What is Crazing in Concrete? Causes and Prevention of Crazing

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What is Crazing in Concrete?

Crazing in concrete is the development of a network of fine random cracks or fissures on the surface of concrete caused by shrinkage of the surface layer. These cracks are rarely more than 3mm deep, and are more noticeable on over floated or steel-troweled surfaces. The irregular hexagonal areas enclosed by the cracks are typically no more than 40mm wide and may be as small as 10mm in

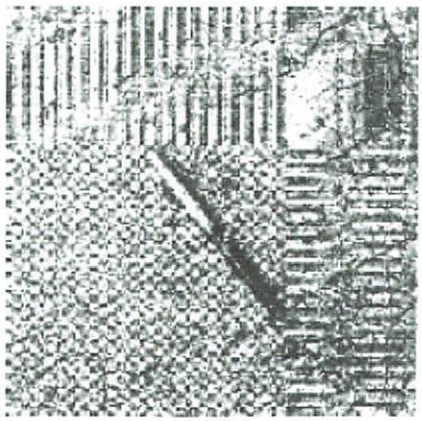


Fig. 1(a): Crazing

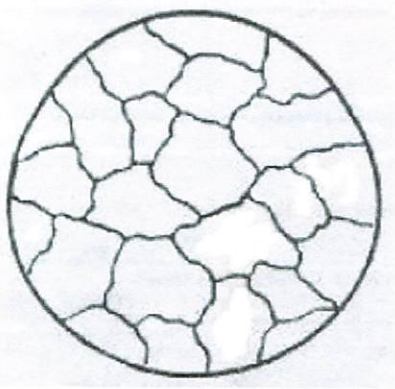
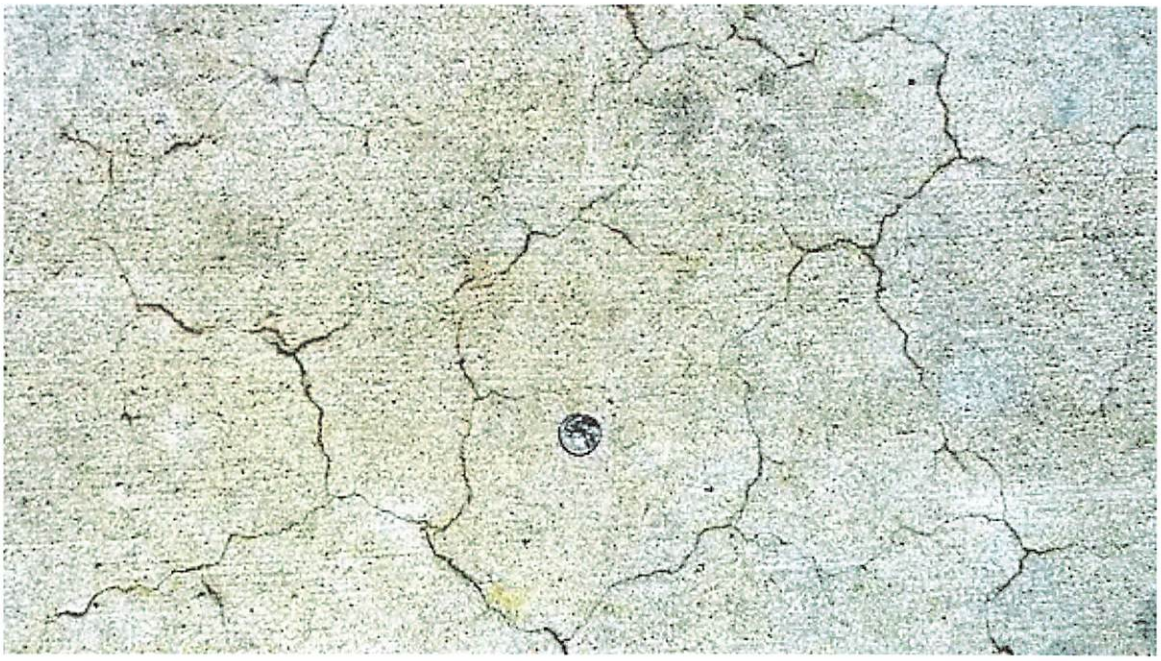


Fig. 1(b): Crazing Pattern

unusual instances (Fig. 1(a) & (b)). Generally, craze cracks develop at an early age and are apparent the day after placement or at least by the end of the first weak. Often they are not readily visible until the surface has been wetted and it is beginning to dry. They do not affect the structural integrity of concrete and rarely do they affect durability. However crazed surfaces can be unsightly.



Causes of Crazing in Concrete

Crazing in concrete usually occurs because of wrong construction practices like:

- Poor or inadequate curing - Curing of concrete is required to maintain the moisture content when concrete starts to set and gain strength. When the evaporation rate from the concrete surface is higher than the moisture gain from curing, the crazing cracks occurs in concrete. This occurs due to direct sunlight, low humidity, or drying winds.
- Intermittent wet curing and drying - intermittent curing allows the concrete surface to dry for sometime and this leads to concrete crazing.

- Excessive floating is the accumulation of cement paste on the top of concrete while the coarse aggregate settles down. This causes the moisture accumulation at top which when dries up causes crazing.
- Excessive laitance on surface.
- Finishing with float when bleed water is on the surface.
- Sprinkling cement on the surface to dry up the bleed water. This will create a weak surface on the concrete due to concentration of fines on surface.
- Over vibration loading extra bleed & laitance on surface.

Preventive Measures for Crazing in Concrete

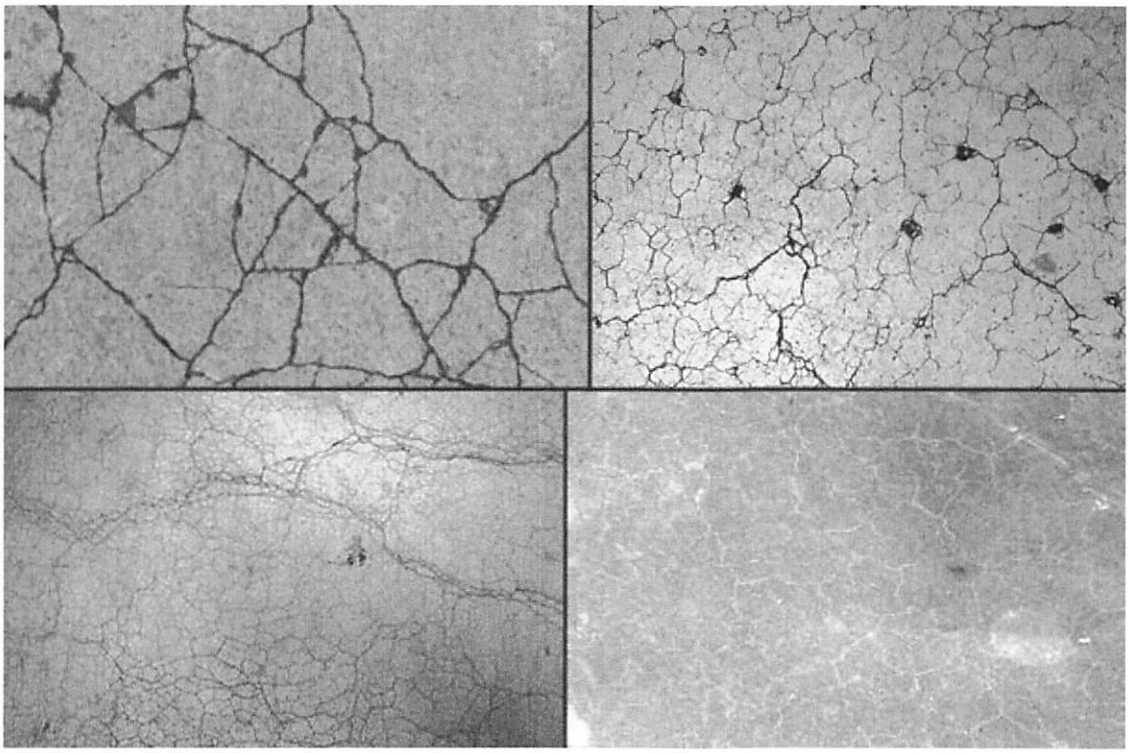
- Proper and early start of curing prevents the loss of moisture in concrete and helps in hydration process of concrete. The maintenance of continuous supply of moisture in concrete prevent the appearance of crazing on concrete surface.
- Use of curing compound on the surface prevents the rapid evaporation of moisture from concrete surface and crazing is prevented.
- Never sprinkle dry cement or a mixture of cement and fine sand on the surface of the plastic concrete to prevent the appearance of crazing.
- Use low water-cement ratio as possible, consistent with adequate compaction.
- Use workability enhancing air-entrained concrete with a moderate slump. Air-entrainment reduces rate of bleeding in fresh concrete and reduces the likelihood of crazing.
- Use low slump concrete, Higher slump allows the concrete mixture to segregate, resulting in a weak surface layer.
- Avoid steep moisture difference between concrete surface and the interior of the concrete.
- Trowel the surface as little as possible and in particular avoid the use of steel float.
- Avoid the use of rich finishing mixes, not richer than 1:3.
- Avoid over vibration which results in bringing too much slurry to the top or side.
- Avoid grouting processes or rubbing the surface with neat cement paste.

References:

1. *ACI 302.1R Guide for concrete floor and slab construction*
2. *IS177T Concrete slab surface defects - Causes, prevention and repair by Portland Cement Association*
3. *Avoiding Common Outdoor flatwork problems by Ward Malisch, in Concrete Construction, July 1990.*

What is Concrete Crazing and how can we avoid it?

By **Constro Facilitator** - March 4, 2021



Crazing in concrete floor

Crazing in concrete floors is the development of random cracks or fissures on the surface of concrete caused by shrinkage of the surface layer. It is a result of conditions and curing methods at the point the concrete is laid or even the way it is finished. They are associated with early surface drying or cooling, causing the immediate surface to shrink differently than the underlying concrete. Crazing is caused by drying out of the concrete surface, so it is particularly common when the surface has been exposed during placement to low humidity, high air or concrete temperature, hot sun, or any combination of these. The irregular hexagonal areas enclosed by the cracks are typically no more than 40 mm across and may be as small as 20 mm in unusual instances. Generally, crazing 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. They do not affect the structural integrity of concrete and rarely do they affect the durability or wear resistance.

Causes for concrete crazing

Improper curing **–** When the evaporation rate from the concrete surface is higher than the moisture gain from curing, the crazing cracks occur in concrete. This occurs due to direct sunlight, low humidity, or drying winds. Even the delayed application of curing will permit rapid drying of the surface and crazing.

Intermittent curing – Making the concrete dry for some time is called intermittent curing. During the process of making the concrete wet, the surface tries to absorb water inside and makes the crazing appear on the surface.

Excessive floating – 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.

Inappropriate finishing – Finishing while there is bleed water on the surface or the use of a steel trowel because the smooth surface of the trowel brings up too much water and cement fines. Use of a bull float or darby while bleed water on the surface will produce a high water-cement ratio weak surface layer which will be susceptible to crazing.

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

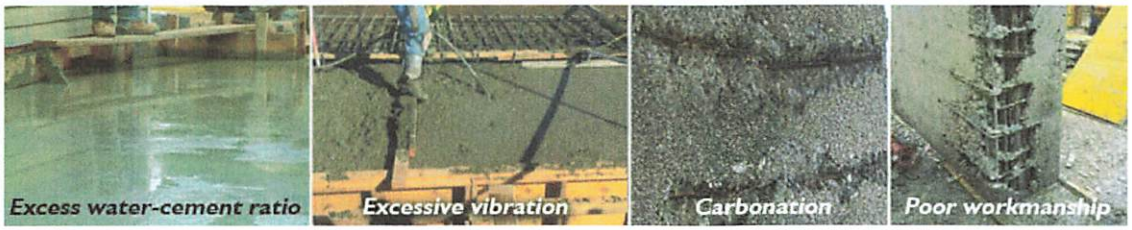
Causes for concrete crazing

Excess water-cement ratio – Excessive water leads to crazing. After the concrete has been placed, excess water settles at the top which moves the cement particle creating a thin layer on the surface. It gets dried and causes craze.

Excessive vibration – Too much vibration on the concrete makes the blue metal settle down and let the cement slurry to the top which causes crazing.

Carbonation – 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.

Poor workmanship – Using more hand trowels actions while placing the concrete leads to the improper settlement of concrete and raises cement paste to the surface and makes water bleed leading to crazing.



Causes for concrete crazing

Prevention measures for concrete crazing

- Don't allow the labour to disturb the concrete by hand trowels.
- 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 combinations of cement and water.
- Use moderate slump 80 to 100 mm, air-entrained concrete. Higher slumps can be used providing the mixture is designed to produce the required strength without excessive bleeding and/or segregation.
- Go for air entrainment as it helps to reduce the rate of bleeding of fresh concrete and thereby reduces the chance of crazing.
- Avoid 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. Don't perform any finishing operation while bleed water is present on the surface.
- Dampen the subgrade before concrete placement to prevent it from absorbing too much water from the concrete. If an impervious membrane is required on the subgrade cover it with 25 to 50mm of damp sand to reduce bleeding.
- Use low water-cement ratio as possible, consistent with adequate compaction
- Look into steep moisture differences between the concrete surface and the interior of the concrete.
- Avoid over-vibration which results in bringing too much slurry to the top or side.
- Don't perform grouting processes or rubbing the surface with neat cement paste
- Use moderate slump 80-100mm air-entrained concrete.
- Avoid excessive manipulation of the surface, which can depress the coarse aggregate and increase the cement paste at the surface, and increase the water-cement ratio at the surface.
- Delay steel troweling until water sheen has disappeared from the surface.
- Wet curing such as flooding the surface for several days with water.
- Use of membrane-forming curing agents to retard the dehydration process.

Prevention measures for concrete crazing

Image Source: azdot.gov, concretenetwork.com, chamberlinltd.com, bay-lynx.com, construct-ed.com, st-astier.com, civil4m.com, concretedecor.net, everything-about-concrete.com, flexcrete.com