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Quality Bulletin

Review of Technical Changes to ASTM C94

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In April of 2021, after 6 years of balloting, the ASTM Subcommittee C09.40 on Ready Mix Concrete updated ASTM C94/C94M-21 Standard Specification for Ready-Mixed Concrete with two significant changes in respect to the time limit from the start of mixing to the completion of discharge. The first was a revision to Section 12.9 and the second was the addition of Section 6.10. The sections in the current ASTM are as follows.

- 12.9 Discharge of the concrete shall be completed within time limit as established in 6.1.10. This limitation may be waived by the purchaser if the concrete is of such slump or slump flow after the specified time limit has been reached that it can be placed, without the addition of water, to the batch.

- 6.1.10 Purchaser shall state a time limit from the start of mixing defined in 12.3 or 12.5 to when the concrete discharge must be completed. If no time limit is stated by Purchaser, the Manufacturer shall establish and communicate the limit to the Purchaser prior to delivery. The time limit to complete discharge shall be stated on the delivery ticket.

The intent of the change to the discharge time limit was not to extend or reduce the time limit, only to remove a default value of 1-1/2 hours that has been in place, since the inception of the standard in 1933. Under the normal concrete placement conditions of 40F to 95F, a typical concrete mixture of cement, fine and coarse aggregates, and water will start to set at a time between 60 minutes and 120 minutes. This depends primarily on the cement chemistry, w/c ratio, cement content, and mixed concrete temperature, which were used as the scientific basis for setting the original 1 1/2 hour limit.

However, there have been numerous technological advances in the production of concrete over the years and the subcommittee concluded that the existing standard did not allow users of the standard, to apply these advances. The new changes will allow the Purchaser or Manufacturer the opportunity to decrease or increase the time limit based on these advances, at the same time allowing them to still choose 1-1/2 hours, if they are unable to determine a more appropriate limit. It also allows for changes in the time limit based on project duration or placement conditions, since it must be stated on the delivery ticket.

In addition, guidance is still provided to the user on items that can affect the time limit with the addition of a new Note 9 and the continued use of Note 21, as follows:

- NOTE 9 – There are many options available to the manufacturer to provide the required quality of concrete with end of discharge limits beyond 1 ½ h or less than 1 ½ h. The Purchaser should consult with the Manufacturer for available options to establish a time limit to end of discharge prior to or at the time concrete is ordered. Selection of a time limit to end of discharge should consider ambient conditions, types of cementitious materials and admixtures used, placement procedures, and projected transportation time between the batch plant and the point of delivery.

- NOTE 21 – Depending on the project requirements, technology is available to the manufacturer to alter fresh concrete properties such as setting time, slump or slump flow, air content, and alter delivery and discharge times, or both. Discharge limitations should consider ambient conditions, placement procedures, and distance or projected transportation time between the batch plant and the point of delivery.

To further assist with temperature extremes, and incorporated by reference in the standard, are ACI 305 Guide to Hot Weather Concreting and ACI 306R Guide to Cold Weather Concreting. ACI 305.1 states a maximum temperature of concrete at delivery of 35°C (95°F) and provides procedures to qualify placement of concrete at higher temperatures. ACI 306 provides minimum temperatures of concrete placed and maintained of 4°C (40°F) to 12.8°C (55°F), dependent on structure size, as well guidance on required concrete temperatures for air temperatures above -1°C (30°F) to below -18°C (0°F).

Regardless of what time limit to discharge is specified, and agreed upon, the concrete quality must still meet the Purchasers requirements in Sections 1.1, 6.4.2, and 6.6.2. The requirements for these sections did not change, in the new standard. These sections summarize that the Manufacturer shall provide the mix designs for approval by the Purchaser and furnish evidence satisfactory to the Purchaser that the materials to be used and proportions selected will produce concrete meeting the project specifications.

Lastly, the current language within ASTM C94 does not provide requirements as to what the Manufacturer or Purchaser can do or should do when the time limit to discharge is reached. This decision still resides with the Purchaser as outlined in Section 12.9.

Users of the standard should also be aware that ACI 301 Standard Specification for Structural Concrete, also incorporated by reference, Section 4.3.2.2 requires that discharge shall be in accordance with this standard, unless otherwise specified, and that air content of entrained concrete, slump, and temperature are verified at 1-1/2 hours, regardless of the specified discharge time. This new change should be considered by Registered Design Professionals when completing project specifications and Manufacturers when producing and delivering ready mix concrete.

ATL provides this summary to bring your attention to these important changes. Please contact Scott McCasland, at 315-735-3309 or smccasland@atlantictesting.com to discuss any implications this may have on your projects. For additional information, visit AtlanticTesting.com.

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