General Concrete Curing:

Curing can be described as keeping the concrete moist and warm enough so that the hydration of cement can continue. More elaborately, it can be described as the process of maintaining satisfactory moisture content and a favorable temperature in concrete during the period immediately following placement, so that the hydration of the cement may continue until the desired properties are developed to a sufficient degree to meet the service requirement.

If curing is neglected in the early period of hydration, the quality of concrete will experience a sort of irreparable loss. An efficient curing in the early period of hydration can be compared to a good and wholesome feeding given to a newborn baby.

Curing VS Drying:

Concrete Curing: The chemical reaction of water with the silicate and aluminate materials in the cement.
*"Curing is providing adequate moisture, temperature and time to allow concrete to achieve the desired properties…for a time typically ranging from **3 – 14** days."* – ***Portland Cement Association***

Concrete Drying: Evaporation at the top surface, during a planned drying period following curing.
"Drying is providing the proper conditions to allow concrete to achieve a moisture condition appropriate for it's intended use, [especially] for application of moisture sensitive flooring…typically for 28 days." – ***Portland Cement Association***

Methods of Curing Concrete:

Concrete Curing:

- **Water cure:**
  The concrete is flooded, ponded, or mist sprayed. This is the most effective curing method for preventing mix water evaporation. Make sure you allow proper time for water curing.
- **Water retaining methods:**
  Use coverings such as sand, canvas, burlap, or straw that is kept continuously wet. The material used must be kept damp during the curing period.
- **Waterproof paper or plastic film seal:**
  Are applied as soon as the concrete is hard enough to resist surface damage. Plastic films may cause discoloration of the concrete-do not apply to concrete where appearance is important.

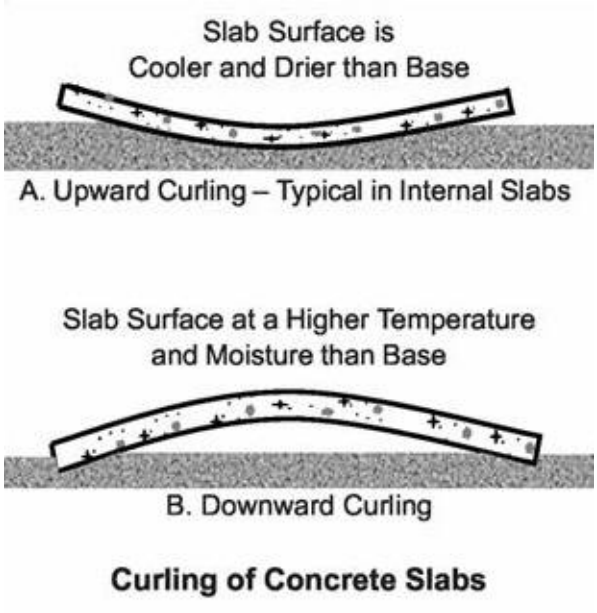
In all but the least critical applications, care must be taken to properly cure concrete, to achieve best strength and hardness. This happens after the concrete has been placed. Cement requires a moist, controlled environment to gain strength and harden fully.

Hydration and hardening of concrete during the first three days is critical. During this initial hydration period, the concrete must be kept under a controlled temperature and humid atmosphere. In practice, spraying or ponding the concrete surface with water, thereby protecting the concrete mass from any ill effects of ambient conditions, achieves this.

Abnormally fast drying and shrinkage due to factors such as evaporation from wind during placement may lead to increased tensile stresses at a time when it has not yet gained sufficient strength, resulting in greater shrinkage cracking and the possibility of slab-curling.

"Slab-Curling":

Concrete slabs curl due to the effects of temperature variation between opposing surfaces of the slab. Concrete slabs may curl when the top surface of the slab is cooler than the bottom surface. The cool surface shortens due to thermal shrinkage, which may deform the perimeter of the slab section upward as the temperature of the bottom surface of the slab stays at a higher temperature. On the other hand, the top surface will expand when it is heated (such as with intense sunlight), which may relax curling or cause reverse curling. Reverse curling is when the concrete slab deforms downward instead of upward.



Curling of Concrete Slabs

Shrinkage Cracking:

When concrete is mixed, more water than is needed for hydration is mixed with the dry components, such as sand, cement and an aggregate. Most of the water will eventually evaporate, causing shrinkage of the concrete slab.

Since water evaporates from the surface, which is exposed to air, at a rate different from the underlying concrete, The hot, expanding underlying concrete acts as a restraint to shrinkage of the cooling, shrinking surface concrete. this differential shrinkage rate produces tensile stresses, which are relieved by cracking of concrete near the surface.

Concrete Cure Times:

- Concrete curing: One inch per each inch of the overall thickness per month.
- LEED Qualified Concrete curing with added fly ash or slag: 1" per inch of concrete per 2 months or 56 days per inch for this LEED concrete.
  4" slab: ~224 days;
  6" slab: ~336 days