Evaluation of Bond Strength by Slant Shear

This test procedure applies to the Polymer Modified Portland Cement Mortar Guide Bridge Special Provision.

Reference Test Procedure(s):

1. AASHTO M 201 (Illinois Modified), Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concrete

2. AASHTO T 22 (Illinois Modified), Compressive Strength of Cylindrical Concrete Specimens

3. AASHTO T 23 (Illinois Modified), Making and Curing Concrete Test Specimens in the Field

4. AASHTO R 39 (Illinois Modified), Making and Curing Concrete Test Specimens in the Laboratory

5. ASTM E 29 (Illinois Modified), Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

To maintain brevity in the text, the following will apply:
Example: AASHTO T 22 (Illinois Modified) will be designated as "T 22."
ASTM E 29 (Illinois Modified) will be designated as "ASTM E 29."

1. GENERAL

This procedure describes the testing performed to evaluate the bond strength by slant shear of a material bonded to hardened concrete. The test material is bonded to a hardened half-section of a 4 × 8 in. (100 × 200 mm) portland cement concrete cylinder, which has a diagonally cut bonding area at 30° from the vertical. The bond strength is determined at the diagonal face by testing the composite specimen in compression.

All rounding shall be according to ASTM E 29.

2. EQUIPMENT

a. A mortar mixer, concrete mixer, or a paddle on the end of a drill shall be used to thoroughly mix the test material. The apparatus shall be appropriate for the material being tested.

b. Compression Testing Machine as described in T 22.

c. Dummy Section— A complete 4 × 8 in. (100 × 200 mm) cylinder of portland cement concrete shall be cast, and, after curing (see Section 3), shall be saw cut at an angle of 30° from the vertical. The diagonal face of the section shall be sand blasted and dry brushed to expose the aggregate and remove loose surface material prior to use. Dummy sections shall be used in pairs originating from the same batch of concrete.

The concrete mix design for the dummy section shall be as follows:
- A cement factor of 565 lb/ yd³ (335 kg/m³) and a mortar factor of 0.80 shall be used.
- The air content of the freshly mixed concrete shall be 5.0 to 8.0 percent.
- The slump of the freshly mixed concrete shall be 3.0 in. to 4.0 in. (75.0 mm to 100.0 mm).

d. Specimen Molds— The molds shall be according to T 23 or R 39, 4 in. (100 mm) inside diameter and 8 in. (200 mm) high.

e. Small Tools— Tamping rod, brush, trowel, etc. The tamping rod shall be a round, metal rod, approximately 12 in. (300 mm) long and 3/8 in. (10 mm) in diameter, having both ends rounded to hemispherical tips of said diameter.

3. MATERIAL

a. Laboratory conditions and procedures for mixing the Portland cement concrete from which the dummy sections are cast shall be according to T 23 or R 39, unless otherwise specified. The materials and proportions of the portland cement concrete shall be such that the cast cylinders shall have a minimum compressive strength of 4500 psi (31 MPa) tested at 28 days according to T 22.

b. Bonding System. A sufficient amount of the test material shall be prepared, according to the manufacturer's instructions, to make a minimum of 3 composite specimens for testing.

4. PROCEDURE

a. Brush a portion of the prepared test material on to the diagonal face of the dummy section. Place the dummy section in the cylinder mold diagonal face up.

b. Fill the remainder of the mold with the test material in two layers of approximately equal volume. Rod each layer 25 times.

c. Strike-off the surface level with the top of the mold. Immediately cap the cylinder mold with a plastic lid.

d. Prior to demolding, cure test specimens in the laboratory air at 73 ± 7 °F (23 ± 4 °C) for 7 days. Then, demold and cure in a saturated lime water bath at 73 ± 3 °F (23 ± 2 °C) for an additional 21 days.

e. On the 28th day, test the specimens in compression according to T 22.

5. CALCULATIONS

a. Calculate the nominal bond strength of the concrete repair system as follows:

$$Bond\ Strength = \frac{P}{0.7854 \times a \times b}$$

Where: P, Maximum load carried by the composite specimen at failure in lb. (N),
a, Length of major axis to the nearest 0.01 in. (0.25 mm), and
b, Length of minor axis to the nearest 0.01 in. (0.25 mm)

6. REPORT

a. Average bond strength to the nearest 10 psi (0.1 MPa),

b. Maximum load in lb. (N) of each specimen at failure,

c. Number and total area of voids in the bond and/or defects in each specimen, and

d. Type and position of the fracture in each specimen.