ARIZ 725a
September 5, 1996
(4 Pages)

TENSILE PROOF DOWEL TEST

(An Arizona Method)

SCOPE

1. (a) This test method covers the determination of the tensile force necessary to break the bond between a steel reinforcing bar and portland cement concrete when utilizing an epoxy adhesive, under defined procedures for preparation, conditioning, and testing.

(b) Tensile strength is the maximum tensile load carried by the test specimen during a tension or pull-out test. The results are expressed in Newtons (pounds force).

(c) This test method may involve hazardous material, operations, or equipment. This test method does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user to consult and establish appropriate safety and health practices and determine the applicability of any regulatory limitations prior to use.

(d) See Appendix A1 of the Materials Testing Manual for information regarding the procedure to be used for rounding numbers to the required degree of accuracy.

(e) Metric (SI) units and values are shown in this test method with English units and values following in parentheses. Values given for metric and English units may be numerically equivalent (soft converted) for the associated units, or they may be given as rounded or rationalized values (hard converted). Either the metric or English units along with their corresponding values shall be used in accordance with applicable specifications. See Appendix A2 of the Materials Testing Manual for additional information on the metric system.

APPARATUS

2. Requirements for the frequency of equipment calibration and verification are found in Appendix A3 of the Materials Testing Manual. Apparatus for this test procedure shall consist of the following:

(a) A rotary hammer drill with a 25.4 mm (1 inch) drill bit.

(b) Testing Machine, capable of maintaining a specified rate of loading and comprised of essentially the following:

1) Fixed Member - The upper member of the machine has grips for holding the test specimen in the machine. These grips shall secure the reinforcing bar in such a way that the concrete cylinder shall move into a seating alignment as soon as a load is applied.

2) Movable Member - This seating alignment shall bring the concrete cylinder into a uniform bearing against a steel plate that bears against the bottom of the movable or lower member.

MATERIALS

3. (a) The concrete cylinder shall be a 152.4 x 304.8 mm (6 x 12 inch) concrete cylinder fabricated according to AASHTO T 23 (ASTM C 31). The concrete utilized to fabricate the cylinder shall have a minimum compressive strength of 40 MPa (6000 psi) when tested in accordance with Arizona Test Method 314.

(b) The reinforcing bar shall be No. 20M (No. 6), conforming to the requirements of AASHTO M 31 (ASTM A 615) Grade 60, with a length of 815 mm (32 inches).

(c) The epoxy adhesive product, prepared according to the manufacturer's recommendations.

PREPARATION

4. (a) A 25.4 mm (1 inch) diameter hole is drilled in the center and parallel to the principal axis of the cylinder to a depth that will accommodate a full 150 mm (6 inches) of reinforcing bar. Compressed oil-free air shall be used to purge drill dust from the hole. Then, water under pressure along with a bottle brush will be used to flush out any remaining particles. Water under pressure will be continuously applied to the hole until the rinse water turns clear. Then the cylinder is moved to a storage area and set up side down to allow any free moisture to drain away. The cylinder will be dry before any epoxy adhesive is applied in fabricating the test specimen.

(b) If a low or medium viscosity epoxy is used, pour a sufficient quantity of epoxy into the hole, such that when a square end of reinforcing bar is pushed to the full depth of the drilled hole, the epoxy shall reach the top of the hole. A small amount of excess material extruded will be acceptable. The reinforcing bar should be rotated approximately one to three revolutions in an effort to more uniformly distribute the epoxy adhesive over the reinforcing bar and the wall of the drill hole.

(c) If a high viscosity or non-sag epoxy is used, use a spatula or putty knife in the application of the epoxy to place a sufficient quantity of the material into the drill hole. In addition, the length of reinforcing bar that is to be embedded, should be coated with epoxy before the square end of the reinforcing bar is inserted into the drill hole. A small amount of excess material extruded will be acceptable. The reinforcing bar should be rotated approximately one to three revolutions in an effort to more uniformly distribute the epoxy adhesive over the reinforcing bar and the wall of the drill hole.

(d) If a glass self-contained epoxy adhesive capsule is used, one end of the reinforcing bar shall be chisel pointed. The other end of the bar will have a square end, which shall be fitted into an attachent on a rotary hammer drill. The glass capsule shall be inserted into the drill hole and the reinforcing bar with the chisel point is then driven into the drill hole. The reinforcing bar shall be driven to the full depth of the drilled hole or refusal.

TEST SPECIMEN

5. Each test specimen shall consist of a fully assembled 152.4 mm (6 inch) diameter concrete cylinder with the rebar bonded within utilizing the epoxy adhesive product submitted for evaluation. The test shall consist of performing testing on two test specimens; one being tested at one day, and the other at three days, unless other time periods are agreed upon.

CONDITIONING

6. The conditioning of the test specimens shall be maintained, until such time as the tests are conducted, at a temperature of 24 ± 4 °C (75 ± 7 °F) and a relative humidity of 50 ± 2 percent.

PROCEDURE

7. (a) Place the test specimen in the test machine so the grips fully engage the reinforcing bar, while taking care to align the concrete cylinder and the bearing plate so that they will bear uniformly against the lower or movable member. The application of the tensile loading should begin as quickly as possible. An initial loading of 22 kN (5000 pounds force) shall be applied to the test sample. Loading shall then be applied at a rate of movement which corresponds to a loading rate within the range of 22 to 27 kN/minute (5000 to 6000 pounds force/minute) to failure.

(b) Record the maximum load carried by the test specimen at failure, to the nearest 450 N (100 pounds force).

(c) Record the type of failure that occurred. This will be based on a visual inspection. (See Note below).

NOTE: Adhesive failure refers to the lack of bond obtained by observing how much of a failure has occurred in the epoxy adhesive being in contact with the surfaces to be bonded, poor distribution of epoxy material. Concrete tensile failure could be described as being a complete failure that is preceded by developing a shallow surface cone.