VRMCA BUILD VIRGINIA STRONG.®

TECHNICAL BULLETIN

BULLETIN #6: QUICK REFERENCE GUIDE FOR RESIDENTIAL CONCRETE CONSTRUCTION

I: Sub-grade Preparation

The sub-grade should be free of topsoil and other organic materials prior to placement. The sub-grade should be of reasonably uniform soil type and compacted. Correct any soft or muddy spots. For exterior flatwork the finished elevation of sub-grade must be high enough to allow water drainage away from the concrete. In dry weather the sub-grade should be pre-dampened one day before placement. Do not place concrete on frozen sub-grade or subgrade where water is free standing.

II: Concrete Quality

Concrete should have a design strength as shown in the following table for the intended application.

Type and location of concrete construction	Minimum Design Strength
Basement walls and foundations not exposed to the weather	2500 {IRC 2015, R 402.2}
Basement walls, foundation walls, exterior walls and other vertical surfaces exposed to the weather	3000 (1) {IRC 2015, R402.2}
Driveways, walkways, porches, carport slabs, and steps exposed to weather and garage floor slabs.	4000(1) (2) (3) {ACI 332-14}

(1) Concrete for use in these applications will have potential exposure to freezing and thawing in a moist condition and must be air entrained.
(2) ACI 332-14 requires a minimum design compressive strength of 4000 psi to provide increased durability when the concrete will be exposed to moisture during freezing and thawing cycles and where deicer chemicals may be used.
(3) However, the IRC only requires the use of a 3500 psi design strength in these applications when used in Residential Use Groups R-1, R-2, R-3, R-4, and R-5. For minimum strength requirements for other building use groups consult with the International Build Code or your local building official.

All exterior concrete shall be air entrained.

Do not use air entrained concrete for interior concrete floors that will be hard troweled (excluding garage slabs) unless the concrete will be exposed to freezing and thawing during construction or service. Note: Air entrained concrete is highly prone to the development of blisters and delaminations when hard troweled. If air entrained concrete is used special care must be taken to avoid sealing the surface before bleeding has stopped. For garage slabs, the IRC permits the air content to be decreased to a minimum of 3% provided that the concrete design strength is increased to not less than 4000 psi.

Limit slump of the concrete to a maximum of 5 inches unless a plasticizing agent is used to further increase the slump.

In order to help prevent early age plastic shrinkage cracking, the addition of micro-fibers to the concrete mix, the use of a spray-on evaporation retardant during finishing, or both is recommended.

Do not use calcium chloride in the concrete where color uniformity is important as this may result in a dark discoloration of the concrete surface. Also, the use of calcium chloride should be restricted in reinforced concrete and not permitted in concrete containing embedded dissimilar metals or aluminum. If dry flake calcium chloride is to be used it must first be mixed in a water solution before being added to the concrete – do not add dry flake calcium chloride directly to the concrete.

III: Joints:

1: Isolation {expansion} Joints: Provide a full-depth isolation joint at the perimeter of concrete floors and slabs where they abut any wall or other fixed building elements such as stoops, columns, etc.
2: Control {shrinkage} Joints: Saw-cut or form joints in all slabs when it is necessary to minimize random cracking. The ACI 332-14 Code requires the use of control joints in all unreinforced slab-on-grade construction and that the joints be spaced at intervals not to exceed the values shown in the following table.

Slab thickness in inches	Maximum size coarse aggregate < 3/4”	Maximum size coarse aggregate =/> 3/4”
3.5	8 ft	10 ft
4.5	10 ft	13 ft
5.5	12 ft	15 ft

The panel formed by the joint layout should be as square as possible, but the length should not exceed 1 ½ times the width. The joint depth for saw-cut joints should be a minimum of ¼ the slab thickness, except when early entry saw cutting is used the minimum depth should be1". If welded wire fabric reinforcement or other reinforcement is used, do not extend it across the locations of control joints.

3: Joint Sealing: Seal joints in exterior flatwork when the sub-grade is a clay soil.

IV: Placing and Finishing:

Place concrete as close to finial position as possible and avoid segregation of the concrete. Bullfloat with a wood or magnesium bullfloat immediately following strike-off and before bleed water comes to the surface. Do not float or trowel the surface while any free water is present. Do not add water to the surface during finishing. Do not dust surface with dry cement.

For exterior slabs float if needed, but do not trowel. Avoid or minimize the use of power float machines on exterior slabs. Apply final finish texture by brooming or burlap drag.

For interior slabs float and trowel as necessary to achieve the desired finish. Do not trowel the apron area of a garage slab that will be exposed to the weather.

V: Curing:

Protect concrete from freezing for a minimum of 7 days following placement. Note: Some methods of protection may include heating the area or covering the concrete with insulating material such as insulated blankets or straw. Covering the concrete with plastic sheeting, alone, is not adequate to prevent heat loss. Heaters used in an enclosed or partially enclosed area must have the exhaust vented to the outside to prevent damage to the concrete from carbon dioxide fumes.

Additionally, protect concrete from moisture loss by curing with one of the following methods:

a) Cover concrete with wet burlap and keep wet continuously for 7 days. Do not let the concrete dry out and do not allow alternate wetting and drying of the concrete.

b) Cover concrete with plastic sheeting, securing the edges and lap seams to prevent loss of moisture from the concrete. Keep in place for a minimum of 7 days. Caution: The use of plastic or sheet coverings can cause surface discoloration.

c) Apply a curing compound by sprayer or roller. Keep foot and vehicle traffic off for 7 days. Note: Do not use curing compound on interior floors where an adhesive will be used to secure a vinyl or sheet floor covering.

Start the curing method as soon as the concrete has hardened enough to resist scuffing of the surface.

This *Quick Reference Guide to Residential Concrete Construction* has been provided as an industry service by the Virginia Ready Mixed Concrete Association Technical Committee to promote improved quality in concrete construction.

NOTE: This guide is as a synopsis addressing the more pertinent materials and construction issues related to residential concrete construction. The recommendations are based on both code and industry standards. However, this guide does not claim to address all the specification and code requirements. The user of this guide is advised to consult with local and state code requirements.

More detailed information can be obtained from:

- Portland Cement Association @ 1-847-966-6200: publications; Residential Concrete #LT202HC; Design and Control of Concrete Mixtures #EB001TC
- American Concrete Institute @ 1-248-848-3700: publications; ACI 302 Guide for Concrete Floor and Slab Construction; ACI 332-14 Code Requirements for Residential Concrete; ACI CCS-1 Concrete Craftsman - Slabs on Grade
- International Code Council, Inc. @1-888-422-7233, International Residential Code, 2012; International Building Code, 2012

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