

Concrete in Practice

What, why & how?



CIP 14 - Finishing Concrete Flatwork

WHAT is Finishing

Finishing is the operation of creating a concrete surface of a desired texture, smoothness, and durability. The finish on a concrete slab can be functional or decorative.

WHY Finish Concrete

Finishing makes the concrete slab surface functional, serviceable, and attractive. The final texture, surface hardness, and joint pattern on slabs, floors, sidewalks, patios, and driveways depend on the concrete's end use. Warehouse or industrial floors need to be flat and level and have greater wear resistance, while other interior floors covered with floor coverings do not have to be as smooth and durable. Exterior slabs must be sloped to drain water with a texture that will not be slippery when wet. Excessive finishing should be avoided. A wide range of decorative finishes are possible using special techniques not discussed here.

HOW to Place Concrete

Before finishing, concrete is placed, consolidated and leveled. These operations should be carefully planned. Skill, knowledge, and experience are required to deal with a variety of concrete mixtures, placement methods, and field conditions. Having the proper manpower and equipment available; and timing the operations properly is critical.

Complete all subgrade excavation and compaction, formwork, and placement of mesh, reinforcement, or other embedments, as required, before concrete delivery. Delays after the concrete arrives create will reduce the final quality of flatwork.

The subgrade should be compacted uniformly and properly sloped as needed for drainage. Avoid wet spots and do not place concrete on a cold subgrade.

General guidelines for placing and consolidating concrete are:

- a. Selecting the correct concrete mixture for the job. Consult your concrete supplier. Do not add excess water to the load to increase slump. Concrete should be resistant to segregation, slump ordered



Construction Crew Finishing Concrete

should be appropriate to placement and finishing methods, and supply should be consistent and timely. Deposit concrete as near as possible to its final location—directly from the truck chute or use wheelbarrows, buggies, or pumps. Start at the far end placing concrete abutting previously placed concrete and work towards the near end. On slopes, use lower slump concrete and work up the slope.

- b. Spread the concrete using a short-handled, square-ended shovel, or a come-along. Never use a garden rake or tined tool to move concrete horizontally as it causes segregation.
- c. Concrete should be well consolidated with particular attention to the edges by tamping concrete with a spade or piece of wood along form edges. For larger areas, consolidation is usually accomplished by using a vibrating screed or internal vibrator.
- d. When manually striking off and leveling the concrete, use lumber or metal straightedge (called a screed). Rest the screed on edge on the top of the forms, tilt it forward and draw it across the concrete with a slight sawing motion. Maintain a head of concrete ahead of the screed to fill in any low spots. Do not use a jitterbug or vibrating screed with concrete slump that exceeds 3 inches (75 mm). Vibrating screeds should be moved rapidly to ensure consolidation but avoid working up an excessive layer of mortar on the surface. Do not overwork the surface during strike-off.

HOW to Finish Concrete

1. **LEVEL** the concrete surface using a bull float, darby, or highway straightedge soon after strike-off. This operation should be completed before bleed water appears on the surface. This operation should embed large aggregate, smooth the surface, and even out high and low spots. Keep the bull float as flat as possible to avoid sealing the surface prematurely.
2. **WAIT** before starting subsequent finishing operations until the concrete has stopped *bleeding* and there is no water sheen on the surface. Any finishing operations done while the concrete is still bleeding or with water on the surface **will result** in surface defects, such as dusting, scaling, crazing, delamination and blisters. The waiting period depends on the setting and bleeding characteristics of the concrete and the ambient conditions. During the waiting period, protect against hot, dry and windy conditions that cause rapid evaporation from the concrete surface. Cover a small portion of the slab to check if it is still bleeding. Estimate set for final finishing operations when a footprint indentation on the slab is between $\frac{1}{8}$ to $\frac{1}{4}$ inch (3 to 6 mm) deep.
3. **FLOAT** the concrete by hand or machine after bleeding has ceased. Floating embeds aggregates and levels and prepares the surface for further finishing.
4. **TROWEL** the concrete when required for its end use. Trowel finishes are more common for interior slabs. For a smooth floor make successive passes with a smaller steel trowel and increased pressure. Repeated passes with a steel trowel will produce a smooth floor that will be slippery when wet. Excessive troweling may create dark *trowel burns*. Improperly tilting the trowel will cause an undesirable “chatter” texture. Exterior slabs typically require a textured finish. Trowel finishing of air-entrained concrete, like lightweight interior slabs, should be done with caution and proper timing. Rate of bleeding is slower for air entrained concrete and premature finishing will result in delamination and blisters.
5. **TEXTURE** the concrete surface as required after floating or troweling. For exterior concrete flatwork—sidewalks, patios, or driveways—texture the concrete surface after floating with a coarse or fine push-broom to give a non-slip surface. A swirl finish is used on some slabs. For interior flatwork texture the concrete surface after final troweling. Concrete can be finished with decorative treatments, such as exposed aggregate, dry shake color, integral color, and stamps or patterns. Decorative finishes need special procedures and experience.
6. **NEVER** sprinkle water or cement on concrete to facilitate finishing. This will cause dusting or scaling.
7. **EDGE** the concrete when required. Spade the concrete to break any bond with the form with a mason’s trowel. Use the edging tool to obtain durable rounded edges.
8. **JOINT** the concrete where required. Joints can be placed before concrete sets using a tool or saw cut after it has hardened. The blade of the jointing tool should be at least $\frac{1}{4}$ the depth of the slab. Use a straight piece of lumber as a guide. A shallow-bit groover should only be used for decorative grooves. Saw-cutting joints should be done as soon as the concrete is hard enough not to be torn by the blade. Early-entry saw cutting can be done before the concrete has completely hardened. See CIP 6.
9. **CURE** the concrete as soon as all finishing is completed to provide proper conditions for hydration of cementitious materials. Curing is essential to achieve the required strength and durability of the concrete surface. In severe conditions causing early drying, slab protection may be needed before finishing is complete. See CIP 11.
10. **AVOID** concrete burns to skin by following proper safety practices. Do not allow fresh concrete to come into contact with skin or eyes. Wear clothing, gloves and boots to protect against burns when working with fresh concrete. When concrete comes into contact with skin or eyes, wash off immediately with clean water.

References

1. *Concrete in Practice (CIP) Series*, National Ready Mixed Concrete Association, Silver Spring, Maryland. www.nrmca.org
2. *Guide for Concrete Floor and Slab Construction*, ACI 302.1R, American Concrete Institute, Farmington Hills, MI. www.concrete.org.
3. *Slabs on Grade*, ACI Concrete Craftsman Series, CCSI, American Concrete Institute, Farmington Hills, MI.
4. *Concrete Floors on Ground*, EB075, Portland Cement Association, Skokie, IL. www.cement.org.
5. *Sealing Effects of Finishing Tools*, Suprenant, B.A., Malish, W.R., Concrete Construction, September 1999. www.concreteconstruction.net.
6. *Finishing Tool Primer*, Kim Basham, Concrete Construction, July 2000.

Follow These Rules to Finish Concrete

1. Place and move concrete to its final location using procedures that avoid segregation.
2. Strike off and obtain an initial level surface without sealing the surface.
3. Wait until the bleed water disappears from the surface before starting finishing operations.
4. Use the appropriate surface texture as required for the application.
5. Avoid steel troweling air-entrained concrete or use appropriate cautions when required.
6. Cure the concrete to ensure it achieves the desired strength and durability.

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