MANITOBA READY MIX CONCRETE ASSOCIATION

CONCRETE TECH-TIP 13

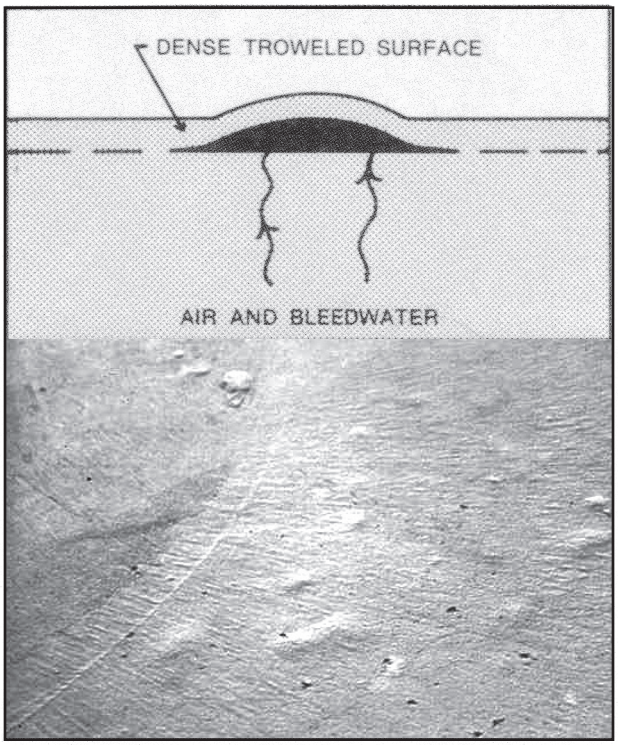
Concrete Blisters

1. **WHAT** are Blisters?

Blisters are hollow, low-profile bumps on the concrete surface typically from the size of a dime (10mm) up to the size of a quarter (25mm), but occasionally even 50 to 75mm in diameter. A dense troweled skin of mortar about 2mm thick covers an underlying void which moves around under the surface during troweling.

The void forms under a dense surface skin by one of two phenomena: air voids rise in sticky concretes and are trapped under a dense surface skin produced by troweling, or bleed water rises and collects to form a void under this skin. That water is re-absorbed into the underlying concrete leaving a weak layer or irregular void space under the surface which can cause blistering. 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.



Concrete blister

2. **WHY** Do Blisters Form?

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

Moderately rapid evaporation of bleed water makes the surface appear ready to be troweled while the underlying concrete is still bleeding or still plastic and releasing air. Evaporation from the surface is increased by wind, low relative humidity or a warm concrete surface. If evaporation is too rapid, the slab could be affected to a depth of 25 mm or more and blisters will be prevented - but plastic shrinkage cracks may develop!

Entrained air is often involved, since it reduces the rate of bleeding and supplies the fat necessary to produce the dense impermeable surface layer. A cool subgrade will delay set in the bottom and make the top set first.

Blisters are more likely to form if:

1. The subgrade is cool and the concrete in the bottom sets slowly.
2. Entrained air is used or is higher than normal so that the surface is ready to finish earlier.
3. A dry shake surface hardner is used, particularly over air-entrained concrete.
4. The concrete is sticky from higher cement content or excessive fine sand. Lean mixes bleed rapidly for a shorter period, have higher total bleeding and tend to delay finishing.
5. The slab is thick.
6. The slab is on polyethylene and the slump is greater than 80 mm.
7. Excessive use of a jitterbug or a vibrating screed which works up a thick mortar layer on top.

3. **HOW** To Prevent Blisters

The finisher should be wary of a concrete surface that appears to be ready to trowel sooner . Emphasis in finishing should be on placing, screeding and floating the concrete as rapidly as possible and without working up an excessive 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. In initial floating the float blades should be flat to avoid densifing the surface too early. 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 can be taken to slow evaporation should help.

Follow These Rules to Avoid Blisters

1. Do not seal surface before air or bleed from below have escaped.
2. Avoid dry shakes on air-entrained concrete.
3. Use heated or accelerated concrete to promote even setting throughout the depth of the slab.
4. Do not place slabs directly on polyethylene sheeting.
5. Design mix to minimize bleeding.

MRMCA
Manitoba Ready Mix Concrete Association

MANITOBA READY MIX CONCRETE ASSOCIATION
TELEPHONE (204) 667-8539 FAX (204) 668-9740
3 PARK RIDGE DRIVE, EAST ST. PAUL, MANITOBA R2E 1H7
www.mrmca.com • e-mail: info@mrmca.com