ACI 310R-13

Guide to Decorative Concrete

Reported by ACI Committee 310

American Concrete Institute®

First Printing
December 2013

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Guide to Decorative Concrete

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ISBN: 978-0-87031-853-5

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ACI Committee 310 wishes to extend special acknowledgements to the following individuals for their contribution to the development of this guide: M. S. Smith, N. Blackburn, J. Strieder, and A. Werner.

This guide describes techniques for imparting aesthetic finishes to concrete flatwork, of which many can be combined for unique effects. The designer/engineer will acquire detailed, practical guidance for achieving aesthetic effects using proven techniques. Recommendations are made for the production of cast-in-place decorative concrete flatwork, decorative stains, and overlays. In addition to attention to the specified materials, mixture designs, concrete placement, curing, protection, sealing, and other treatments, this guide also considers the effects of these treatments on the overall aesthetics of the facility.

Keywords: aggregates; cementitious materials; decorative overlays; dry-shake hardeners; dry-shake release agents; embedments; embossing; engraving; etching; flatwork; imprinting; inlays; pavements; polishing; sealants; stains; stamping; tooling.

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ACI 310R-13 was adopted and published December 2013.

CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

Decorative concrete has been in existence since approximately 70 A.D., when concrete was used for defining affluent or important areas of living space in communal cultures. Early examples of this type of adornment are the streets and paving throughout the city of Pompeii near Naples, Italy. Early decorative concrete used colored aggregates and varying shapes or natural materials embedded in concrete paving.

Traditionally, concrete has been specified more for its functional characteristics than as an enhancement to the aesthetics of the structure. Landscape architects were leaders in using concrete flatwork to enhance the visual appeal of hardscapes. Using color and texture introduced concrete as a landscape feature in addition to its functionality. An example is flatwork textured and colored to replicate the look of slate, brick, or natural stone as shown in Fig. 1.1a and 1.1b.

Fig. 1.1a—Stamped, colored concrete with slate and brick patterns in landscape setting (courtesy of Decorative Concrete Resources).

Fig. 1.1b—Concrete slab enhances design aesthetic with mimic of stone slab (courtesy of L. M. Scofield Company).

The use of decorative concrete has been well received and considered as an alternative to other building materials for durable, versatile, and economical finishes. More designers are creating greater aesthetic appeal in projects by using one or more combinations of special concrete placement techniques including integral concrete colors, color hardeners, chemical stains, pigments and dyes, surface texturing, jointing, exposed aggregate, surface embossing, polishing,

Fig. 1.2—Cast-in-place decorative concrete combining treatments during and post placement to achieve aesthetic effects (courtesy of Concrete Mystique Engraving).

and the use of sealants and coatings. The combinations of techniques and mediums described in this guide are exclusive; they cannot be replicated by any other durable medium.

1.2—Scope

This guide describes several techniques for imparting aesthetic finishes to concrete, many of which can be combined for unique effects (Fig. 1.2). The guide provides detailed practical guidance for achieving aesthetic effects using proven techniques, both within and beyond the context of ACI 302.1R, which also governs these concrete elements.

Recommendations for the production of cast-in-place decorative concrete, stains, and overlays are presented. In addition to attention to specified materials, mixture designs, concrete placement, curing, protection, sealing, and other treatments, consideration of the effects of these treatments on the overall aesthetics of the structure is also addressed.

CHAPTER 2—DEFINITIONS

"2013 ACI Concrete Terminology" provides a comprehensive list of definitions that are available online at: http://terminology.concrete.org. The definitions provided here complement that source.

acid (or chemical) stain—see **reactive stain**.

color hardener—similar to traditional one-component hardeners, having additional constituent materials formulated to color the concrete surface.

concrete dye—colorant for concrete that is applied to the concrete while it is in solution and results in a stained appearance; concrete dyes do not produce color via chemical reaction—they are usually a synthetic organic compound and can degrade when exposed to light or alkalinity.

crack chaser—rotary tool using a v-shaped diamond blade to enlarge cracks in concrete to facilitate repair. The v-shape of the blade assists the operator in following the curves of the crack so as to not cause unnecessary damage to the piece being prepared for repair.

decorative aggregate—specially selected aggregates chosen for their artistic contribution to the project; examples of materials used as decorative aggregate include colored stone, intrinsically valuable gathered stone, semiprecious stone, or colored glass.

decorative overlay—mixture of cementitious materials installed over an existing concrete substrate; they can be integrally colored, stenciled, or used for artistic enhancement post-placement.

densifier—combination of silicate and water-based compounds that react in the surface of the concrete to produce additional calcium silicate hydrate (C-S-H); silicates are combined with carrier compounds, most commonly sodium-, potassium-, or lithium-based to aid the process. Some products also contain siliconate.

embossing—creating a raised pattern or reverse replication of an object in the concrete surface.

engraving—cutting with a mechanical rotary or impact tool to texture a concrete surface product.

etch—textured surface produced by cutting with a mechanical impact tool or by chemical etching by use of acid.

grinding—intentional removal of a visually apparent amount of surface without consideration of gloss.

integral color—pigment that changes the color of the paste portion of the concrete mixture to produce a color change throughout the hardened concrete matrix.

microtopping—bonded cementitious overlay usually 1/8 to 3/16 in. (3 to 5 mm) in thickness; when installed over an existing concrete substrate post-placement, it can be integrally colored, stenciled, or used for artistic enhancement.

needle scaler—reciprocal impact tool that uses single or multiple thin rods to strike a surface.

polished concrete—post-placement architectural finish or texturing technique where concrete undergoes sequential mechanical abrasion resulting in a glossy surface with clarity ranging from matte to high gloss, depending on which point in the sequence the abrasion is ended; does not achieve gloss solely by the use of surface coatings. The complete process commonly includes chemical densification for increased strength and reduction of absorption.

polished overlay—bonded cementitious overlay 3/8 to 1 in. (10 to 25 mm) in depth cast over an existing concrete substrate designed to accept diamond abrading for a polished concrete appearance.

reactive stain—reactive solution of one or more metal salts stabilized by acid that produces coloration in a concrete substrate by neutralization of acid followed by precipitation of metal hydroxides or oxides.

stain(v)— use of a chemical stain or a concrete dye to change the color of the concrete surface that can be a penetrant or a low build coating that does not appreciably change the concrete's texture; some acid stains can etch the concrete's surface and can alter the texture.

stamping—process of applying a surface pattern to decorative concrete by using impact pressure to emboss texture, patterns, or faux joints into the surface of plastic concrete; usually providing a pattern of simulated natural materials