ACI 548.11R-12

Guide for the Application of Epoxy and Latex Adhesives for Bonding Freshly Mixed and Hardened Concretes

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This guide provides information, requirements, and procedures for bonding freshly mixed and hardened concretes by using epoxy or latex adhesives. This guide covers evaluation of hardened concrete, selection of suitable epoxy or latex adhesive and application methods.

Keywords: adhesives; bonding; epoxy adhesives; evaluation; latex adhesive; preparation.

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ACI 548.11R-12 supersedes ACI 503.6R-97(03) and became effective September 6, 2012.

CHAPTER 1—SCOPE

This guide provides information, requirements, and procedures for bonding freshly mixed and hardened concretes by using epoxy or latex adhesives. This information will be of particular use to contractors.

This guide consists of:

a) Evaluation of hardened concrete to determine proper preparation and surface conditioning before application of adhesives

b) Selection of suitable epoxy or latex adhesive depending on the expected performance and environmental conditions (ACI 503.5R)

c) Application methods

CHAPTER 2—DEFINITONS

2.1—Definitions

ACI provides a comprehensive list of definitions through an online resource, "ACI Concrete Terminology," http://terminology.concrete.org.

CHAPTER 3—HARDENED CONCRETE EVALUATION

Contaminated and deteriorated concrete can be detected by visual inspection; however, in many cases, visual determination of the soundness of the concrete is not sufficient to select the repair and preparation methods. It is necessary to determine the extent and cause of deterioration, and if that cause is active. For guidance on surveys for these determinations, refer to ACI 201.1R, ACI 364.1R, and ASTM C823/C823M.

Methods common for evaluating and determining concrete condition include sounding with a hammer or chain drag, ultrasonic pulse velocity, petrographic analysis, infrared thermography, radar detection, core evaluation, impact echo, measurement of chloride ion content, and bond tests as described in ACI 228.1R and ASTM C1583/C1583.

Proper preparation, as described in Chapter 5, of any concrete to receive an adhesive is of primary importance. Inadequate preparation may result in bond failure at the adhesive interface.

The surface conditions required for different types of adhesive are described in Chapters 4 and 5.

CHAPTER 4—REMOVAL OF UNSOUND CONCRETE

The removal of unsound or damaged concrete prior to placing an adhesive and before placement of the freshly mixed concrete is a necessary part of the rehabilitation of structures.

The first step involves saw cutting the periphery of the removal area to a depth of 1 in. (25 mm) or to a lesser depth necessary to clear the reinforcing steel (VDOT 2007). This saw cutting delineates the repair area and reduces edge spalling and weakness introduced by outlining the area using other methods. Saw cutting also provides a shoulder against which the repair materials can be placed and finished, resulting in a neater appearance. The saw-cut line should be located outside of the determined limits of the defect to ensure that all defective concrete is removed and that the fresh material is bonded to sound concrete.

Several types of systems are available to remove unsound concrete.

a) Scabblers or bush hammers are tools with several points that remove concrete by pulverizing or fracturing the surface

b) Scarifiers have wheels with several points that are tipped with carbide, tungsten, or diamonds. This equipment removes concrete by scraping or impacting the surface

c) Water blasting (hydrodemolition) removes concrete by projecting jets of potable water

d) Jackhammers remove concrete by impacting the surface

CHAPTER 5—SURFACE PREPARATION

After the concrete has been removed by one or more of the aforementioned methods (USACE 1995), except for water blasting, all newly exposed surfaces should be abrasive blasted and washed thoroughly with a water jet that has a pressure of at least 1500 psi (10 MPa). The surface should then be dried with oil-free compressed air or vacuumed to remove any residual debris.

Surfaces or parts of surfaces not requiring removal of concrete should be cleaned to remove all surface contaminants detrimental to the bond of the adhesive. Such contaminants may include laitance, curing membranes, surface coatings, treatments, oil, grease, rust stains, and dust.

These methods are commonly used to remove contaminants

a) Shot blasting, which projects metal balls of varying size at high velocity to impact and abrade the surface

b) Abrasive blasting, which projects particles of varying size to impact and abrade the surface. The particles may be carried by air or water

c) Scabbling, which uses bush hammers

d) Scarification

e) Water blasting

One or more of these methods may be required for preparation. For guidance, refer to ASTM D4258 and D4259 and ICRI No. 310.1R, No. 310.2R, and No. 310.3R.

Regardless of surface preparation method, the results should be such that the surface is abraded to expose the coarse aggregate in the surface with a maximum surface texture of 0.01 in. (0.254 mm) measured in accordance with ASTM E965. Heavier textures require the use of excessive adhesive.

To determine if surface preparation is adequate for bonding, test for pulloff strength in accordance with ASTM C1583/C1583. If 250 psi (1.7 MPa) is achieved, then the surface preparation and concrete quality is adequate. If the pullout value is less than 250 psi (1.7 MPa) and 50 percent or more of the failure area is in the concrete at a depth of 0.236 in. (6 mm) or greater, then the surface preparation