EVENRANGE

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Concrete Treatment Solutions

PLASTIC SHRINKAGE CRACKING

1. WHAT is Plastic Shrinkage Cracking?

Plastic shrinkage cracks are cracks that appear on the surface of a freshly placed concrete slab during the finishing operation or soon after. These cracks are usually parallel to each other on the order of 1 to 3 feet apart and 1 to 2 inches deep rarely do they 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 minimised if appropriate measures are taken prior to and during construction.

(Note: Plastic shrinkage cracks should be distinguished from other early or pre-hardening cracks caused by settlement of the concrete on either side of a reinforcing bar due to bleeding and resistance to settlement over the bar of because of formwork movement.)

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. 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 five 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 10mph will quadruple rate of 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 50 to 70 degrees Fahrenheit the rate of evaporation of water from the surface can double.

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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 Minimise 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 of 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 minimise it occurrence. They are:

a. Have proper manpower. Equipment and supplies on hand so that the concrete can be placed and finished promptly. If delays occur cover the concrete with wet burlap, polythene sheeting or building paper between finishing operation. Some contractors find that plastic shrinkage cracks can be prevented in hot dry climates by spraying a chlorinated rubber-curing compound or monomolecular film on the surface behind the screeding operation and before floating or screeding.
b. Start curing with liquid membrane curing compound as soon as bleed water has gone and the new concrete has hardened sufficiently so as not to be marked b the application process.
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 formwork and the reinforcement should also be dampened.
d. The use of vapour barrier under a slab on grade greatly increases the risk of plastic shrinkage cracking. If a vapour carrier is required cover it with a 2-inch 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 sunshades to control the surface temperature of the slab. If conditions are critical schedule placement to begin in the late afternoon or early evening.

Follow These Rules to Minimise Plastic Shrinkage

1. Dampen the subgrades and forms.
2. Prevent excessive surface moisture evaporation by providing fog sprays and erecting windbreaks
3. Cover concrete with wet burlap or polythene 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.

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EVENRANGE liquid impermeable-membrane curing compounds are "apply and forget" systems that effectively, efficiently and economically replace labour intensive curing systems such as wet hessian, polythene or ponded water. These latter systems whilst effective if utilised properly, require constant maintenance because they are very easily disrupted by atmospheric conditions such as winds or high temperatures.

EVENRANGE can supply the curing compound most suited to your needs whether it be water based, solvent based, bituminous and chlorinated rubber.

References

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Your Manufacturer

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