Don't apply floor coverings too soon

Some practical jobsite tests to determine whether the concrete slab is dry enough

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Moisture in concrete slabs is essential for curing. But it can be detrimental to the adhesion of floor-covering materials such as resilient tile or sheet flooring, paints, coatings and sealers. Flooring materials sometimes fail because the alkaline moisture in the concrete interferes with the bonding properties of the flooring or its adhesive. Therefore, it is wise to test the moisture condition of the slab before flooring is applied. The test should show that the slab is dry enough to accept the particular floor covering.

The drying period required will vary with environmental conditions, type and thickness of concrete, and location of the slab. For example, slabs on ground require longer drying periods than suspended slabs. Usually, several months of drying are required after the period of moist curing. (Several manufacturers recommend that concrete be at least 60 days old before their floor covering is installed.) Lightweight concrete may require a longer drying period than normal-weight concrete.

Concrete will take longer to dry out if the humidity is naturally high than if it is low. In some regions of high humidity, special measures may be required, such as dehumidifying and heating the air to dry the concrete sufficiently.

Moisture tests

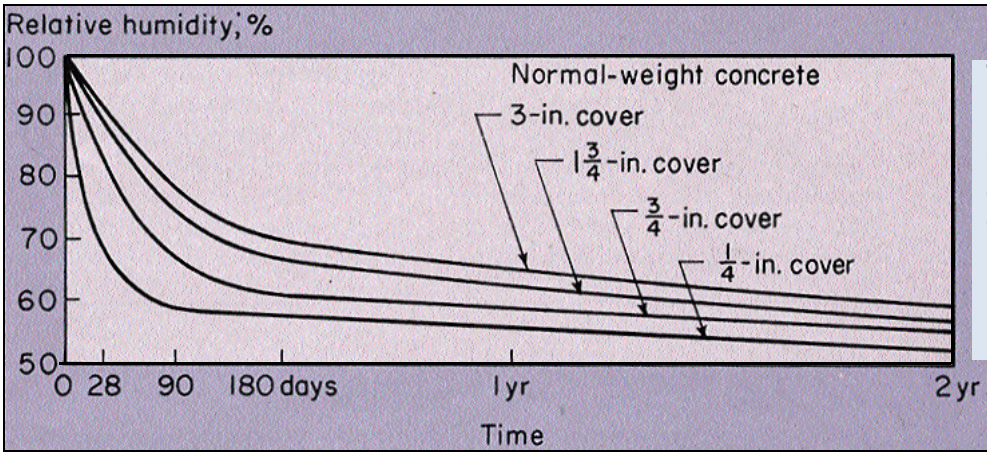
The best way to determine if a slab is ready for flooring material is to test—rather than guess—the moisture condition of the slab. Before using one of the several methods discussed below, consult the floor-covering manufacturer as to which test or what degree of dryness is required for that company's product.

Polyethylene sheet test—The moisture condition of a concrete floor can be checked by taping a 4-foot-square sheet of polyethylene or other clear plastic film to the slab surface. If no moisture accumulates on the underside of the plastic film after 24 hours (or in less time than it takes the flooring material or its adhesive to cure) the slab may be considered dry enough to apply the flooring material. If visible moisture collects under the plastic film during the time required for the bonding material to cure, you would probably get a poor bond if you applied the flooring material at this time.

Relative humidity test—This test is intended for use when you plan to bond moisture-sensitive floor-covering materials, such as linoleum, cork or rag-felt-backed vinyl to concrete slabs. A relative-humidity meter is placed under an 18-inch-square sheet of polyethylene film and the edges of the film are sealed to the slab with tape. The meter and film should be left undisturbed until the meter reading stabilizes, usually within 24 to 72 hours. Reference 1 recommends you not try to bond floor-covering materials to slabs unless the concrete relative humidity reading is 80 percent or less. If the reading is more than 80 percent the floor should be dried longer and retested. CAUTION: This method may not be applicable in highly humid regions of the country.

Mat moisture and bonding test—The moisture and surface-bonding characteristics of concrete slabs that are to receive floor coverings of rubber tile, solid vinyl tile, and vinyl sheet may be checked with the mat moisture and bonding test. The test may also be used before placing any resilient flooring on slabs from which paint, oil, adhesive, curing compound or other coatings have been removed. The test is performed by placing 24-inch-square linoleum or vinyl sheet mats on two adhesive bands. One of these is a water-soluble adhesive and the other a water-resistant latex adhesive. The edges of the mats are taped to the floor. After 72 hours the mats are removed and the adhesives examined. If there is too much moisture present it will partially or completely dissolve the water-soluble adhesive, while the water-resistant adhesive will be stringy and have little bond. If, after further drying and retesting, moisture in the slab still affects the adhesives, you should use some alternative flooring materials that are more moisture-resistant.

A similar test is recommended by Armstrong World Industries Inc. In the Armstrong Bond and Moisture Test, 3 x 3-foot panels of the selected floor-covering material are bonded to the slab with the specified adhesive. If the panels, spaced about 50 feet apart, are still securely bonded after 72 hours, the floor is considered sufficiently dry and clean to install the floor covering. Securely bonded means that an unusual amount of force would be required to lift a panel and that the adhesive would cling to both the slab and the flooring panel.



These are typical relative humidity distribution curves in 6 x 12-inch concrete cylinders that have been moist-cured 7 days and then air-dried at 73 degrees F and 50 percent relative humidity. Reference: Portland Cement Association Development Department Bulletin D141.

CONCRETE SUBFLOOR CONSTRUCTION

Experience has shown that capillary moisture from soil can cause more flooring distress than the original moisture in the slab. Therefore it is just as important to properly construct the slab beds for slabs on ground as to make sure the concrete is dry before applying a floor-covering material. Moisture that migrates up from soil can break down a cured floor covering or its adhesive, or it can collect at the concrete surface and physically uplift a floor-covering material. Some flooring materials, polyester resin for example, can form blisters under these conditions, or tile can break loose from the floor. Other floor coverings may expand and buckle in the presence of moisture.

The moisture may also be carrying dissolved concrete alkalies to the surface. Salt deposited at the concrete surface when the water evaporates can chemically attack the adhesive or flooring material unless alkali-resistant materials are used. The salt buildup may also physically separate the floor covering from the slab.

The following steps are usually recommended when constructing a moisture-resistant concrete floor on ground:

- Slope landscaping away from the structure.
- Use a 4-inch granular fill to form a capillary break between the soil and the slab.
- Install foundation drain tile.
- Use a vapor barrier, which is required by most floor-covering manufacturers.
- Install insulation (optional) over or under the vapor barrier to help keep the slab temperature above the dew point and thus prevent moisture in the air from condensing on the slab surface.
- Place a layer of sand over the vapor barrier or insulation.
- Use a low-water-cement-ratio concrete to reduce the evaporable water, the drying period and the moisture permeance.
- Moist-cure 5 days for a more watertight concrete.
- Allow a 2-or-more-month drying period.
- Test the slab moisture condition before placing a floor-covering material.

Moisture meters

Various types of moisture meters are available to measure the relative humidity or moisture content within the concrete. Examples are:

- embedded meters
- insert-meters cast in wells
- surface meters

An electrode-type moisture meter uses electrical resistivity to determine the moisture content of concrete at or below the surface. Two ¼-inch-diameter holes are drilled ¾ inch apart into the concrete to the depth at which the moisture level is to be checked; nails are then driven into the holes. The two pins of the electrode are placed in contact with the nails and the subsurface moisture content is read from the meter.

CAUTION: Experience and skill are needed in using this instrument or any instrument that provides instant readings of relative humidity or moisture content at the concrete surface. The moisture content may be significantly less at or near the surface than at lower depths, as illustrated in the figure.

When an impermeable flooring material is bonded to a concrete slab, the surface moisture content increases as moisture deeper in the slab migrates to the surface. This condition is most likely to exist in arid climates where the surface of a slab dries out faster than the deeper concrete.

Summary

Before placing a floor-covering material, consult the manufacturer regarding the concrete slab moisture condition required. When a moisture-sensitive covering is to be placed on a concrete slab on ground, proper subslab construction practices—use of granular fill and vapor barrier—should be followed (see box). After the concrete has dried a sufficient period of time (two or more months), the slab's moisture condition should be tested. Once proper dryness is obtained and the surface is clean, the floor-covering material can be applied with confidence.

References

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2. Concrete Floors on Ground, EB075D, Portland Cement Association, 1983, 36 pages

3. O'Neil, Edward F., and McDonald, James E., An Evaluation of Selected Instruments Used to Measure the Moisture Content of Hardened Concrete, Technical Report C-76-1, Concrete Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, February 1976, 69 pages

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