

These guidelines are intended for exterior residential use. They should not be used in place of the requirements of project specifications nor should it be substituted for competent engineering advice.

Subgrade

- Subgrade is the existing soil after the topsoil is removed
- Any pockets of soft soil that cannot be uniformly compacted must be removed and replaced with suitable material.
- Slope the subgrade away from structures enough to ensure good drainage.
- Dampen the subgrade thoroughly prior to placing the concrete.
- Never place concrete on frozen or muddy subgrade.
- The first requirement of quality exterior concrete is a uniform subgrade.

Mix Quality and Strength

- Water/cementitious materials ratio less than or equal to 0.45
- Strength greater than or equal to 4500 psi at 28 days.
- Strength must reach 4000 psi prior to exposure to frost; the average first frost is October 6
- The air content and strength of the mix is affected by any retempering water that is added at the jobsite.
- All concrete must be placed within 90 minutes from the time the truck

Coarse Aggregate

- Complying with ASTM C 33 class designation 4S quality requirements
- For concrete with minimal popouts, a Mn/DOT Class A aggregate such as granite, must be used. Normal range of popouts is 3-5 per square foot.

Air Entrainment

- An air percentage of 5 to 8 percent at the time of placement is recommended.

Slump Recommendations

- 4 inches maximum without the use of a mid or high range water reducing chemical admixture.
- 5 inches maximum using a mid or high range water reducing chemical admixture.

Slab Thickness

- 5 inches recommended; 4 inches is acceptable if the subgrade conditions are ideal
- Reinforcement, such as wire-mesh, is not required if proper jointing procedures are used on most applications.

EXTERIOR CONCRETE GUIDELINES

Placing and Finishing

- Place the concrete as near to final position as possible.
- No finishing operations shall be performed when there is excess moisture or bleed water on the surface.
- The only finishing operations required are: screeding or strike-off – bull floating prior to the appearance of any bleed water -- a waiting period for the water sheen to disappear -- edging and jointing -- and a broom texture (the safest and most durable final finish.)
- Protection of the concrete from the hot sun, high winds, or freezing temperatures is required until the concrete has a chance to cure properly.

Control Joints

- Joints should be installed in a timely manner and installed in accordance with ACI 302. Install joints at spacings not exceeding 24 times the slab thickness.
- The joints depths should be 1/4 to 1/3 of the slab depth.
- Use a center line control joint when driveways are more than 12 feet wide.
- Control joints do not require sealing.

Isolation Joints

- Isolation joints are only required at existing slabs, structures, and other fixed objects.
- Isolation joints should run the full depth of the slab.

Curing Guidelines (Begin Immediately after Final Finishing)

Concrete should be protected from losing moisture until final finishing using suitable methods like wind breaks, fogger sprayers, or misters to avoid plastic shrinkage cracks. After final finishing, the concrete surface must be kept continuously wet or sealed to prevent evaporation for a period of at least several days after finishing. The following systems can be used.

- Burlap or cotton mats and rugs with a soaker hose. Care must be taken not to let the coverings dry out and absorb moisture from the slab.
- Straw that is sprinkled with water regularly. The straw should be 6 inches thick.
- Damp earth, sand or sawdust can be used to cure flatwork. There should be no organic or iron staining compounds present in the material used.
- Sprinkling on a continuous basis is suitable as long as temperatures are well above freezing.
- Ponding of water on a slab is an excellent method of curing. The water should not be more than 20 degrees cooler than the concrete and the dike around the slab should be secured against leaks.

AVR Inc recommends the following curing and sealing procedures.

Before October 1st

- Option 1: Apply an appropriate membrane or curing compound as soon as possible and no later than one (1) hour after the final finishing is completed. In hot weather, flush the surface with water before curing to minimize alkali-silica reaction ASR.
- Option 2: Cover the slab with a plastic sheet, waterproof paper or wet burlap for 3 to 7 days.

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Sealing Guidelines (for Additional Slab Protection)

Standard Method

- Method 1: No later than one hour after the final finishing is completed, cure with Cure and Seal at a rate of 300 square feet per gallon, making sure not to over-apply. Overuse may result in uneven color or discoloration. Approximately thirty days later, apply a second coat of Cure and Seal to seal the concrete, using a coverage rate of 300 square feet per gallon and being careful not to over-apply.
- Method 2: No later than one hour after the final finishing is complete, cure with Dissipating Cure at a rate of 300 square feet per gallon, taking care not to over-apply. Approximately thirty days later or when the Dissipating Cure has dissipated (an aggressive washing or power brooming may be required), seal the concrete by applying Siloxane, a water repellent, at a rate of 100 to 200 square feet per gallon. Do not over-apply.

Cold Weather Concrete

With the arrival of fall and cooler temperatures, the placement of residential flatwork can continue, provided that the principles of "Cold Weather Concreting" are followed. By definition (ACI 306), cold weather conditions exist when "...for more than 3 consecutive days, the average daily temperature is less than 40°F AND the air temperature is not greater than 50°F for more than one-half of any 24 hr. period."

To overcome delayed strength and initial set development associated with cold weather conditions, one or a combination of the following mix adjustments are recommended:

- Substituting Type I with Type III cement
- Addition of calcium chloride admixtures
- Addition of non-chloride accelerators
- Increasing the Type I cement content by 100-200 lbs.

Placement guidelines

- Do not place concrete on a frozen subgrade; upon thawing, uneven settlement and cracking are likely to occur.
- The minimum concrete temperature, as placed and maintained, must exceed 55°F, however, caution should be exercised with concrete temperatures above 75°F.
- Appropriate curing and cold weather protection must be incorporated to prevent the concrete from freezing.

Curing and cold water protection

To develop the strength, durability and permeability potential of the concrete, curing and protection during cold weather conditions are essential. The following guidelines are recommended upon placement:

- The curing period must extend a minimum of 7 days (maintaining the 55°F temperature).
- Do not seal freshly placed concrete. Sealing retains water in the concrete thereby keeping it saturated during freeze/thaw conditions.
- Cold weather protection is best provided through insulating blankets or loose straw (minimum 12 inches deep) sandwiched between a waterproof cover e.g. polyethylene.

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Hot Weather Concrete

Throughout summer, difficulties in mixing, placing and curing concrete often arise. High ambient/concrete temperatures, low relative humidity, and moderately high wind velocities contribute to rapid evaporation of moisture from the surface and accelerated set characteristics (hydration).

To minimize the potential for plastic shrinkage crack development and related finishing concerns, the following recommendations are listed for planning your next hot-weather related construction project:

- Prior to placement, dampen forms and subgrade materials.
- Limit the addition of water at the job site. Add water on arrival to adjust the slump if necessary. Do not exceed 2-2 ½ gallons per cubic yard.
- Have adequate manpower to quickly place finish and cure the concrete.
- Consult your ready mix supplier for hot weather mix design alternatives.
- Schedule prompt transport, placement, and finishing of concrete. Whenever possible, schedule early morning placements.
- Erect temporary windbreaks to reduce wind velocity over the concrete surface.
- Erect temporary sunshades to reduce concrete surface temperatures.
- To minimize surface evaporation, incorporate fog misting or evaporation retarders. Continue fog misting until curing is initiated.
- Slabs on grade should not be placed directly on polyethylene sheeting or vapor retarders.
- Incorporate synthetic fibers (polypropylene) to resist shrinkage cracking.
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Homeowner Care

- Do not drive on the new concrete for at least 7 days.
- Do not allow water to drain beneath the slab as settlement cracks may develop.
- Do not allow snow and ice to accumulate the first winter and keep the driveway shoveled off.
- Do not apply deicing chemicals for snow and ice removal the first winter. As an alternative, sand can be used for traction.
- WARNING: Never use deicers containing ammonium sulfate or ammonium nitrate (i.e. fertilizers). Such products are known to aggressively attack concrete.
- Minnesota is classified as a severe weathering region. Therefore, a sealer must be applied approximately 30 days following placement provided that the surface is dry and ambient temperatures are above 55°F.
- Contact AVR to purchase a concrete sealer.
- Follow the manufacturer's instructions for sealer application.
- Re-application of the sealer is generally required every 2 years.