

Method of Test for  
**COMPRESSIVE STRENGTH OF EPOXY MORTAR**

DOTD Designation: TR 705

**I. Scope**

- A. This method of test is intended to determine the compressive strength of cured epoxy resin systems with the addition of aggregate.

**II. Reference Documents**

- A. ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
- B. ASTM C579 – Method B – Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- C. AASHTO MP 41 – Standard Specification for High Friction Surface Treatment for Asphalt and Concrete Pavements Using Calcined Bauxite
- D. AASHTO M 231 – Specification for Weighing Devices Used in the Testing of Materials
- E. ASTM C305 – Standard Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
- F. ASTM C778 – Standard Specification for Standard Sand
- G. AASHTO T 106 – Compressive Strength of Hydraulic Cement Mortar

**III. Apparatus**

- A. Balance – A balance conforming to AASHTO M 231 (Class G2 minimum).
- B. Beaker – A 500 ml (minimum) graduated disposable plastic beaker.
- C. Mixing Tools – Stainless steel spatulas.
- D. Vertical Overhead Stirrer (Figure 1) –The vertical overhead stirrer shall be capable of variable speeds and have a digital timer and counter. (Caframo BDC2010 or equal)
- E. Crossed Blade Radial Flow Impeller (Figure 2) (Caframo A130 or equal).
- F. Thermometer – A thermometer conforming to the requirements of ASTM and capable of reading to 1°F (0.5 C).
- G. Mixer – Mechanical mixer, paddle and mixing bowl conforming to ASTM C305.
- H. Molds – Specimen molds for 2-inch cubes conforming to AASHTO T 106.
- I. Testing Machine – A compression testing machine conforming to the requirements of AASHTO T 106.
- J. Micrometer – Capable of recording to the nearest 0.001 inch.
- K. Timer – A clock or stop watch capable of measuring minutes and seconds.
- L. Wax – Paraffin wax.
- M. Oven – Capable of obtaining and maintaining 150°F (65 C).
- N. Hot Plate – Capable of obtaining and maintaining 150°F (65 C).
- O. Paint Brush – A 1-inch paint brush.
- P. Aggregate – Sand conforming to ASTM C778 20-30.
- Q. Straightedge – A 12-inch metal straightedge.
- R. Scoop – Metal or other non-absorbent material

#### IV. Health Precautions

The following precautions should be observed when handling epoxy components and cleaning fluids:

- A. Use appropriate protective clothing, including rubber or plastic gloves, and appropriate eye protection such as safety glasses.
- B. If any epoxy or cleaning material should contact the skin, the material should be removed immediately with a dry cloth or paper towel, and the affected area should be washed thoroughly with soap and water.
- C. If any material should come in contact with the eyes, flush immediately with water and contact a physician.
- D. Adequate ventilation is necessary to prevent inhalation of vapors. Perform testing in a well ventilated area under a vent hood.
- E. Observe all precautions as specified by the manufacturer before handling each material.

#### V. Sample

- A. Minimum of 1-gallon of each component “A” and “B” of epoxy.
- B. Samples delivered in a sealed 1-gallon friction top metal can or cartridge/tube system.

#### VI. Temperature

- A. Laboratory Temperature during sample preparation shall be  $73 \pm 2^{\circ}\text{F}$  ( $23 \pm 1^{\circ}\text{C}$ ).

#### VII. Test Specimens and Preparation of Specimen Molds

- A. Using the hot plate or oven, melt the wax and condition the molds to the temperature of  $150^{\circ}\text{F}$ . The wax will act as a form release agent once the sample has cured.
- B. Brush a light coat of melted wax on the inner and outer surfaces of the conditioned/heated compressive strength specimen molds, paying special attention to seam areas.
- C. Make a minimum of three (3) specimens from a lot/batch or material formulation of epoxy for each period of test or test age.

#### VIII. Procedure for Mixing Epoxy Mortar

- A. Prior to combining components “A” and “B” thoroughly stir each individual component for at least one minute.
- B. Use separate sampling tools when obtaining and mixing the desired quantities of each epoxy component to avoid contamination. In a disposable beaker combine and mix sufficient quantities of components “A” and “B” in accordance with the manufacturer’s recommended mixing ratio, such that a minimum sample quantity of 400 ml is obtained.

*Note 1: If the material is submitted in a cartridge/tube form, dispense and discard approximately the first 20 ml of material. Then measure the minimum 400 ml of material in a disposable beaker.*

- C. Mix “A” and “B” components epoxy with a Vertical Overhead Stirrer (Figure 1) at 600 rpm for no less than 3 minutes and a uniform consistency is obtained.
- D. Place the mixed epoxy into the mixing bowl, removing as much of the epoxy from the disposable beaker as possible using the metal spatula.

- E. Using the manufacturer's recommended proportions, measure 2.75 parts by volume of 20-30 sand conforming to ASTM C778 by pouring the sand into the beaker using a scoop.

*Note 2: Departmental research has shown that 1,100 ml of loose volume 20-30 sand is roughly equivalent to 1,820 g. (1ml loose volume 20-30 sand = 1.65 g)*

*Note 3: The mix design example above should yield nine (9) test specimens.*

- F. Add the entire measured quantity of sand slowly into the ASTM C305 Mechanical Mixer over a 30-second period, while mixing at slow speed.

- G. Stop the mixer once sand has been wetted out.

Figure 1: Vertical Overhead Stirrer



Figure 2: Crossed Blade Radial Flow Impeller



## IX. Procedure for Molding Test Specimens

- A. Fill the specimen molds one-half full. Remove any entrapped air by using a cutting and stabbing motion with a spatula distributed uniformly over the surface area.
- B. Fill the remainder of the specimen mold. Remove any entrapped air by using a cutting and stabbing motion with a spatula distributed uniformly over the surface area while working down into the previously placed layer.
- C. Upon completion of the filling operation, the tops of the specimens should extend slightly over the tops of the molds. When the molds have been filled, strike off the excess epoxy mortar with the straightedge by using a sawing motion over the top of the mold.

**X. Procedure for Conditioning and Curing**

- A. Permit the epoxy mortar to remain in the mold until it has set sufficiently to allow removal without danger of deformation or breakage.
- B. Cure the specimens in air at  $73 \pm 2^{\circ}\text{F}$  ( $23 \pm 1^{\circ}\text{C}$ ) for the specified curing/testing time, including the time in the mold before testing

**XI. Procedure for Compression Testing**

- A. Immediately following the specified curing period, remove the specimens from the molds and measure the cross-sectional dimensions to the nearest 0.001 inch using a micrometer. Take two measurements for each dimension at mid-height and perpendicular to the load axis and average them as per ASTM C 579 – Method B
- B. Center the cube specimens on the lower testing head of the compression testing machine.
- C. Apply a compressive load at a rate of approximately 400 lbs./sec. (6,000 psi/min.)

*Note 4: Testing times for individual specimen ages shall be from time of molding.*

*Tolerances are:*

*3-Hour  $\pm 5$  minutes*

*24-Hour  $\pm 15$  minutes*

*7-Day  $\pm 6$  hours*

- D. Record the maximum load indicated by the testing machine (W) to the nearest pound (lbf).
- E. If the epoxy mortar continues to yield beyond 0.25 inches of crosshead travel, record the maximum load indicated by the testing machine (W) at 0.25 inches of crosshead travel and make note of this instance on the worksheet.

**XII. Calculations**

- A. Calculate the compressive strength of each specimen to the nearest 10 psi using the following formula:

$$S = \frac{W}{(L1 \times L2)}$$

Where:

S = Compressive Strength, (psi)

W = Maximum Load Indicated by Testing Machine, (lbf)

L1 & L2 = Cross-section dimensions of cube measured in XI.A, in.

Example:

Load (W) = 24,653 lbs

L1 = 2.01 in.

L2 = 2.00 in.

$$S = \frac{24,653 \text{ lbs}}{(2.01 \times 2.00)} = 6,132 \text{ psi}$$

### **XIII. Report**

- A. Complete Identification of the Material Tested, including:
  - 1. Manufacturer's Code
  - 2. Product Name
  - 3. Source
  - 4. Mixing Ratio
  - 5. Batch/Lot Numbers
  - 6. Type
  - 7. Grade
  - 8. Class
- B. Specimen Dimensions-
- C. Conditioning Procedure
- D. Conditions in Test Room
- E. Number of Specimens Tested
- F. Maximum Load (W) Indicated by the Testing Machine
- G. Compressive Strength (S) of Each Specimen to the Nearest 10 psi
- H. Average Compressive Strength of a Set of Specimens to the Nearest 10 psi
- I. Date and Time of the Mix
- J. Date and Time of the Break

### **XIV. Precision and Bias**

- A. Test specimens that are manifestly faulty should be rejected and not considered in determining the compressive strength.
- B. If any strength value(s) differs from the mean by more than 15 %, the value farthest from the mean shall be rejected and the mean recalculated. If any value(s) still differs from the new mean by more than 15 %, the farthest value should again be rejected and the mean recalculated. If any value(s) remains 15 % from the mean, the test should be rerun

Louisiana Department of Transportation and Development  
 Materials Section

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**TR 705**  
**"Compressive Strength of Epoxy Resin Systems"**

Sample ID \_\_\_\_\_

Manuf. \_\_\_\_\_ APS Code \_\_\_\_\_

Product Name \_\_\_\_\_ Source (Field, Plant , Other ) \_\_\_\_\_ Mix Ratio: \_\_\_\_\_

Type \_\_\_\_\_ Grade \_\_\_\_\_ Class \_\_\_\_\_

Lot No. (Part A) \_\_\_\_\_ Volume \_\_\_\_\_ Weight \_\_\_\_\_

Lot No. (Part B) \_\_\_\_\_ Volume \_\_\_\_\_ Weight \_\_\_\_\_

**Totals:** Volume \_\_\_\_\_ Weight \_\_\_\_\_

ASTM C778 ( 20-30 ) Sand Volume (2.75:1) \_\_\_\_\_ Weight \_\_\_\_\_

Date/Time Mixed \_\_\_\_\_ Technician \_\_\_\_\_

Epoxy Mixing Duration \_\_\_\_\_

Epoxy Mortar Mixing Duration \_\_\_\_\_

Notes:

Specimen Age	Break Date & Time	Cube Weight	Load (L)	Area (A)	Comp. Strength (C) (C = L/A)
3 HR - A					
3 HR - B					
3 HR - C					
3 HR - Avg					
24 HR - A					
24 HR - B					
24 HR - C					
24 HR - Avg					
7 DAY - A					
7 DAY - B					
7 DAY - C					
7 DAY - Avg					

Date / Time Tested \_\_\_\_\_ Technician \_\_\_\_\_