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

MATERIALS PROCEDURE

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.

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.

3. REFERENCED DOCUMENTS

- ASTM C1074 – Standard Practice for Estimating Concrete Strength by the Maturity Method

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 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 and slump values and chemical admixture dosage rate which will be used in the field.

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 C1074-11, 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.

4.2.5 Minor variations from the conditions encountered during establishment of the strength-maturity relationship may be encountered in the field during actual concrete placement. These conditions may include higher than anticipated air content, slightly higher slump/water content, etc. To account for this, and to build in a factor of safety, a second strength-maturity curve shall be constructed similar to the first curve (Strength-Maturity Curve), but using compressive strength results which are ten-percent lower than those obtained in Section 4.2.1. This curve, constructed ten-percent below the Strength-Maturity Curve, shall be referred to as the "Construction Maturity Curve".

4.3 APPLICATION OF STRENGTH-MATURITY RELATIONSHIP

4.3.1 The Construction Maturity Curve shall be the curve which 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 Construction Maturity Curve shall not be permitted to be used in place of 28-day acceptance cylinders. The strength-maturity relationship and Construction 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).

4.4 VALIDATION OF STRENGTH-MATURITY RELATIONSHIP

4.4.1 After ten days of production or after sufficient concrete has been placed, such that ten sets of compressive strength acceptance cylinders would be required, seven "Maturity

Validation Cylinders" shall be fabricated. One of these cylinders shall have a maturity sensor installed in it within ± 5/8" 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 either of the average compressive strengths obtained in Section 4.4.1 fall at a point lower than the Construction 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. The Contractor shall continue to conduct these maturity validations until three consecutive validations (consisting of both three and seven day results) are all at points above the Construction Maturity Curve.

4.4.4 If, after five maturity validations, the Contractor has not obtained three consecutive validations which are all at points above the Construction Maturity Curve, 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. The new average seven-day strength shall be established by averaging the five seven-day strength results from the five maturity validations.

4.5.2 The percent by which the average three-day strength is below the Strength-Maturity Curve shall be calculated. The percent by which the average seven-day strength is below the Strength-Maturity Curve shall also be calculated. The greater of these percentages shall be the percent by which the Strength-Maturity Curve is lowered. A new Construction Maturity Curve shall then be established, as outlined in Section 4.2.5, at ten percent below the new Strength-Maturity Curve.

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