

# REPORTER

## Butterfield reviews the basics of concrete in a residential setting

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**R**esidential projects almost always use concrete made from Portland Type I Cement mixed with coarse aggregate (gravel), fine aggregate (sand) and water – admixtures are added to achieve special purposes. It is either batch mixed at the plant or transit mixed in a truck that delivers the material to the site. When hardened in the intended form at the jobsite, it is referred to as “cast-in-place” concrete.

Concrete is ordered from the batching plant in increments of cubic yards. Generally, a mixer truckload carries 9 cubic yards. Any order for less than 5 cubic yards will likely incur a premium charge.

The person placing the order specifies the desired strength in P.S.I.s (pounds per square inch in compressive strength). Material to be used for conventional footings might have the requirement to have as little as 2,500 P.S.I., which

would be a weak mix. By contrast, a structural suspended slab reinforced with rebars and bearing on edges, (possibly with intermediate columns depending on the length of the span) might require a stronger mix of 6,000 P.S.I. or more. For flat work, the lower strength concrete mix is difficult to finish to a fine surface, as there isn't much cement in the mix that can be worked to the surface. Often a stronger mix containing more cement is used for flat work. Finishers will often “bootleg” calcium chloride into the mix when no one is watching the mixer truck. The addition of “car”, as it is called on the job, causes the moisture to be absorbed by the calcium chloride so the mix sets up quicker, allowing less time between floating and final troweling, thus a faster rate of hydration. Another reason for adding “cal” is that it slightly lowers the freezing temperature of the mix for cold weather concreting. There

are serious side effects to this practice. The most disastrous effect is corrosion of the reinforcement and other imbedded items, ultimately causing spalling and other types of failures. For these reasons engineer/architect supervised projects do not allow the addition of “car” to the mix. Most significant jobs that have specifications will have wording in the specifications that state “No calcium chloride or other admixture shall be used except as approved in writing by the Architect or Engineer.” It is rare, however, for a residential project to have strict specifications; therefore, this basic restriction will generally not be observed in residential projects.

One admixture (an additive to the mix) that is commonly used, especially in exterior flat work (driveways, walks, patios, stoops, curbs, gutters) is an Air Entraining Admixture. It increases resistance

to the freeze-thaw cycle disintegration of the completed surfaces and offers some protection from salts and other chemicals in the future. It has little effect on the ultimate strength and the cost per cubic yard is nominal.

Proper mixing of the concrete is critical to future proper performance in attaining the desired strength. The number of turns of the drum of the transit mix truck, the temperature of the mix, the wetness of the aggregates prior to adding the water are all important factors and are taken into account by the batching plant.

Most important is the quantity of water added to make the mix plastic. Again, where a job is being observed by an inspector, a slump test is usually performed on a sample taken from the mix. Where the test indicates a slump greater than allowed by the Specifications of the job, the batch may be rejected and the truck sent back – cost of load being borne by the supplier or the person that directed the quantity of water to be used.

Slab-on-grade concrete work (basement slabs, walks, driveways and patios) should always be poured on a polyethylene vapor barrier to prevent the water in the mix from being absorbed out of the mix by the drier earth or gravel base. If water is “pulled” out by contact with dry earth or a gravel base, the desired strength will not be achieved and most likely the surface will show shrinkage cracks from the quick loss of water from the mix.

Slabs-on-grade are usually “reinforced” by the placement of welded wire fabric, called “wire mesh.” This does not make the slab stronger. It does keep the concrete “together” should cracks

develop. When cracks develop, the surfaces on either side of the crack will remain on the same plane. Unless otherwise required, this wire mesh should be at the center of the thickness of the slab. For this to happen, the wire mesh must be supported at the proper height. As a poor substitution for supports, the mesh may be lifted during placement of concrete, but this procedure lacks accuracy. If not supported or lifted, the mesh will be at the bottom surface of the slab, next to the poly and will not be effective.

### **Concrete glossary - residential construction**

**Aggregate, coarse:** Gravel used in concrete for strength and as fill. Usually limited to 1" diameter in size.

**Aggregate, fine:** Sand, sharp and free of contaminants

**Bag:** Refers to bag of Portland Cement per cubic yard. Each bag weighs 94 lbs.

**Broom finish:** After troweling is completed, a damp push broom is lightly dragged across the surface to avoid a high-sheen finish.

**Cal - calcium chloride:** Sometimes added to a batch of concrete as it is being mixed, to hasten the hardening process of concrete and/or to lower the freezing temperature.

**Cement:** A powdered substance made of burned lime and clay. The bonding ingredient of concrete and mortar.

**Concrete pump:** A motorized pump, usually truck mounted, to convey concrete in its plastic state from one area to another by means of a pipe. Specially designed mixes must be used when concrete is to be pumped.

**Expansion joint:** A space between two materials filled with a materi-

al designed to allow expansion and/or contraction and to isolate the two materials to prevent them from chemically bonding.

**Finisher:** A worker skilled in placing and finishing concrete.

**Float:** To manipulate the surface of freshly poured concrete with a flat tool to cause the large aggregate to settle and the fine aggregate and cement to rise to the surface.

**Georgia buggy:** A type of wheelbarrow used to carry concrete.

**Rebars:** Steel reinforcing bars (shaped like rods) of varying diameters measured in increments of 1/8", poured in the concrete to strengthen the concrete. Bars of 3/8" diameter or larger have deformations on the surface to increase friction and bonding.

**Slump test:** Performed at jobsite on a small sample of concrete in the plastic state to determine the water content of the mix.

**Strength, compressive strength:** Measured in P.S.I.s (pounds per square inch) as determined by the highest pressure achieved prior to failure of a test cylinder. Tests are done off site by certified labs, at 7, 14 and 28 days.

**Trowel:** A steel hand tool used to smooth the surface of hardening concrete. Troweling machines can be used on larger projects.

**Trowel finish (also steel trowel finish):** Concrete surface finished to produce a smooth surface with a sheen.

**Vapor barrier:** A non-permeable, flexible material used to keep freshly poured concrete from coming in direct contact with the earth.

**Water:** Used in mixing the materi-

als into a plastic state. Must be clean and free of acids, alkalis, minerals or organic contaminants. In cold weather, may be heated before mixing.

**Wire mesh (correctly named welded wire fabric):** Strands of wire of various gauges, woven to provide 6" x 6" openings. Smaller gauges of wire are delivered in rolls. Larger gauges are delivered in flat sections often called "mats."

**Yard (cubic yard):** A unit of measurement for batching concrete. One cubic yard measures 3' x 3' x 3' = 27 cubic feet = 1 cubic yard. One cubic yard of concrete weighs about 3,900 lbs. ■

**Author's background:** Before becoming a home inspector in 1972, James R. Butterfield worked as a project manager for homes and commercial buildings in the Washington, DC area. He's participated in the MAC- ASHI Chapter and has published construction-related articles. He invites comments: [jandb56@aol.com](mailto:jandb56@aol.com)

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