

TECHNICAL TOPIC:

Plastic Shrinkage Cracks

BOTTOMLINE:

Plastic shrinkage cracks are cracks in the surface of concrete, usually flat-work, that appear before the concrete actually achieves "final set". Perhaps more appropriately stated: they form while the concrete is still "plastic". They are relatively short in length, often parallel, and do not extend throughout the depth of the slab nor do they extend from edge to edge.

Plastic shrinkage cracks are simply the result of moisture loss from the surface of the concrete while the concrete is still plastic and before it has hardened and attained strength. Most causal descriptions use the appropriate wording "rapid moisture loss". From a practical viewpoint, the moisture loss at the surface, caused by evaporation, is occurring at a greater rate than the rising bleed-water, from within the body of the concrete, can replace that evaporated surface moisture. This causes the surface of the concrete to shrink more than the "body" of the concrete.

The Portland Cement Association, IS177T, further describes this action by stating..... "as the interior concrete restrains shrinkage of the concrete, stresses develop that exceed the concrete's tensile strength, resulting in surface cracks...they are of varying lengths, spaced from a few inches up to 10 feet apart, and often penetrate to mid depth of the a slab".

Factors that affect the rate of moisture loss and increase the risk of plastic shrinkage cracks are:

- Low humidity
- Wind
- High concrete temperature
- Moderate to high air temperature
- Concentrated artificial heat, or concentrated ambient air from fans

The National Association of Home Builders in their Residential Concrete publication adds the following "Plastic shrinkage cracks are more likely to form in hot, dry, windy weather. However, they may occur in cool weather if evaporation is very rapid. Very warm concrete in cold surrounding air may cause evaporation and plastic shrinkage cracks."

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The American Concrete Institute in their document *ACI 305, Hot Weather Concreting*, provides a chart to estimate the rate of evaporation. It is based on wind speed, humidity and temperature. The chart indicates when special concreting precautions may be required.

To reduce the possibility of plastic shrinkage cracks when adverse conditions exist:

- Slow evaporation is recommended.
- Dampen forms and subgrade prior to concrete placement
- Erect windscreens to reduce surface wind
- Use fog spraying in the air directly above the surface to increase humidity.
- Avoid high concrete temperatures in cold weather and cool the concrete in hot weather.
- Begin to cure the concrete immediately after finishing or before finishing by covering the concrete with damp burlap or plastic sheeting
- Use an evaporative retardant on the surface. Applied by spray behind the screeding operation and following floating or troweling, as needed, until curing is started.
- Consider the use of synthetic fibers (ASTM C1116)

Finally, if plastic shrinkage cracks begin to form, tamp the concrete on both sides of the crack with a float to close the crack together, then refloat. Remembering though, if rapid evaporation hasn't been brought under control, this may be a futile effort.

