



CONCRETE IN PRACTICE

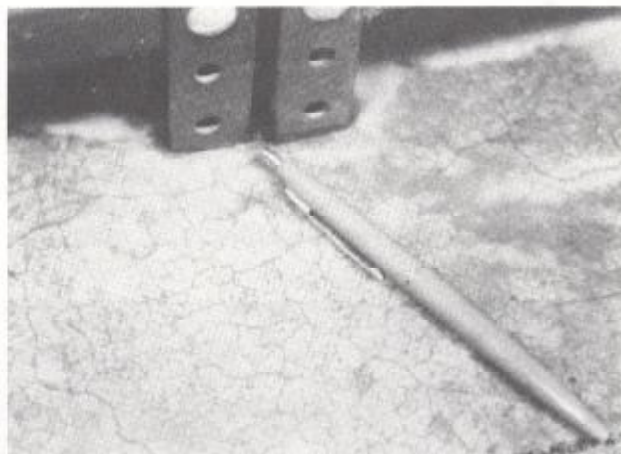
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What, Why and How? Crazing Concrete Surfaces

WHAT Is Crazing?

Crazing is the development of a network of fine random cracks or fissures on the surface of concrete or mortar caused by shrinkage of the surface layer. These cracks are rarely more than $\frac{1}{8}$ inch deep and are more noticeable on steel-troweled surfaces. The irregular hexagonal areas enclosed by the cracks are typically no more than $1\frac{1}{2}$ inch across and may be as small as $\frac{1}{2}$ or $\frac{3}{8}$ inch in unusual instances. Generally, craze cracks develop at an early age and are apparent the day after placement or at least by the end of the first week. Often they are not readily visible until the surface has been wetted and it is beginning to dry out.

Crazing cracks are sometimes referred to as shallow map or pattern cracking. They do not affect the structural integrity of concrete and rarely do they affect durability or wear resistance. However, crazed surfaces can be unsightly. They are particularly conspicuous and unsightly on concrete which contains calcium chloride.



Crazing Concrete Surface (Dampened)

WHY do Concrete Surfaces Craze?

Concrete surface crazing usually occurs because one or more of the rules of "good concrete practice" were not followed. The most frequent violations are:

- a. Poor or inadequate curing. Intermittent

wet curing and drying or even the delayed application of curing will permit rapid drying of the surface and provoke crazing.

b. Too wet a mix, excessive floating, the use of a jitterbug or any other procedures which will depress the coarse aggregate and produce an excessive concentration of cement paste and fines at the surface.

c. Finishing while there is bleed water on the surface or the use of a steel trowel at a time when the smooth surface of the trowel brings up too much water and cement fines. Use of a bullfloat or darby while bleed water is on the surface will produce a high water-cement ratio weak surface layer which will be susceptible to crazing, dusting and other defects.

d. Sprinkling cement on the surface to dry up the bleed water is a frequent cause of crazing surfaces. This concentrates fines on the surface.

e. Occasionally carbonation of the surface causes crazing. Carbonation is a chemical reaction between cement and carbon dioxide or carbon monoxide from unvented heaters. In such instances the surface will be soft and will dust as well.

tion of cement with water. This chemical reaction between cement and water is called hydration.

b. Use moderate slump (3 to 5 inches), air entrained concrete. Higher slump (up to 6 or 7 inches) can be used providing the mixture is designed to produce the required strength without excessive bleeding and/or segregation. Air entrainment helps to reduce the rate of bleeding of fresh concrete and thereby reduces the chance of crazing.

c. *NEVER* sprinkle or trowel dry cement or a mixture of cement and fine sand into the surface of the plastic concrete to absorb bleed water. Remove bleed water by dragging a garden hose across the surface. *DO NOT* perform any finishing operation while bleed water is present on the surface.

d. Dampen the subgrade prior to concrete placement to prevent it absorbing too much water from the concrete. If an impervious membrane, such as polyethylene, is required on the subgrade cover it with 1 to 2 inches of damp sand to reduce bleeding.

HOW to Prevent Crazing

a. To prevent crazing start curing the concrete as soon as possible. The surface should be kept wet by either flooding the surface with water or, covering the surface with damp burlap and keeping it continuously moist for a minimum of 3 days or, spraying the surface with a liquid membrane curing compound. Curing retains the moisture required for proper combina-

References

1. "Guide for Concrete Floor and Slab Construction," ACI 302.1, Manual of Concrete Practice.
2. "Slab Construction Practices Compared by Wear Tests," by L. Blake Fentress, ACI Journal, July, 1973.
3. "Concrete Slab Surface Defects: Causes, Prevention, Repair," Portland Cement Association (IS 177 T).
4. "Solutions to the Problems of Scaling, Crazing, Dusting of Concrete Slabs," Modern Concrete, November, 1963.

Follow These Rules to Prevent Crazing

1. Use moderate slump (3-5 inch) air entrained concrete.
2. Finish properly:
 - a. Remove bleed water before performing any finishing operations. *DO NOT* dust any cement onto the surface to absorb bleed water.
 - b. Avoid excessive manipulation of the surface, which can depress the coarse aggregate, increase the cement paste at the surface, and increase the water-cement ratio at the surface.
 - c. Delay steel troweling until water sheen has disappeared from the surface.
3. Cure properly as soon as finishing has been completed.



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