Concrete Tech Tip
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Vapour Retarders Under Slabs on Grade

1. WHAT are Vapour Retarders?

Vapour retarders are materials that will minimize the transmission of water vapour from the sub-slab support system into a concrete slab. Vapour retarders are typically specified according to ASTM E 1745 and have a permeance of less than 0.2 metric perms when tested by ASTM E 96. According to the National Building Code of Canada clause 9.13.2.7 2 “Where installed below the floor, damp proofing membranes shall consist of polyethylene not less than 0.15mm thick…” and “3) Joints…shall be lapped not less than 100 mm.”

2. WHY are Vapour Retarders Used?

Vapour retarders are frequently specified for interior concrete slabs on grade where moisture protection is desired. Protection from moisture is required when concrete floors will be covered with carpet, tile, wood, resilient, and seamless polymeric flooring. It is also required when moisture-sensitive equipment or products will be placed on the floor. Permeation of water vapour through concrete slabs can cause failure of moisture-sensitive adhesives or coatings resulting in delamination, distortion or discolouration of flooring products, trip-and-fall hazards, and possibly fungal growth or odours.

Zero perm membranes below floor slabs on grade, in conjunction with sealed joints, also provide a barrier to radon penetration into closed spaces when such conditions exist (See CTT# 18 Radon Resistant Buildings).

3. WHAT Conditions Require Vapour Retarders?

A floor is part of the building envelope and should be constructed to eliminate moisture infiltration into the slab and into the occupied building space. For many years, vapour retarders were specified only for floor slabs intended to receive floor coverings. However, floors intended for “bare” use in services such as warehouses, mechanical rooms, and unfinished expansion areas, often are converted to other uses. Moisture-sensitive flooring is may be required and installed. Such “adaptive re-use” cannot be predicted during the design and construction of a new building. Vapour retarders are typically not required when placing exterior slabs on grade.

Vapour retarders do not prevent the migration of residual moisture within the concrete slab to the surface. It is important to use a concrete mixture with the lowest water content that will afford workability. Chemical and mineral admixtures are generally used to minimize the water content in a concrete mixture and provide adequate workability for placement. After proper curing, the concrete slab should be allowed to dry out and tested to ensure moisture is not being transmitted through the slab prior to installing flooring materials (see CTT #28 Concrete Slab Moisture).

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Concrete Tech Tip #20: *Delamination of Troweled Concrete Surfaces.* Alberta Ready-Mixed Concrete Association, Edmonton, AB.

Concrete Tech Tip #13: *Concrete Blisters.* Alberta Ready-Mixed Concrete Association, Edmonton, AB.

Concrete Tech Tip #19: Curling of Concrete Slabs. Alberta Ready-Mixed Concrete Association, Edmonton, AB.

Concrete Tech Tip #28: Concrete Slab Moisture. Alberta Ready-Mixed Concrete Association, Edmonton, AB.

Guide to Floor and Slab Construction, ACI 302.1R. American Concrete Institute, Farmington Hills, MI

ASTM E1643 *Standard Practice for Installation of Water Vapor Retarder Used in Contact With Earth or Granular Fill Under Concrete Slabs,* ASTM, West Conshohocken, PA.

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ASTM E 96-00 Standard Test Methods for Water Transmission of Materials, ASTM International, West Conshohocken, PA.

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4. PLACING Concrete on Vapour Retarders.

ACI Committee 302 recommends the placement of a concrete slab directly on top of a vapour retarder when the concrete slab surface will receive a vapour sensitive floor covering. If environmental conditions exist for increased possibility of plastic shrinkage cracking, placing concrete directly on the vapour retarder can help to alleviate the plastic shrinkage cracking somewhat by enhancing the bleed water.

Placing concrete directly on the vapour barrier can also create potential problems. If environmental conditions do not support evaporation of bleed water at a similar rate to its arrival at the slab surface, finishing may be delayed. If final finishing takes place before all of the bleed water has come to the surface, it may get sealed under the surface creating surface delamination (see CTT#20) and blisters (see CTT#13).
If a concrete mix contains too much water or is retempered on site to facilitate placement, it may stiffen slower, which means the trowel finishing operations must be delayed; thus increasing the susceptibility to shrinkage cracking.

Curling (CTT #19) can occur due to differential drying and related shrinkage at different levels in the slab. Most of these problems can be alleviated by using a concrete with a low water content, moderate cementing materials factor and aggregate graded to facilitate bleed rates aligned with jobsite environmental conditions.
In the majority of circumstances, the sub-grade and the base beneath the vapour retarder should be adequately compacted to mitigate potential future subsidence. However, for residential *dwelling* units and buildings containing *residential occupancies,* the National Building Code of Canada (NBCC) and Alberta Building Code (ABC Section 9.13.4) stipulates the establishment of an air barrier system that isolates the living space above the slab by placing a non-compacted gas-permeable granular fill layer between the subgrade and the slab (see CTT #18 Radon Resistant Buildings).

A geotechnical evaluation of a jobsite may recommend the installation of a capillary break between the slab and the subgrade consisting of 150-200 mm of pit run gravel or coarse crushed stone. However, this will not prevent moisture *vapour* transmission from the subgrade. A vapour retarder is still required. To prevent potential perforation of a vapour retarder placed over a capillary break, use a minimum 15 mil vapour retarder and choke the top surface of the granular layer with 5 mm of graded fine-grained compactable material to buffer the sharp corners of any angular coarse material. Place the vapour retarder on the smooth, well compacted fill. Vapour retarder sheets should be overlapped by 150 mm at the seams and taped and sealed around utility or column openings, grade beams, footings and foundation walls. Air barrier systems, mentioned previously, that incorporate polyethylene sheeting, must be overlapped by 300 mm to comply with NBCC and ABC.

Follow These Rules When Using Vapour Retarders

1. Provide a vapour retarder directly under all interior slab-on-grade floors.
2. Place the vapour retarder so that it is vapour tight to moisture sources below the slab, at its edges and at penetrations.
3. Order a concrete mixture designed for minimal shrinkage, and follow best practices for finishing and curing that reduce the potential for water vapour emission.
4. If the concrete slab will receive a vapour-sensitive floor covering, cure the concrete using plastic sheeting rather than using membrane curing compounds for 3 to 7 days to reduce drying time and minimize surface preparation costs.

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