Concrete Atlantic béton Atlantique

Concrete Tech-Tip #20

Crazing

What is Crazing?

Crazing refers to the formation of a network of very fine, randomly oriented surface cracks in concrete or mortar resulting from shrinkage of the surface layer. These cracks are typically shallow, rarely extending more than about 3 mm deep, and are most noticeable on steel troweled surfaces. The cracks form irregular hexagonal patterns, usually no greater than about 40 mm across, although in rare cases they may be as small as 12 to 20 mm.

Crazing generally develops at an early age and is often visible within a day of placement or by the end of the first week. In many cases, the cracks are difficult to see until the surface becomes wet and then begins to dry. Crazing is sometimes referred to as shallow map cracking or pattern cracking. While it does not affect the structural performance of the concrete and rarely influences durability or wear resistance, crazing can be aesthetically undesirable. Over time, the cracks may become more pronounced as dirt and debris collect within them.

Example of concrete crazing

What causes Crazing?

Concrete surface crazing typically results from one or more deficiencies in construction or finishing practices. The most common contributing factors include the following.

- Poor or inadequate curing. Intermittent wetting and drying or delayed application of curing methods allows rapid moisture loss from the surface, increasing the likelihood of crazing.
- Excessively wet concrete, over floating, or the use of a jitterbug or similar tools that push coarse aggregate downward. These practices create a surface layer rich in cement paste and fine materials, which is more prone to shrinkage and cracking.
- Finishing operations performed while bleed water is still present, particularly steel troweling. The smooth action of a steel trowel draws excess water and cement fines to the surface. Similarly, using a bull float or darby during bleeding can create a weak surface layer with a high water to cementitious materials ratio, making it susceptible to crazing, dusting, and other surface defects.
- Sprinkling dry cement onto the surface to absorb bleed water. This practice concentrates fine material at the surface and frequently leads to crazing.
- In some cases, surface carbonation can cause crazing. Carbonation is a chemical reaction between cement paste and carbon dioxide or carbon monoxide, often associated with unvented heaters. When this occurs, the surface is typically soft and may also exhibit dusting.

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How to Prevent Crazing?

To reduce the risk of crazing

- Curing should begin as soon as possible after placement. The concrete surface should be kept continuously moist by flooding with water, covering with damp burlap that is maintained wet, or applying a liquid membrane curing compound. Curing should be maintained for a minimum of three days. Proper curing retains the moisture needed for the chemical reaction between cement and water, known as hydration, to proceed effectively.
- Use moderate slump concrete in the range of 80 to 100 mm with air entrainment. Higher slumps may be acceptable provided the mixture is properly proportioned to achieve the required strength without excessive bleeding or segregation. Air entrainment reduces the rate of bleeding in fresh concrete and helps lower the likelihood of crazing.
- Never sprinkle or trowel dry cement or a mixture of cement and fine sand onto the surface of plastic concrete to absorb bleed water. Bleed water should be removed by gently drawing a garden hose across the surface. No finishing operations should be carried out while bleed water is present.
- Dampen the subgrade prior to placement to prevent it from absorbing water from the fresh concrete. Where an impervious membrane such as polyethylene is used, it should be covered with 25 to 50 mm of damp sand to help reduce bleeding and improve surface performance.

Things to consider to prevent crazing

- Use moderate slump air entrained concrete in the range of 75 to 125 mm. Workability should be adjusted using slump modifying or high range water reducing admixtures rather than adding water. Properly designed mixtures with admixtures are less prone to segregation and typically exhibit reduced bleeding.
- Place concrete on compacted granular fills where practical, as these can absorb a limited amount of surface moisture and help reduce bleeding. Granular fills should only be moistened when high evaporation conditions exist. For interior slabs placed on a vapour retarder, water should not be added to increase slump.
- Finish the concrete correctly by ensuring all bleed water has been removed before any finishing operations begin. Sprinkling cement onto the surface to absorb bleed water is a common cause of crazing and should never be permitted.
- Avoid excessive surface manipulation during finishing. Overworking the surface can force coarse aggregate downward, concentrate cement paste near the surface, and locally increase the water to cementitious materials ratio.
- Delay steel troweling until the surface water sheen has completely disappeared.
- Begin curing immediately after finishing is complete. The surface should be kept continuously moist using flooding, wet burlap, curing blankets, or a nonwoven geotextile covered with polyethylene sheeting. Moist curing should be maintained for a minimum of three to seven days while ensuring the concrete temperature remains at or above 10°C. Curing preserves the moisture necessary for hydration, the chemical reaction between cement and water.
- Avoid alternating wetting and drying of concrete surfaces at early ages. When water curing is used, the curing water temperature should not be more than 10°C cooler than the concrete.

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Three Rules to Consider:

1. Begin curing immediately after placement and keep the surface continuously moist.
2. Use moderate slump, air-entrained concrete and avoid adding extra water to increase workability.
3. Avoid overworking the surface, and delay steel troweling until the surface sheen disappears.

References

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