curing

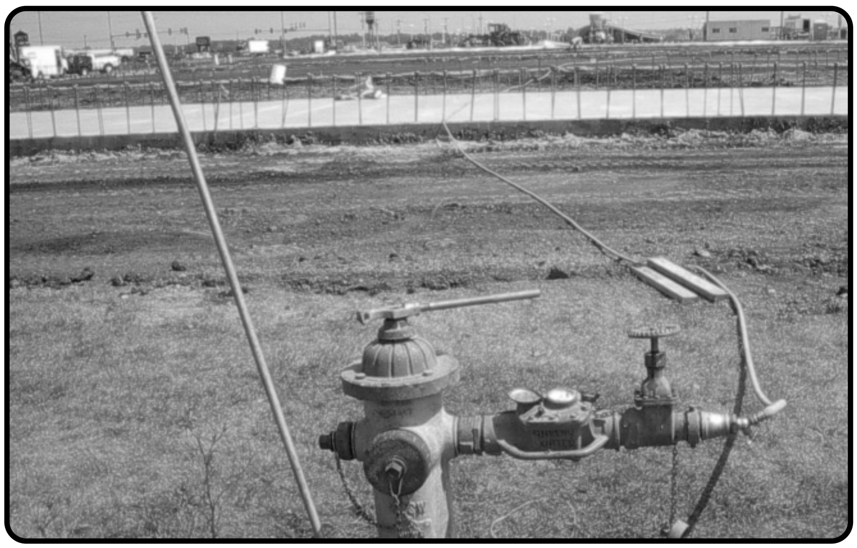
Definition

Curing is maintaining, an adequate moisture AND temperature, in concrete at early ages so that it can develop properties the mixture was designed to achieve. Curing begins immediately after placement and finishing so that the concrete may develop the desired strength and durability. Without an adequate supply of moisture, the concrete will dry out and not achieve its potential properties. Proper curing temperatures should be maintained (generally above 50°F) for an adequate rate of strength gain, and to avoid possible thermal cracking. Curing procedures are of particular interest in central Iowa because of effect it might have on aggravating ASR occurrence. Less expensive curing methods are often not an option because of increased popouts when cured by these methods.

Why Cure Concrete?

Several important reasons are:

■ Predictable strength gain. Concrete left to cure in a dry environment will lose as much as 50% of its potential strength when compared to similar concrete cured in a moist environment. Concrete placed in high temperatures will gain early strength quickly, but later strengths may be reduced. Concrete cured in cold temperatures will take longer develop strength, and may delay subsequent construction.



Waterline to soaker hoses on newly placed concrete

■ Improved durability. Well-cured concrete has better surface hardness, and will better stand surface wear and abrasion. Curing also makes concrete more watertight.

■ Better serviceability and appearance. A concrete slab that has been allowed to dry out too early will have a soft surface with poor resistance to wear and abrasion. Proper curing reduces crazing, dusting, and scaling.

How to Properly Cure Concrete

Concrete should be protected from losing moisture until final finishing, using suitable methods like wind breaks, fogger sprays, or misters to avoid plastic shrinkage cracking. After final finishing, the concrete surface must be kept continuously wet or sealed to prevent evaporation for a period of at least several days.

Systems to keep concrete wet include:

■ Burlap, cotton mats, rugs, etc., used with soaker hose or sprinkler. Do not allow covering to dry out. The edges should be lapped and weighted down so they are not blown away.

■ Straw that is sprinkled with water regularly. Layer should be not less than six inches thick and covered with a tarp. Take measures so straw will not blow away.

■ Damp earth, sand, or sawdust can be used on flatwork. There should be no organics or iron-staining contaminants in the materials used.

■ Sprinklers are acceptable, as long as temperatures remain above freezing. Do not allow the concrete to dry out between soakings, however.

■ Ponding of water is an excellent method of curing. The water should be no more than 11°F cooler than the concrete.

Moisture retaining materials include:

■ Liquid membrane-forming curing compounds. Curing compound must meet ASTM C309. Apply to concrete about one hour after finishing. Do not apply to concrete that is still bleeding, or has visible water at the surface. On smooth-troweled finished floors, will aggravate ASR problem.

■ Plastic sheets. Must be at least 4 mils thick, preferably reinforced with fiberglass. Plastic should be laid in direct contact with the concrete, as soon as possible, without marring the surface. The edges should be weighted down and fastened with waterproof tape. Make sure wind does not get under the plastic. Will make a dark spot when plastic raises up off the surface. Aggravates ASR problem as bad as curing compounds.

■ Waterproof paper. Used like plastic sheeting, but does not mar the surface

Note: Evaporation retarders are not curing agents. They should only be used on concrete in the plastic state, while there is moisture at the surface of the slab. Not recommended for use as finishing aid.

Control of temperature

In cold weather, do not allow concrete to cool faster than a rate of 5°F per hour for the first 24 hours. Concrete should be protected from freezing till it reaches a compressive strength of at least 500 psi. Cure methods that retain moisture, rather than wet curing, should be used when freezing temperatures are anticipated. Guard against rapid temperature changes after removing protective measures.

In hot weather, higher initial curing temperatures will result in rapid strength gain and lower ultimate strengths (see cold weather concreting). Water curing and sprinkling can be used to achieve lower curing temperatures in summer. Day and night temperature extremes that allow for faster cooling than 5°F per hour during the first 24 hour, should be protected against (see hot weather concreting).

References

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