Plastic Shrinkage Cracking

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Print FAQs

Q **Why ..... Plastic Shrinkage Cracking and other answers ...**

A 1. What is Plastic Shrinkage Cracking?

Plastic shrinkage cracks are cracks that appear on the surface of a freshly placed concrete slab during finishing operation or soon after. These cracks are relatively short and usually parallel to each other on the order 30 - 90 mm apart, and 10 to 50 mm deep. The cracks occur randomly and seldom intersect the perimeter of the slab.

Plastic shrinkage cracks rarely impair the strength of concrete floors and pavements, nevertheless, they are unsightly. The development of these cracks can be minimized if appropriate measures are taken prior to and during construction.

2. Why Do Plastic Shrinkage Cracks Occur?

The most common explanation for the occurrence of plastic shrinkage cracking is that the rate of evaporation of surface moisture exceeds the rate at which it is being replaced by bleed water. This causes shrinkage of the surface while the underlying plastic concrete remains the same volume. However, some field investigations have shown that the bleeding characteristics of concrete do not have a major influence on plastic shrinkage cracking. There is evidence that all cement paste shrinks during early hydration which produces very small micro cracks. When the rate of evaporation is high and the concrete has enough strength (or stiffness) to cause horizontal shrinkage the normal micro cracking tendency is accentuated and noticeable plastic cracking may result.

The following are examples of weather conditions which increase the rate of evaporation and, therefore, the risk of plastic shrinkage cracking.

a. Decrease in relative humidity. Changes in relative humidity have pronounced effects on the rate of evaporation. If the relative humidity changes from 90% to 50% the rate of evaporation is increased by 5 times.

b. Increase in wind velocity. When wind blows across the surface of concrete during placement and finishing the evaporation of surface moisture will increase. For example an increase in wind speed from 0 to 15 km/h will quadruple rate of the evaporation.

c. Temperature. If the temperature of both the concrete and the surrounding air rises, the rate of evaporation will increase. For instance, when the temperature of both concrete and air increases from 10 to 20 degrees C the rate of evaporation of water from the surface can double.

d. Rapid evaporation and plastic cracking may also occur when the temperature of the concrete is significantly higher than the air temperature (and the “dew point” temperature). This can occur in cold weather with heated concrete even when the humidity is high and the concrete is placed indoors where the wind velocity is negligible.

3. How to Minimize Plastic Shrinkage Cracks

Attempts to eliminate plastic shrinkage cracking by increasing the bleeding characteristics of the concrete either by increasing slump or by using different cement or aggregate or by addition of a retarder have not been found to be consistently effective. To reduce plastic shrinkage cracking it is important to recognize ahead of time, before placement, when weather conditions may occur that are conducive to plastic shrinkage cracking. Precautions can then be taken to minimize its occurrence. They are:

a. Have proper manpower, equipment and supplies on hand so that the concrete can be placed and finished properly. If delays occur, cover the concrete with wet burlap, polyethylene sheeting or building paper between finishing operations. Some contractors find that plastic shrinkage cracks can be prevented in hot dry climates by spraying an evaporation retarder on the surface behind the screeding operation and before floating, or troweling.

b. Start curing the concrete as soon as possible. Spray the surface with liquid membrane curing compound or cover the surface with wet burlap and keep it continuously moist for a minimum of 3 days.

c. If concrete is to be placed on a dry subgrade or on previously placed concrete, the subgrade or the concrete base should be thoroughly dampened. The form work and

reinforcement should also be dampened.

d. The use of vapour barriers under a slab on grade greatly increases the risk of plastic shrinkage cracking. If a vapour barrier is required cover it with 25mm layer of damp sand.

e. In the very hot and dry periods use fog sprays. Erect temporary windbreaks to reduce the wind velocity over the surface of the concrete and if possible also provide sun shades to control the surface temperature of the slab. If conditions are critical, schedule placement to begin in the late afternoon or early morning.

Follow These Rules To Minimize Plastic Shrinkage Cracking

1. Dampen the subgrade and forms.

2. Prevent excessive surface moisture evaporation by providing fog sprays and erecting windbreaks.

3. Cover concrete with wet burlap or polyethylene sheets between finishing operations.

4. Use cooler concrete in hot weather and avoid overheating the concrete in cold weather.

5. Cure properly as soon as finishing has been completed.