MANITOBA READY MIX CONCRETE ASSOCIATION

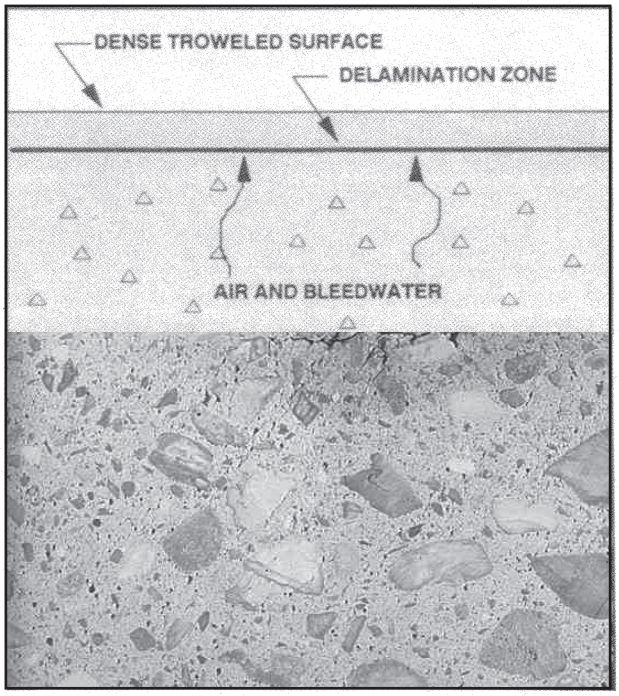
CONCRETE TECH-TIP 20

Delamination of Troweled Concrete Surfaces

1. **WHAT** are Delaminations?

In a delaminated surface, the top 20mm is densified and separated from the base slab by a thin layer of air or water. The delaminations on the surface of a slab may range in size from several square centimeters to many square meters and can be detected by a hollow sound when tapped with a hammer or with a heavy chain drag. They may exhibit cracking and color differences because of rapid drying of the thin surface during curing. Traffic or freezing may break away the surface in large sheets. They are similar to blisters, but much larger (see CTT-13).

Delaminations form during final troweling. They are most frequent in early spring and late fall when concrete is placed on a cool subgrade with rising daytime temperatures, but they can occur anytime.



Delaminated Concrete

2. **WHY** Does Delamination Occur?

Delamination occurs when the fresh concrete surface is sealed by troweling, while the underlying concrete is plastic and bleeding or able to release air. Delaminations form fairly late in the finishing process, after floating and after the first troweling. Rapid evaporation of bleed water, due to surface drying, (wind, sun, or low humidity) makes the surface appear ready to trowel, while the underlying concrete is plastic and can still bleed or release air. Vapor barriers under slabs force water to rise and compound the problem. The use of fly ash and chemical retarders will delay initial set of the underlying concrete and allow bleed water and air to move upward after the surface is sealed.

Entrained air reduces bleeding and promotes early finishing which will produce a dense impermeable surface layer. A cool subgrade delays set in the bottom relative to the top. Air and water collect under the dense surface layer during finishing.

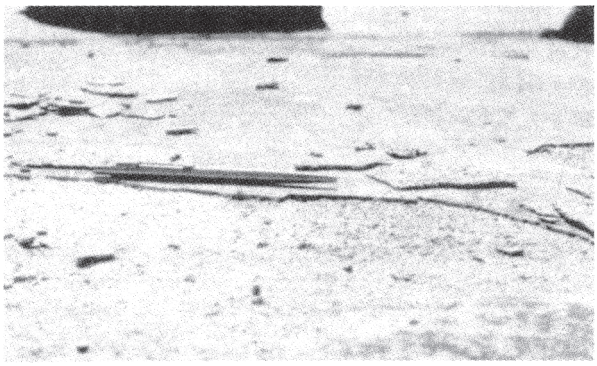
Delamination is more likely to form if:

1. The underlying concrete sets slowly because of a cool subgrade.
2. Set is retarded by retarders and/or fly ash.
3. Entrained air is used (or is higher than normal).
4. Use of a jitterbug or vibrating screed brings too much mortar to the surface.
5. A dry shake surface hardner is used, particularly with air-entrained concrete.
6. The concrete is sticky from higher cementitious material or sand content.
7. The slab is thick.
8. The slab is placed directly on a vapor barrier.

3. **HOW** to Prevent Delamination

Be wary of a concrete surface that appears to be ready to trowel before it would normally be expected. Emphasis in finishing should be on screeding, straight-edging, and floating the concrete as rapidly as possible - without working up an excessive layer of mortar.

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 densifying the surface too early. Accelerators or heated concrete often prevent delamination in cool weather.



Delaminated Concrete

Delamination may be difficult to detect during finishing operations. If delamination is observed, try to 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.

If a vapor barrier is required, place a layer of damp fine aggregate over the plastic sheet. Do not place concrete directly on a vapor barrier. Do not use air-entrained concrete in floor slabs which have a hard trowelled surface or will not be subject to deicing salts.

Follow These Rules to Avoid Delamination

1. Do not seal surface early - before air or bleed water from below have escaped.
2. Avoid dry shakes on air-entrained concrete.
3. Use heated or accelerated concrete to promote even setting throughout slab depth.
4. Do not place concrete directly on vapor barriers.
5. Avoid placing concrete on substrate with a temperature of less than 5°C.
6. Design mix to minimize bleeding.

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