

ACI 357.3R-14

Guide for Design and Construction of Waterfront and Coastal Concrete Marine Structures

Reported by ACI Committee 357



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Guide for Design and Construction of Waterfront and Coastal Concrete Marine Structures

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Waterfront and coastal concrete marine structures are exposed to severe environmental conditions for which concrete is ideally suited. These conditions include wind; waves, including seiches and tsunamis; ice and ship impact; abrasion and impact from floating debris; passing vessel effects; and seismic events. As many of these structures are pile-supported, the seismic loading can be critical and, therefore, a discussion of piles and their installation is included in this guide. Also provided are the measures that can be taken to minimize the undesirable effects of these environmental factors and reduce the potential for serious problems.

This guide also defines waterfront and coastal concrete marine structures, discusses materials that can be used to construct them, describes potential durability issues and how to mitigate them, and presents sustainability and serviceability requirements. Design loads, analysis techniques, design methodology, and construction considerations are also presented. Other topics include quality control (QC), above-water and below-water inspection of these structures, and repair of damaged structures. The materials, processes, QC measures, and inspections described in this guide should be tested, monitored, or performed as applicable only by qualified individuals holding the appropriate ACI certifications or equivalent.

Keywords: construction procedures; durability; inspection; marine structures; materials, quality control; serviceability; sustainability; structural analysis; structural design.

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CHAPTER 1—GENERAL

1.1—Introduction

The use of properly designed, durable, and sustainable concrete is an economical approach to the design of marine structures. Except for some criteria in *ACI 357R* and specialized criteria in other ACI guides on durability, there are no comprehensive guidelines or standards that cover the application of concrete in the marine environment for coastal marine structures. Current building codes and ACI standards do not address the requirements unique to the design of these structures, with the exception of special applications or requirements for piles and concrete durability. This guide provides design guidance for the use of concrete for coastal marine structures, and is intended to complement other design manuals and guides used for this purpose.

1.2—Scope

This guide primarily covers marine structures used for berthing marine vessels in protected harbors, and for supporting the associated loads. Structures covered by this guide include pile-supported platforms, bulkheads, and gravity structures. It is not intended to cover marine structures such as gravity block walls, tunnels, breakwaters, floating structures, or offshore platforms. Emphasis is placed on special considerations for marine concrete and guidance for the design and construction of marine structures. Because of the severe nature of the marine environment and associated loading conditions, certain recommendations in this report are intended to complement the requirements of *ACI 318*.

Existing design guides are used for basic concepts, loadings, marine hardware, and other criteria that affect the use of concrete in marine structures. There are some comprehensive manuals that cover functional and structural guidelines for the design of coastal marine structures (*MIL-HDBK-1025 2006*; *BS 6349-1 to 8*; *Goda et al. 2009*; *EAU 2004*; *Ports, Customs and Free Zone Corporation 2007*; *Werner 1998*; *FEMA P-55 2011*).

CHAPTER 2—NOTATION AND DEFINITIONS

2.1—Notation

- D = dead loads
- E = earthquake loads
- EI = flexural stiffness
- E_s = modulus of elasticity of steel
- E_v = vertical seismic load