

EXTERIOR CONCRETE GUIDELINES



Introduction

Concrete is a mixture of natural sand and stone that is glued together with portland cement, supplementary cementitious materials, water, and admixtures. You can expect some variations in surface and performance because concrete is mostly made of natural materials. Concrete can provide long-term durability and value when you use quality materials, and place, cure and maintain it properly. This document addresses a specific concrete issue and provides guidance on how to prevent it.

Concrete

ACI 201.2R-16, for F3 exposure class, recommends the following concrete properties:

- Minimum strength 4500 psi at 28 days
- Water to cementitious ratio 0.45 maximum
- Air Content as given for severe exposure F3 (ACI 201.2R-16) in Table 1.

Table 1. Total air content for air Entrained Concrete in very severe exposure(F3) (ACI 201.2R16).

Nominal Maximum Aggregate Size, in.	Air Content* (%)
3/8"	7.5
1/2"	7
3/4"	7
1"	6.5

*Field tolerance on air content is recommended as $\pm 1\text{-}1/2$ percent. (ACI 201.2R-16)

Curing

Curing is essential for maintaining concrete's design strength and durability; It ensures a satisfactory moisture content and temperature for a period of time immediately following placing and finishing so strength and durability may develop.

Curing can be done in two ways:

1. Wet Curing

- Soaker hoses
- Ponding and immersion
- Saturated covering (wet burlap, wet curing blankets etc.)

2. Membrane curing, trapping the existing mix water

- Plastic sheets etc. (Note: may cause surface discoloration)
- Curing compounds

Wet curing is preferred and ideally should be done for no less than seven days. With today's construction schedules, though, membrane curing using a curing compound is the most practical method. Apply an appropriate curing compound as soon as possible and no later than one hour after the finishing is complete. In hot weather, flush the surface with flowing water before curing to minimize any potential alkali-silica pop-outs.

There are two main curing compounds that are commonly used. The type of curing compound you use depends on the selection of the sealing compound that will be placed after 28 days.

- Membrane forming curing and sealing compound
- Dissipating curing compound

Curing compounds differ from sealing compounds. The primary purpose of a curing compound is to retard the loss of water from newly placed concrete. It should be applied immediately after finishing. Surface sealing compounds, on the other hand, retard the penetration of harmful substances into hardened concrete and are typically not applied until the concrete is 28 days old.

Sealing

Sealing compounds (sealers) are liquids applied to the surface of hardened concrete to reduce the penetration of liquids or gases such as water, deicing solutions, and carbon dioxide that cause freeze-thaw damage, corrosion of reinforcing steel, and acid attack.

Sealers are generally classified as either membrane forming or penetrating. Penetrating sealers, such as siloxanes and silanes, are preferred. They chemically bond to the concrete, and retard moisture from entering the concrete.

Special Note

Typically, you'll need to apply a "cure and seal" product twice. First you apply the curing portion immediately after finishing procedures. Then you apply the sealing portion after 28 days.

Curing Exterior Flatwork Late in the Season

You may need to modify your curing procedures for exterior concrete that you place late in the season, as cold weather approaches. The concrete needs to undergo a drying period before exposure to freeze-thaw cycles. You'll get favorable results by covering the concrete with plastic and, in cold weather, blankets for seven days. Then remove the curing, which gave the concrete a chance to dry out, and apply a silane or siloxane sealing compound.

Cement hydration and thus strength gain, virtually ceases when the temperature of the concrete approaches 50°F. Concrete needs to be protected from freeze and thaw cycles until it gains its design strength.

Deicing Chemicals

ACI 302.1 R states: "The use of any deicing chemicals is not recommended in the first year of service." Use sand or other grit materials for traction.

Even after the first year, minimize the use of deicers since they increase the frequency and severity of freezing and thawing cycles on concrete. Some deicers that contain materials like ammonium sulfate, ammonium nitrate, and magnesium chloride (ACI 302.1) should not be used as deicers on concrete.

Ensure proper drainage and do not let water and salt stand on the surface for extended periods of time. Even salt carried on cars can damage recently-placed concrete.

If you are concerned about your exterior concrete, please contact your contractor and concrete producer for the most suitable materials and methods for your application.

For more information, call your local concrete contractor, ready mix producer or www.chooseconcrete.com.

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