

Guide to Cold Weather Concreting

Reported by ACI Committee 306

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Guide to Cold Weather Concreting

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This document guides specifiers, contractors, and concrete producers through the selection processes that identify methods for cold weather concreting. The objectives of cold weather concreting practices are to: a) prevent damage to concrete due to freezing at early ages; b) ensure that the concrete develops the recommended strength for safe removal of forms; c) maintain curing conditions that foster normal strength development; d) limit rapid temperature changes; and e) provide protection consistent with intended serviceability of the structure. Concrete placed during cold weather will develop sufficient strength and durability to satisfy intended service requirements when it is properly proportioned, produced, placed, and protected.

Keywords: accelerating admixtures; antifreeze admixtures; cold weather concreting; concrete temperature; curing; enclosures; form removal; freezing and thawing; heaters; heating aggregates; insulating materials; maturity testing; protection; strength development.

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CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

The conditions of cold weather concreting exist when the air temperature has fallen to, or is expected to fall below, 40°F (4°C) during the protection period. The protection period is defined as the amount of time recommended to prevent concrete from being adversely affected by exposure to cold weather during construction. Concrete placed during cold weather will develop sufficient strength and durability to satisfy the intended service recommendations when it is properly proportioned, produced, placed, and protected. The necessary degree of protection increases as the ambient temperature decreases.

Take advantage of the opportunity provided by cold weather to place low-temperature concrete. Concrete placed during cold weather, protected against freezing, and properly cured for a sufficient length of time, has the potential to develop higher ultimate strength (Klieger 1958) and greater durability than concrete placed at higher temperatures. It is susceptible to less thermal cracking than similar concrete placed at higher temperatures.

Refer to ACI 306.1 for cold weather concreting requirements in a specification format. The Mandatory Items Checklist in ACI 306.1 can be used to add appropriate modifications to the contract documents.

This document guides the specifier, contractor, and concrete producer through the recommendations that identify methods for cold weather concreting.

1.2—Scope

This guide discusses general recommendations, concrete temperature during mixing and placing, temperature loss during delivery, preparation for cold weather concreting, protection requirements for concrete with or without construction supports, estimating strength development, methods of protection, curing recommendations, and admixtures for accelerating setting and strength gain including antifreeze admixtures.

The materials, processes, quality-control measures, and inspections described in this document should be tested, monitored, or performed as applicable only by individuals holding the appropriate ACI Certifications or equivalent.

CHAPTER 2—NOTATION AND DEFINITIONS

2.1—Notation

M = maturity factor, deg-h