

Guide for the Design of Durable Parking Structures

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This guide is a summary of practical information regarding design of parking structures for durability. It also includes information about design issues related to parking structure construction and maintenance.

The guide is intended for use in establishing criteria for the design and construction of concrete parking structures. It is written to specifically address aspects of parking structures that are different from those of other buildings or structures.

Keywords: Concrete durability; construction; corrosion; curing; finishes; freeze-thaw durability; maintenance; parking structures; post-tensioning; precast concrete; prestressed concrete.

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CHAPTER 1-GENERAL

1.1-Introduction

ACI 318 requires a general consideration of the durability of concrete structures. Because some concrete parking structures have undergone significant deterioration, it is the purpose of this guide to provide specific practical information regarding the design, construction, and maintenance of parking structures with respect to durability.

The guide is primarily concerned with those aspects of parking structures that differentiate them from other structures or buildings. Thus, the guide does not treat all aspects of the structural design of parking structures.

1.2-Definition of terms

Reference is made to the following selected terms to help clarify the intent of the information provided throughout the document. Unless otherwise noted, the terms are as defined in ACI 116R and are repeated here for the convenience of the reader.

Admixture-A material other than water, aggregates, hydraulic cement, and fiber reinforcement, used as an ingredient of concrete or mortar, and added to the batch immediately before or during its mixing.

Admixture, accelerating-An admixture that causes an increase in the rate of hydration of the hydraulic cement, and thus shortens the time of setting, or increases the rate of strength development, or both.

Admixture, air-entraining-An admixture that causes the development of a system of microscopic air bubbles in the concrete, mortar, or cement paste during mixing.

Admixture, retarding-An admixture that causes a decrease in the rate of hydration of the hydraulic cement, and lengthens the time of setting.

Admixture, water-reducing-An admixture that either

increases slump of freshly mixed mortar or concrete without increasing water content or maintains slump with a reduced amount of water, the effect being due to factors other than air entrainment.

Admixture, high-range water-reducing-A water-reducing admixture capable of producing large water reduction or great flowability without causing undue set retardation or entrainment of air in mortar or concrete.

Air content-The volume of air voids in cement paste, mortar, or concrete, exclusive of pore space in aggregate particles, usually expressed as a percentage of total volume of the paste, mortar, or concrete.

Air entrainment-The incorporation of air in the form of minute bubbles (generally smaller than 1 mm) during the mixing of either concrete or mortar.

Air void-A space in cement paste, mortar, or concrete filled with air; an *entrapped air void* is characteristically 1 mm or more in size and irregular in shape; an *entrained air void* is typically between 10 μm and 1 mm in diameter and spherical or nearly so.

Bleeding-The autogenous flow of mixing water within, or its emergence from, newly placed concrete or mortar; caused by the settlement of the solid materials within the mass; also called water gain.

Bond-Adhesion and grip of concrete or mortar to reinforcement or to other surfaces against which it is placed, including friction due to shrinkage and longitudinal shear in the concrete engaged by the bar deformations; the adhesion of cement paste to aggregate.

Bond breaker-A material used to prevent adhesion of newly placed concrete or sealants and the substrate.

Bonded member-A prestressed concrete member in which the tendons are bonded to the concrete either directly or through grouting.

Cast-in-place-Concrete which is deposited in the place where it is required to harden as part of the structure, as opposed to precast concrete.

Cementitious-Having cementing properties.

C.I.P.-Cast-in-place, referring to a method of concrete construction. See cast-in-place.

Chert-A very fine grained siliceous rock characterized by hardness and conchoidal fracture in dense varieties, the fracture becoming splintery and the hardness decreasing in porous varieties, and in a variety of colors; it is composed of silica in the form of chalcedony, cryptocrystalline or microcrystalline quartz, or opal, or combinations of any of these.

Cold joint-A joint or discontinuity resulting from a delay in placement of sufficient time to preclude a union of the material in two successive lifts.

Composite construction-A type of construction using members produced by combining different materials (e.g., concrete and structural steel), members produced by combining cast-in-place and precast concrete, or cast-in-place concrete elements constructed in separate placements but so interconnected that the combined components act together as a single member and respond to loads as a unit.