

IN-LB

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SI

International System of Units

Selecting Protective Treatments for Concrete— Guide

Reported by ACI Committee 515

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Selecting Protective Treatments for Concrete—Guide

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Selecting Protective Treatments for Concrete—Guide

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Concrete structures can be subjected to physical or chemical attacks by various substances, including water, acids, alkalis, salt solutions, and organic chemicals. Damage may vary in intensity from surface discoloration or roughening to catastrophic loss of structural integrity due to acid attack. This guide addresses the effects of various substances on untreated concrete and provides recommendations for protective treatments.

Keywords: acids; alkali; chemical attack; coal tar distillates; coatings; deicer; distress; durability; exposure condition; fatty acids; hardener; membrane; petroleum oils; protective treatment; resin; salt solution; sealer; solvents; topping; vegetable oils.

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CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

Concrete durability and resistance to chemical attack are dependent upon the concrete itself, including the constituent materials, proportioning, mixing, and placement. However, to enhance or extend the service life of concrete structures, a protection system is necessary to provide a barrier to prevent contact with deleterious materials. The protection system itself should also be durable and effective in the concrete's environment.

Generally, there are three methods for increasing concrete durability:

1. Choosing optimized concrete materials and mixtures to lower concrete permeability and mitigate chemical attack
2. Protecting concrete from the agents causing chemical attack by using suitable treatments, sealers, coatings, overlays, linings, or barriers
3. Modifying the composition, temperature, or other factors affecting the rate of chemical attack to make it less aggressive to the concrete

The focus of this guide is selection of materials and material systems to protect the concrete from aggressive chemical substances. When protective material is bonded to concrete, bond strength of the material should be evaluated and should be in compliance with the producer's and specifier's requirements. Refer to [ACI PRC-515.3](#) for more information on assessment of surfaces as well as surface preparation prior to application of protection systems to concrete.

Selection of a protection system should be based on information of various systems, experience with the system,

and specific applications and exposures. This document is intended to be a guide to the user in consideration of various protection systems. This information, based both on the literature and experience, should be considered a guide to assist in designing a test program using the concrete mixtures and chemicals for a specific application or exposure. While some protection systems included in this guide may not be available or are obsolete, they may be encountered on existing structures, so they have been included for information for historical reference.

1.2—Scope

This guide refers to common protective treatments for the chemicals classified in Tables 3.1a through 3.1h. More exotic treatments such as lead sheet, glass, or metalizing are included but not usually called for except in extreme or unusual circumstances. Because various treatments provide different degrees of protection, product producers should be consulted for each application.

The information contained in Tables 3.1a through 3.1h is reproduced from previous versions of ACI Committee 515 documents and PCA IS001 ([Kerkhoff 2001](#)). These tables are based on research published in previous documents ([Kuenning 1966](#); [Kerkhoff 2001](#); [ACI PRC-515.1](#)) and are unchanged and unedited from the previous publication of ACI PRC-515.2 as well as PCA IS001 ([Kerkhoff 2001](#)). Additional information on the development of Tables 3.1a through 3.1h is available in [Goodwin and Harrer \(2023\)](#). The information in the tables included in this document is to be used as a guide and reference. It is the responsibility of the user of this document to confirm current availability, application, and use of the systems included.

In all cases, specific recommendations from material producers should be followed instead of the general guidance given in this guide, as individual treatment types vary widely within a specific product type. Specific product recommendations are beyond the scope or intent of this guide.

CHAPTER 2—NOTATION AND DEFINITIONS

2.1—Notation

Special notation characters are referenced in Tables 3.1a through 3.1h to provide further clarification of specific chemicals and are shown as letters in the column headed "Notes."

- a* = sometimes used in food processing or as food or beverage ingredient; ask for advisory opinion of Food and Drug Administration (FDA) regarding coatings for use with food ingredients.
- b* = water with a pH higher than 6.5 may be aggressive if it also contains bicarbonates; natural water is usually of pH higher than 7.0 and seldom lower than 6.0, though pH values as low as 0.4 have been reported ([Nordstrom et al. 2000](#)); for pH values below 3, protect as for dilute acid.
- c* = frequently used as a deicer for concrete pavements. If the concrete contains too little entrained air, a low-quality air-void system, or has not been aged