

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

ACCEPTANCE USE OF THE MATURITY METHOD FOR THE ESTIMATION OF
CONCRETE STRENGTH ON WVDOH PROJECTS

1. PURPOSE

- 1.1 To establish a procedure to estimate the compressive strength of concrete, used on West Virginia Division of Highways (WVDOH) projects, with the Maturity Method.
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2. SCOPE

- 2.1 This procedure shall apply to all Contractors, Sub-contractors, Consultants, and WVDOH Personnel who test concrete on WVDOH projects.
- 2.2 This procedure may be used in place of compressive strength cylinders, for the determination of the compressive strength of concrete, when allowed by the WVDOH Specifications. The Maturity Method shall not be permitted as a substitute for 28-day acceptance cylinders.
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3. REFERENCED DOCUMENTS

- 3.1 *ASTM C1074 - Standard Practice for Estimating Concrete Strength by the Maturity Method*
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4. PROCEDURE

- 4.1 The procedure outlined in the following sections shall be applied to each WVDOH approved concrete mix design for which the Maturity Method is desired to be used in place of concrete cylinders for the estimation of the concrete strength in the field. A separate strength-maturity relationship must be developed for each approved concrete mix design.

4.2 DEVELOPMENT OF STRENGTH-MATURITY RELATIONSHIP

- 4.2.1 Fabricate a minimum of fifteen concrete cylinders, in accordance with ASTM C192, from each WVDOH approved concrete mix design for which it is desired to establish a strength-maturity relationship. The mixes used to cast these cylinders shall be batched as closely as possible to the anticipated target air content, slump value, and chemical admixture dosage rate which will be used in the field. The mixes shall also be batched at a temperature as close as possible to the temperature that is anticipated in the field during concrete placement.

- 4.2.2 Either 6-inch x 12-inch cylinders or 4-inch x 8-inch cylinders may be used to develop the strength-maturity relationship, but if 4-inch x 8-inch cylinders are going to be used, then 4-inch x 8-inch cylinders must be approved to be used, in

accordance with MP 711.03.23, with the mix design for which the strength-maturity relationship is being developed

4.2.3 Follow the procedure outlined in Section 8 of ASTM C1074-19, and establish a strength-maturity relationship and corresponding Strength-Maturity Curve. The maturity of the subject cylinders shall be recorded to the nearest degree-hour. The axes used to plot this Strength-Maturity Curve shall be Strength, expressed in pounds per square inch on the Y-axis, and Temperature-Time Factor, expressed in °C-hours on the X-axis.

4.2.4 When concrete mixes designed for rapid strength gain are used, the compression tests shall be conducted at ages approved by the Engineer based on the strength development characteristics of that mix. However, a minimum of five test ages shall be used.

4.3 APPLICATION OF STRENGTH-MATURITY RELATIONSHIP

4.3.1 The Strength-Maturity Curve may be used in the field at the Project, in place of compressive strength cylinders, to estimate the compressive strength of the concrete in question.

4.3.2 The strength-maturity relationship and Strength-Maturity Curve shall not be permitted to be used in place of 28-day acceptance cylinders. The strength-maturity relationship and Strength-Maturity Curve shall only be used for the purposes of opening structures to traffic (i.e. Section 501.4.4, Section 506, etc.) and for form removal and construction of superimposed elements (i.e. Section 601.8.7).

4.3.3 When using the Strength-Maturity Curve for these purposes, the procedure outlined in Section 9 of ASTM C1074-19 shall be used for installing temperature sensors within the concrete of which the Strength-Maturity Curve is being used to estimate the compressive strength.

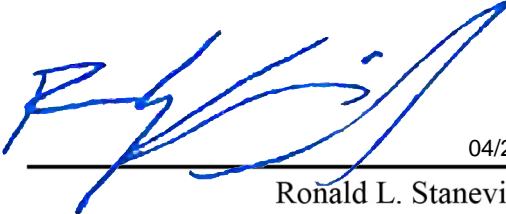
4.4 VALIDATION OF STRENGTH-MATURITY RELATIONSHIP

4.4.1 After five days of production, and every ten days of production after that, seven "Maturity Validation Cylinders" shall be fabricated. One of these cylinders shall have a maturity sensor installed in it within $\pm 5/8$ " (15 mm) of the center of the cylinder. Three of these cylinders shall be tested at an age of three days, and three of these cylinders shall be tested at an age of seven days. The average of each of these sets of three cylinders shall be the average compressive strength at that age.

4.4.2 The Maturity Validation Cylinders shall be the same size as the cylinders which were used to develop the original Strength-Maturity Curve.

4.4.3 If the average of either the three-day or seven-day compressive strength results, obtained in Section 4.4.1, fall at a point more than 5.0% less than the corresponding compressive strength, at the same Temperature-Time Factor point on the Strength-Maturity Curve, additional maturity validations at three and seven days, as outlined in Section 4.4.1, shall be conducted on the next three concrete placements.

- 4.4.4 The Contractor shall continue to conduct these maturity validations until the average result of the three cylinders in each individual compressive strength test in three consecutive validations (consisting of both three-day and seven-day results) is not more than 10.0% less than the corresponding compressive strength at the same Temperature-Time Factor point on the Strength-Maturity Curve, and the average of all three-day and all seven-day results in those three consecutive validations is not more than 5.0% less than the corresponding compressive strength at the same Temperature-Time Factor point on the Strength-Maturity Curve.
- 4.4.5 If, after five maturity validations, the Contractor has not obtained three consecutive validations for which the criteria in Section 4.4.4 has been met, then a new Strength-Maturity curve shall be established, as outlined in Section 4.5.
- 4.5 ESTABLISHMENT OF NEW STRENGTH-MATURITY CURVE
- 4.5.1 The new average three-day strength shall be established by averaging the five three-day strength results from the five maturity validations conducted in Section 4.4.5. The new average seven-day strength shall be established by averaging the five seven-day strength results from the five maturity validations conducted in Section 4.4.5.
- 4.5.2 The percentages by which the average three-day and average seven-day compressive strength results in Section 4.5.1 are below the corresponding compressive strengths at the same Temperature-Time Factor point on the Strength-Maturity Curve shall be calculated. The greater of these two percentages shall be the percent by which the Strength-Maturity Curve is lowered. This new “lowered” Strength-Maturity Curve shall be used from that point forward for estimating the compressive strength of the concrete from that approved mix design in the field



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