

Technical Bulletin

Machine Trowel Finishing & Air-Entrained Concrete



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Concrete Floor
Contractors Association

August 10, 2017

Background

Air-entraining admixtures are incorporated into concrete mixes to create a system of very small, closely spaced air bubbles which allow water to expand when it freezes. Without these air bubbles, concrete in a saturated condition will exhibit faster deterioration in a freeze-thaw climate (water:cement ratio is also critical). When air entrained concrete is machine trowel finished, surface delaminations occur (do not machine trowel finish air-entrained concrete).

A core sample of air-entrained concrete with a machine trowel finish exhibited the following:

- Percentage of air in the top 4mm of slab surface: 0%
- Depth at which the air content is incorrect: up to 25 mm
- Depth at which the air bubble spacing is incorrect: up to 85 mm

Considerations:

In saturated freeze-thaw conditions, air entrainment must be used without a machine trowel finish. Broom, hand float, machine float, imprinted and exposed aggregate finishes have all been found to be durable with air-entrained concrete in saturated freeze-thaw conditions.

For interior concrete floors where a smooth machine trowel finish is desired, air entrainment must not be used or delaminations will occur. All surfaces to receive a machine trowel finish must have no more than a 3% plastic air content at the point of concrete placement (must check with every compressive strength test). Air entrainment is not required for interior concrete floors, freezer floors or refrigerated ice rink surfaces.

For interior slab on grade floors exposed to road slush (eg: fire halls, auto/bus maintenance shops), the traditional solution of non-air-entrained "N-CF" concrete with a 5kg dry natural coloured or 7kg pigmented aggregate hardener remains the proven historical and sustainable solution for these environments. For "plain concrete" solutions without a traditional surface hardener, the water:cement ratio should be reduced to 0.45 to achieve similar surface durability (no air entrainment with a machine trowel finish).

The purchaser of the concrete is responsible to ensure that concrete materials are compatible with the methods of construction (see [Position Statement on Concrete Purchasing](#)). The air-void structure of an air-entrained concrete may be affected by pumping and should be checked at the point of concrete placement.

Further References:

- CSA A23.1 "Concrete materials and methods of concrete construction"

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