

blistering

Definition

Blisters are hollow, low-profile bumps on the concrete surface, typically the size of a dime up to an inch, occasionally even two to three inches in diameter. A dense troweled skin of mortar about 1/8-inch thick covers an underlying void which moves around under the surface during troweling.

Voids form under a dense surface skin by one of two phenomena. Some believe that incidental air voids rise in sticky concretes and are trapped under the dense surface skin, produced by troweling. Others believe that bleed water rises and collects to form a void under this skin. That water is re-absorbed into the underlying concrete, leaving a layer of irregular void space under the surface which is then consolidated by troweling to form a round blister. Frequently, the blister is lined with a faint layer of “washed” sand.

In poorly lighted areas, small blisters may be difficult to see during finishing and may not be detected until they break under traffic.

Contributing Factors

Blisters form when the fresh concrete surface is sealed by troweling while the underlying concrete is plastic or bleeding, or able to release air. The small, round blisters form late in the finishing process, after floating and first troweling. Blisters are more likely to form if:

1. The subgrade is cool and the concrete on the bottom sets slowly.
2. Wind or air blowing over the concrete surface.
3. Premature finishing.
4. The concrete is sticky from higher cement content or excessive fine sand.
5. The slab is thick.
6. The slab is on polyethylene and the slump is three to four inches.
7. Excessive use of jitterbug or vibrating screed, which works up a thick mortar layer on top.

Recommendations

The finisher should be wary of a concrete surface that appears to be ready to trowel before it normally would be expected. Finishing should not take place until the water sheen has left the surface of the concrete and the concrete can bear a man's weight with only indentation of no more than 1/2 inch. Emphasis in finishing should be on placing, straight edge, and floating the concrete as rapidly as possible, without working up an excess layer of fat. After these operations are completed, further finishing should be delayed as long as possible, and the surface covered with polyethylene or otherwise protected from evaporation. Fog sprays should be kept to a minimum. In initial floating the float blades should be flat, to avoid densifying the surface too early (see finishing). Use of an accelerator or heated concrete often prevents blisters in cool weather.

If blisters are forming, try to either flatten the trowel blades, or tear the surface with a wood float and delay finishing as long as possible. Any steps that can be taken to slow evaporation should help.

References

NRMCA CIP 13 (1983). *What, Why and How? Concrete Blisters*
National Ready Mixed Concrete Association

Peterson, Carl, (1974). *Blistering of Concrete Surfaces During Finishing*
Portland Cement Association