

1. Planning

- a.) **Thickness.** 3 1/2 to 4 inches is generally enough. Unless heavy trucks will park on it regularly, a thicker pavement is a waste of material.
- b.) **Base.** Firm, sound subsoil is generally adequate. Sand, gravel or stone base assists in providing uniformity and drainage, if deemed necessary or desirable. Never use cinders under a slab.
- c.) **Reinforcement.** Wire mesh is not necessary in residential slabs on grade.
- d.) **Drainage.** Always slope outside slabs for positive drainage. Make sure no water runs toward the house, unless special drains are incorporated to intercept such flow. The surface of the base should generally parallel the final slab slope. A minimum slope of slab should be 1/8 inch drop per foot.

2. Preparation

- a.) **Excavating.** Be sure to take out all organic matter - grass, leaves, tree roots, wood, etc.
- b.) **Compaction.** Subsoil, (and other base if used) 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 slopes. Scrape base away from forms so edges will be at least full thickness, because if edges are thinner, cracks could develop due to differential thickness. If you decide on a 3 1/2 inch pavement, you can form it with 2 x 4 lumber.
- 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 or other base. Don't over wet to create a muddy condition.

- f.) **Special Features.** If plastic is used directly under the slab (to prevent vapors when bonded floor coverings are to used, or to help in radon control), it should be understood that all water must exit through the top of the slab and finishing operations and timing can be affected.

Never place a slab on frozen soil or base material.

3. Specifications for Concrete

- a.) **Strength.** A high quality mix should be used. A minimum 4000 psi performance mix should be used for concrete subjected to freeze thaw conditions. Strong consideration should be given to added value prescription mixes, specially designed to provide added insurance against scaling and other objectionable defects. Water reducers, set retarders in hot weather, accelerators in cold weather and other aids to mix setting and timely finishing should be discussed and decided upon between contractor and ready mix producer.

- b.) **Slump and Water Content.** A controlled water-cement ratio is more important than slump. A 5 to 6 inch slump is usually desired by the finisher for hand finishing. Water reducers and cementitious material contents should be used to maintain a water to cementitious content of 0.5 or less in all cases. For outside concrete slabs, a water to cementitious content of 0.45, or less, is recommended.

- c.) **Air.** Total amount of entrained air for outside concrete slabs should be 6 to 8%. Slabs never subjected to freeze thaw conditions may be constructed with air entrained or non air entrained concrete at the contractor's option.

4. Placing

- a.) **Tests.** Standard tests generally are not made at the job site on residential work. It is strongly recommended however that air content be checked by someone (plant or job site) to reasonably provide control of this important property for slabs to be subjected to freeze thaw conditions.

- b.) **Addition of Water.** Water should not be added at the jobsite, unless absolutely necessary in preventing unwork-

able concrete. Water additions can alter air contents as well as reducing durability and strength by diluting the cement content. If water is added to the truck at the job site, such additions should be recorded on the trip ticket and the concrete should be remixed approximately 30 revolutions of the truck mixer before discharge.

- c.) **Filling the Forms.** Chute, wheel, or shovel concrete directly into 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 surface.

5. Finishing

- a.) **When to Finish.** Immediately after all the bleed water is gone is the proper time to (1) broom OR float surface ONCE; (2) if hand tooled, cut control joints while concrete is still plastic and (3) edge.

- b.) **Final Finish.** 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.

- c.) **Joints.** Control joints may be hand tooled, sawed or formed by use of inserts. When grooved or sawed, joints must be cut to a depth of at least 1/4 the thickness of the slab. Control joints should be spaced so that the dimension in either direction does not exceed that shown in the following table.

THICKNESS OF SLAB	LONGEST SPACE BETWEEN JOINTS
3 1/2 in.	8 ft.
4 in.	10 ft.
5 in or more	12 ft.

This means that, in addition to lateral jointing, a joint must be cut down the center for the full length of a driveway that is 12" wide and 3 1/2" 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 or-

distances 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 application are complete and as soon as the concrete has hardened sufficiently to permit sawing without raveling.

d.) **Caution.** Do not overwork or overfinish 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.

Also, under certain conditions of humidity, temperatures and/or windy conditions, plastic shrinkage cracks at the surface of the slab will occur. It is highly recommended that contractors maintain a supply of evaporation retardant readily available at the job site when needed. Manufacturers recommendations should be followed in their use.

e.) **Curing.** Apply curing as soon after brooming and edging as it can be done without eroding the surface. See next section.

6. Curing

a.) **Need for Curing.** Curing is one of the most important steps in quality concrete construction and 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). Without curing, the strength of the concrete (where it is needed the most) is basically reduced in half. A 4000 psi mix becomes a 2000 psi mix at the surface with no curing.

b.) **Curing in Warm Weather.** Curing can be accomplished in a number of ways, but the simplest, most economical and widely used method is a liquid membrane which is sprayed on the surface of a slab as soon as possible after finishing. This curing compound should be applied at a rate not thinner than manufacturer's recommendations. For example, the manufacturer may specify a coverage of not more than 200 square feet per gallon (that's twice as thick as you would apply most house paints).

c.) **Curing in Cold Weather.** It is absolutely essential that fresh concrete be kept from freezing after placing.

Usually protection up to one week is essential. To assist in curing and protection from freezing it is desirable to cover slabs with insulated blankets or straw cover with a plastic sheet.

d.) **What Not to Use.** Avoid any curing compound 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 hard freezes are expected (certainly before deicers are applied) has a decided advantage over concrete that has not dried out when cold weather begins.

7. Tips to Owners

a.) **First Winter.** An owner should be advised not to use salt or other deicers during the first winter, especially if concrete is placed after September 15th and is not sealed with a penetrating sealer. It is suggested that sand be used instead.

b.) **Safe Use of Deicers.** Deicers containing salt and/or calcium chloride should generally be 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.

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

d.) **Fertilizers.** Certain lawn fertilizers will chemically attack concrete. Care should be taken to avoid their contact with concrete. Pelletized fertilizers should be swept from concrete slabs before dissolving. Don't use fertilizer for deicing purposes.

GUIDELINES

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