Concrete Slab Drying Shrinkage Cracking

What is it, why does it occur, and how can the potential be minimized?



What is concrete slab drying shrinkage cracking?

When concrete is placed, it typically contains more water than is required to hydrate the cementitious materials the mixture contains. This excess water, or water of convenience, is for workability and placement purposes. Much of this excess water begins to exit the concrete during placement/curing and more will continue to leave as the concrete dries over time. **The water leaving is what causes the concrete to shrink.**

While the concrete shrinks, it is simultaneously restrained by many things such as reinforcement and subgrade. This restraint creates tensile stresses in the concrete slab which in turn may produce **drying shrinkage cracking.** Concrete slab drying shrinkage cracking can be the unfortunate end result of a combination of factors related to:

- material choices
- construction planning
- placement
- curing periods

Knowledge of these types of contributing factors is half the battle.

Why does concrete slab drying shrinkage cracking occur?

There are numerous factors that may cause the phenomenon of slab drying shrinkage. The contributing factors include, but are not limited to:

- Use of wrong concrete mixture design
- Excess water in lieu of the mixture design requirements
- Excess water added on the jobsite
- Improper subgrade preparation (compaction, moisture content, etc.)
- Rapid evaporation of moisture from the slab during placement and curing
- Improper use of reinforcement
- Lack of or improper placement of control joints
- Insufficient timing of saw cuts
- Insufficient saw cut depth
- Improper finishing techniques
- Lack of curing or improper curing techniques



The cutting of the control joint

The way to reduce the amount or frequency of concrete slabs that exhibit drying shrinkage cracking is to **review and implement techniques for proper concrete placement.**

How to prevent drying shrinkage?

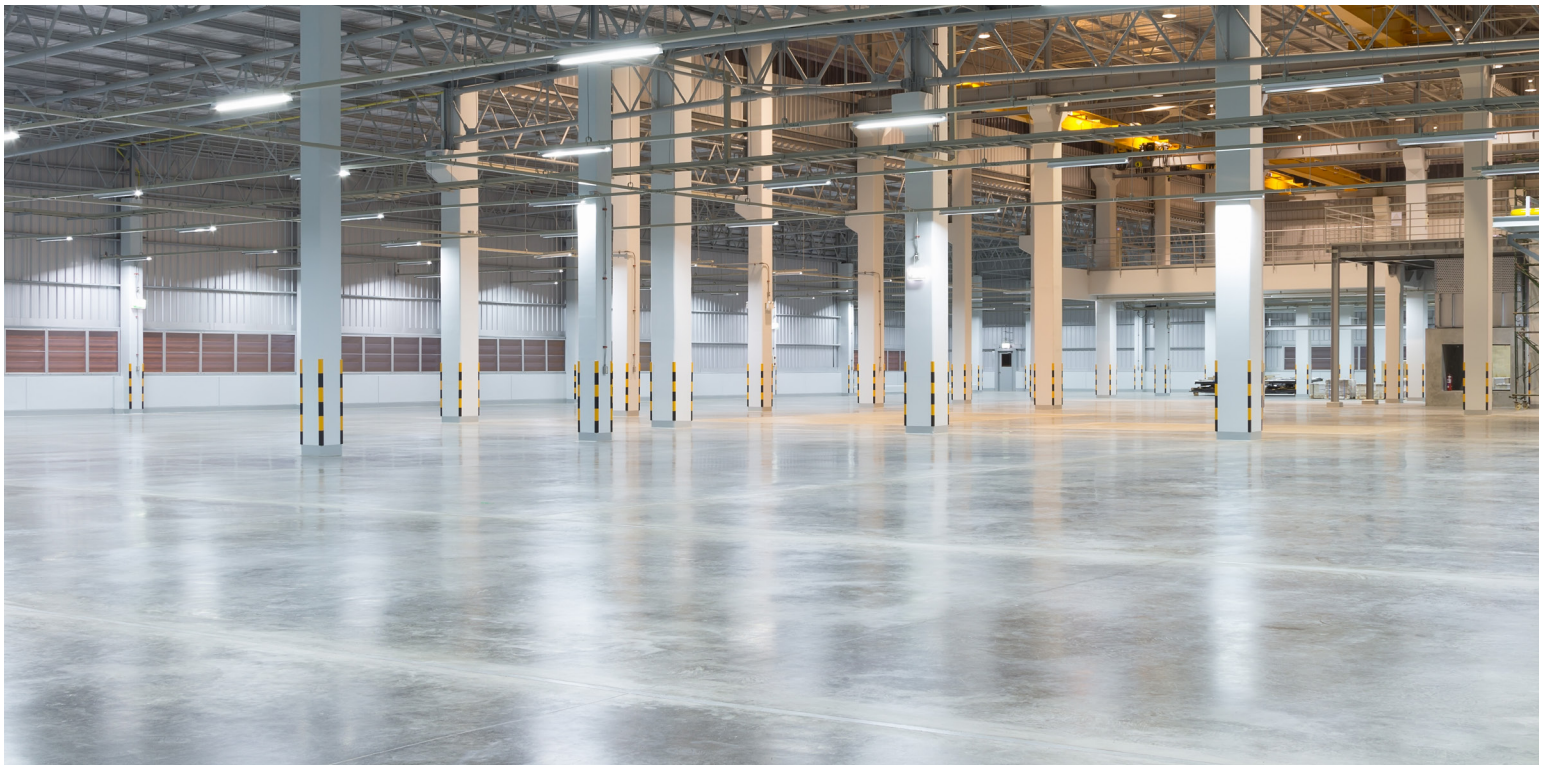
Some of the common practices that should be reviewed before, during and after concrete placement are:

- **Check for predicted extreme temperature variances** during the first 24 hours of expected placement.
- **Ensure the mixture is using the lowest water content for workability/performance purposes.** Excessive water in the mixture may contribute to the possibility of shrinkage.
- **Ensure the maximum size of coarse aggregate is being used.** This will help to minimize the water used in the mix.
- **Ensure the contractor is familiar with the finishing techniques** for the cementitious materials in the mixture. Cementitious materials may increase or decrease the rate of bleed water migration to the surface. This, in turn, may shorten or lengthen the window of time for ease of finish-ability.
- **Review the plans for the subgrade preparation.** The subgrade should be properly compacted at the required moisture content. This preparation will ensure the subgrade will be able to uniformly support the slab as well as not draw moisture from the slab during placement.

- **Review the proper slab thickness and joint spacing as well as methods for installation of the joints.** The review should also include a discussion of the need and design for any vapor or friction barrier materials.
- **Have a plan in place for curing the concrete** for the specified period. This curing plan should include steps for both initial curing of the concrete during placement while in a plastic state as well as after the concrete has hardened.
- **Research *chemical admixtures*** that may help to reduce the amount of drying shrinkage. Please consult your local sales representative for information on those products.
- **Research *synthetic fibers*** that may help control the extent of early drying shrinkage cracks. Please consult your local fiber representative for information on those products.

Other useful resources on drying shrinkage include:

- The American Concrete Institute (concrete.org)
- The Portland Cement Association (cement.org)
- The American Society of Concrete Contractors (ascconline.org)
- The National Ready Mixed Concrete Association (nrmca.org)



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