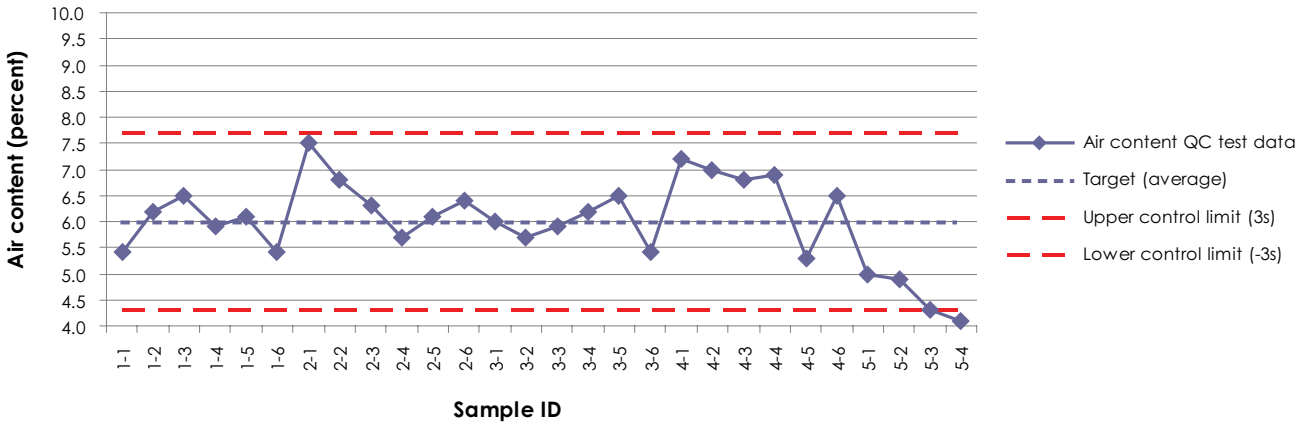

Figure 2. Air content control chart

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