

Guidelines for Durable Driveways, Carports Patios, Walks, Garage Floors

- The Right Concrete Mix
- Placing and Finishing
- Joints Correctly Spaced
- Curing for Durability

"Concrete durability is the ability to resist weathering action, chemical attack, abrasion or any other process of deterioration. Durable concrete will retain its original form, quality and serviceability when exposed to its environment."

For quality concrete around the home, we recommend

1. Planning
2. Preparation
3. Specifications for concrete
4. Placing
5. Finishing
6. Curing, and
7. Extending life of your concrete

1. Planning

- a. Thickness. 4 inches is generally enough, unless heavy trucks will park on it regularly.
- b. Base. Firm, sound subsoil is entirely adequate as a base for residential concrete. There is no need to bring in sand, gravel, or stone unless it is specified or for leveling, drainage, or uniformity.
- c. Reinforcement. Wire mesh is not necessary in residential slabs-on-grade when proper joint spacing and subgrade procedures are followed.
- d. Drainage. Surface of the finished slab should slope a minimum of 1/8 in. per ft. A slope of 1/4 in. per ft. is preferred.

2. Preparation

- a. Excavating. Be sure to take out all organic matter – sludge, leaves, tree roots, wood, etc. Don't dig deeper than you need to.
- b. Compaction. Subsoil on which concrete is to be placed must be compacted uniformly and evenly so the slab won't settle and won't vary in thickness.
- c. Forms. Stake securely. See item 1-d for surface slope. Scrape base away from forms so edges will be at least full thickness, because if edges are thinner, cracks could start at the edge and slowly work their way across the whole slab.
- d. Isolation. Before concrete is delivered, install premolded joint material wherever flatwork comes against buildings, steps, walls, existing slabs, etc. This is so new concrete won't bond to the structures. Joint material must extend all the way to the bottom of the slab.
- e. Moistening. Shortly before placing concrete, wet the forms and the subgrade. Don't make the subgrade so wet that it's muddy. And don't spread plastic under the slab; that forces all the extra water in the concrete to escape through the top and weakens the surface.

3. Specifications for Concrete

- a. Strength: A durable concrete mix design must be a minimum 4000 psi at 28 days.
- b. Air: Air content when placed 6 1/2 % – (5% to 8%)
- c. Slump: Slumps should be 4 in. +/- 1 in. the slump should not exceed 5 in. for durable concrete. Anything more than 6 in. is entirely too wet to use. Slumps greater than 4" will prolong the time you have to wait before finishing, particularly in cool weather.
- d. Aggregates: Use clean, sound aggregates.

4. Placing

- a. Addition of Water: Water should not be added at job site. Adding water dilutes the mixture to less than its designed strength. If it is absolutely necessary to add water to get the desired slump, put it all in at once, then run the mixer at full speed for two full minutes and record amount added.
- b. All concrete should be placed within 90 minutes from the time the truck was loaded. In hot weather the purchaser should shorten the time limit to maintain durable concrete. Prolonged mixing time or waiting time on the job cart result in a loss of air content and/or slump.
- c. Filling the Forms: Chute, wheel or shovel concrete directly to its final position. Don't dump it in piles and then flow, drag or rake it the rest of the way.
- d. Leveling: Screed (strike-off) twice to level the surface. Immediately use wood or mag bullfloat to take out small high and low spots. Then, stop everything on that portion of the slab until bleed water (water sheen) disappears from the surface.
- e. Finishing operations should not be performed when there is excess moisture or bleed water on the surface. No adding of water or cement to the concrete surface to assist in finishing.

5. Finishing

- a. Steel troweling of the concrete surface is not recommended.
- b. When to finish: Immediately after all the bleed water is gone is the proper time to (1) broom OR float surface; (2) if hand tooled, cut control joints while concrete is still plastic and (3) edge.
- c. Final Finis: A broom finish is recommended particularly on driveways, walks, etc. Where a smooth finish is desired (garage floors, patios, etc.) a wood hand float finish should be used. Machine floating and/or troweling is not recommended.
- d. Joints: Control joints may be hand tooled or sawed (sawing is recommended). In either method, they must be cut to a depth of at least 1/4 the thickness of the slab and spaced so that the dimension in either direction does not exceed that shown in the following table.

Slump 4 in. to 6 in.		
Slab thickness, in.	Maximum-size aggregate less than 3/4 in.	Maximum-size aggregate 3/4 in. and larger
4	8	10
5	10	13

This means that, in addition to transverse jointing, a joint must be cut down the center for the full length of a driveway that is 12' wide and 4" thick, or for one that is 16' wide and 6" thick.

Joints usually are at much shorter intervals in public sidewalks. Most common spacing is 5 ft. Local codes or ordinances govern. Joints must be straight and continuous; not staggered or offset.

When control joints are sawed, this should be done after all other finishing and curing applications are complete and as soon as the concrete has hardened sufficiently to permit sawing without raveling. Under normal conditions, joints should be sawed in 6 to 24 hours.

- e. Caution: Do not overwork or over finish the surface of any exposed concrete slab. Not only is it time consuming and expensive but tends to bring too much fine material to the surface and weaken it. Never use a steel trowel on concrete exposed to weather. These practices could result in spalling or scaling.

6. Curing

- a. Need for Curing: Curing is one of the most important steps in concrete construction and, regrettably, one of the most neglected. Effective curing is absolutely essential for surface durability. Fresh concrete must be kept warm and moist until the mixing water combines chemically with the cement (hydration). That's what hardens the concrete and gives it its strength. Without proper curing the, 4000 psi concrete may not reach 2000 psi in 28 days.

- b. Curing in Warm Weather: Using a curing compound applied according to the manufacturer recommendations. In very hot weather, a white pigmented liquid membrane curing compound is best because it keeps the surface up to 40° F cooler and avoids excess evaporation.
- c. Curing In Cold Weather: It is absolutely essential that fresh concrete be kept from freezing for at least the first week after it is placed. In cold weather, membrane curing may not keep the concrete warm enough. A better way is to spread a thick layer of straw over it and then cover that with a plastic sheet (black preferred to retain heat).
- d. What Not to Use: Avoid any curing procedure that lets the surface dry in a short time. Quick drying stops the hardening process thus making a weak surface that is likely to scale.
- e. Drying: Newly placed outdoor concrete not only needs time to cure, but it also needs time to dry in warm air. Concrete placed early enough in the season so that it has one month of temperature above 40° F for curing and still another month for drying out before freezes are expected (certainly before deicers are applied) has a decided advantage over concrete that has not dried out when cold weather begins.

7. Items to Consider Extending the Life of Your Concrete

- a. Wait – to drive on your concrete for 7 days.
- b. Protect – your new concrete from drain water so it cannot undermine the slab and cause settlement cracks.
- c. First Winter: Be advised not to use salt or other deicers during the first winter, especially if concrete was placed after September 15th and was not sealed. Suggest the use of sand instead.
- d. Safe Use of Deicers: Deicers containing salt/or calcium chloride should be generally safe for use on a quality concrete pavement after the first winter. Never use any deicer that contains either ammonium sulphate or ammonium nitrate. Anyone who buys a deicer under a brand name should read the label to see what it contains.

- e. Sealers: Water-repellent coatings and sealers can help reduce damage from freeze/thaw cycles and salting. They keep water from getting into the surface pores. Some of them will cause some darkening of the slab. Newly cured concrete should have its period of air-drying before being sealed. Most sealer applications are effective for about a two-year period.

- f. The Value of your concrete in place far exceeds the cost of sealing. It is highly recommended that you make this small investment to help provide the durability you expect and to maintain a relatively blemish free surface throughout the driveway's service life.



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