THE NATION'S OLDEST WEEKLY BUSINESS JOURNAL

DENVER BUSINESS JOURNAL

July 22-28, 2005

Protect your investment – pros and cons of using a vapor barrier in commercial buildings

Vapor barriers (also called vapor retarders) are used under slabs of buildings to restrict unwanted elements from seeping into the interior space.

On occasion, the intent is to block harmful vapors that may exist in the ground and surrounding environment, but more often a vapor barrier is used to block moisture. This article will specifically address commercial flooring considerations when moisture is present.

JEFFREY GROOM

The majority of commercial buildings use concrete slabs as floors. Typically, the lowest floor is placed directly on soil. Depending upon the type of flooring to be installed, the use of a vapor barrier may be a wise investment.

In recent years we have seen an increase in the number of floor covering "failures" in commercial construction. Typically, failures occur with flooring that is glued to the slab such as linoleum, vinyl tile, carpeting, wood and synthetic surfaces (like the vinyl sheeting used in sterile/clean environments). The failure usually manifests itself as disbonding or bubbling of the floor covering.

In most cases, when the flooring is removed from the slab, the glue has re-emulsified, leaving the bottom of the covering and top of the concrete slab damp or wet. This can occur with slabs on grade as well as elevated concrete slabs.

Several years ago glues were primarily solvent-based. Because of environmental concerns, glues now have low concentrations of volatile organic compounds (VOC), are usually water-based and degrade in environments (like concrete) containing moisture and high levels of pH. Solvent-based glues are still available, but costly.

Many concrete experts have researched moisture moving through concrete slabs. They have found the following "truths" regarding movement of water through concrete:

• It takes a considerable amount of time for excess water (originally added to the concrete) to evaporate from the top surface, on the order of 100 to 200 days.

• Moisture below a concrete slab can, and will, migrate through concrete to the top surface of the slab. If moisture is allowed to evaporate at the top of the slab, the moisture moves through the slab indefinitely.

• The more dense (higher cement content) the concrete, the slower the moisture migrates to the surface.

The key to controlling flooring failures is to minimize the amount of moisture transmission through the slab.

Vapor barriers are woven or smooth plastic sheeting made of polypropylene or polyethylene. There are different thicknesses available with varying puncture strengths and permeability. The level of moisture present and the amount and type of construction traffic on the vapor barrier prior to concrete placement should be considered when determining the thickness and strength of the vapor barrier to be selected. The ideal vapor barrier will be thick enough to minimize vapor emission and strong enough to withstand punctures.

ACI 302.1R-96, Guide for Concrete Floor and Slab Construction recommends the use of a vapor retarder/barrier under slabs that are to receive vapor-sensitive floor coverings.

In the late 1900's it became common practice to place sand or rock on top of the vapor barrier before the concrete was placed. It has since become evident that this procedure can cause increased

Protect your investment continued

moisture problems by creating a reservoir of liquid below the slab. This reservoir may form if water is allowed to enter the sand or rock before the slab is placed, or if subsequent leakage occurs through the slab into the area above the vapor barrier. The current recommendation is to place concrete directly onto the vapor barrier.

Contractors are hesitant to place concrete directly on top of vapor barriers due to the increased potential for concrete slab curling and cracking. Slabs curl due to differential drying throughout the slab. In other words, the top of the slab dries faster than the bottom, causing the concrete to shrink relatively more at the surface than at the bottom of the slab. This pulls the edges of the slab upwards within a few weeks after placement.

The issue of moisture-sensitive floor coverings has become a point of contention at the project level. Designers specify vapor barriers, but some contractors won't use them because of the potential problems with cracking and curling. There are several options available to the construction team:

• Adjust construction schedules to allow for as much slab drying time as possible.

• If moisture sensitive floor coverings are necessary, consider placing concrete directly on top of the vapor barrier and use a shrinkage compensating concrete mix to reduce the potential of curling and cracking.

• Topical treatments are available that claim to reduce vapor emission rates. These are relatively new to the market.

• Consider staining or decorative concrete in lieu of moisture-sensitive floor coverings.

Regardless of the option selected, test for vapor emission rates using the calcium chloride test. Some flooring manufacturers recommend other forms of testing to determine the moisture content of the substrate material; always test in accordance with the manufacturers' recommendation.

Preconstruction mitigation of vapor transmission is costly, but not as costly as post-construction mitigation. Consider the following prices:

• Vapor barrier- 15 cents to 25 cents per square foot installed.

• Shrinkage compensating concrete mix – add roughly 62 cents per square foot to the original concrete price based on 5-inch thick slab (an approximate increase in construction cost of roughly 90 cents per square foot for the vapor retarder/shrinkage compensating concrete mix system).

• Topical treatments $2 per square foot installed.

• Tile floorings $2.50 to $3 per square foot installed (to remove and replace the tile would cost slightly more).

Dealing with moisture-sensitive floor coverings at the inception of a project can potentially save high maintenance costs and costs associated with disrupting the occupant. Solving the problem after construction is time consuming and significantly more costly. Having an understanding of the issues, and what drives potential problems, can turn slightly higher construction fees into a worthwhile investment.

JEFFREY GROOM, P.E., is vice president/principal engineer of CTL|Thompson Materials Engineers, Inc., the construction materials engineering, division of CTL|Thompson, Inc. He can be reached at 303.825.0777 or jgroom@ctlthompson.com.