On The Roof

Does a Traffic-bearing Membrane Constitute a Proper Waterproofing System Over Occupied Spaces?

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Traffic-bearing membranes (TBM) are commonly used in parking garages and balconies. They are considered by some as a "waterproofing system" and are typically marketed as such. These membranes are usually comprised of elastomeric materials (typically one-component, moisture-cured; or two-component, chemically-cured) applied in several layers. Application starts with a prime coat over prepared concrete substrate followed by one or two applications of a base coat, sand broadcast, and a top coat. The sand broadcast is usually used to provide abrasion resistance and improved surface traction. Depending on the grade and manufacturer, the total system thickness can range from 40 mils to over 120 mils. The thicker systems are typically used for high traffic areas such as ramps and drive aisles in parking garages.

TBMs have been around for many years and have generally performed well as "waterproofing membranes" on parking decks and balconies. However, in recent years, the author has seen an increased use of TBMs as waterproofing over occupied spaces. In parking garages, their primary function is to prevent moisture and de-icing salts from migrating into the concrete and reaching the reinforcing steel bars where the moisture (and particularly the salts) can initiate reinforcing steel corrosion and cause extensive damage in the long term. They also perform a similar function on balconies.

Where cracks are present in the concrete substrate, the cracks should be treated properly. The manufacturers' requirements for treating the cracks vary widely. Many TBM manufacturers allow the application of a "detail coat" over the cracks. A "detail coat" is merely an additional layer of the base coat. Some manufacturers stipulate different treatment, depending on crack width or whether the crack is static or dynamic. However, in the author's opinion, all cracks in exposed concrete decks should be routed and sealed prior to application of a TBM (that is assuming that the cracks are not structurally significant or an indication of other problems such as corrosion of embedded steel).

A crack reflecting through a TBM in a relatively new building.

You will be hard pressed to find a crack in an exposed structural slab that will not move with temperature variations or loading variations on the slab. In addition, new cracks can form that were not visible prior to application of the TBM. Since TBMs are almost never constructed with internal reinforcing, it is the author's opinion that they cannot adequately resist crack movements. Although the material manufacturers publish test data that indicate the materials have elongation capabilities in excess of 500%, such elongation capabilities do not reflect the system's ability to bridge moving cracks. For example, if a crack forms after application of the TBM and widens to only 5 mils wide, the theoretical strain at the crack is infinite (5 mils divided by 0). The author has yet to find a material that can handle such movement.

It is this vulnerability to crack reflection that makes TBMs a poor choice as waterproofing systems over occupied spaces. While a minor leak through a reflected crack in a TBM may go unnoticed in a parking garage or a balcony, it will be noticed immediately in an occupied space. For this reason, when specifying a TBM as a waterproofing system over occupied spaces, the designers should be cautious and take several steps to reduce the possibility of failure:

1. Avoid the use of a TBM over occupied spaces, if possible.
2. In cases where economics or site limitations do not allow the use of a conventional waterproofing system overlaid with a wearing course, clearly outline the disadvantages of a TBM to the building owner. Such disadvantages will include increased maintenance, shorter service life, and less reliable waterproofing.
3. When specifying the use of TBMs over any concrete structure, clearly understand the behavior of the concrete deck and its deficiencies. Ensure that all cracks are treated properly (preferably routed and sealed with a sealant that is compatible with the TBM), identify the cause of cracking, and ensure all deficiencies are properly addressed.
4. Employ the same design principles as in conventional waterproofing. For example, the use of a TBM does not preclude the need for base flashing. The TBM will need to provide watertightness at all vertical projections. Therefore, all vertical projections will need to be treated properly. In order to reduce membrane tearing at vertical projections, the application of a sealant bead along the vertical projection is typically beneficial (similar to a cant in a built-up roof).
5. Ensure that substrate moisture emission does not cause the membrane to blister.
6. Take measures to ensure that the applied thickness of various layers can be properly maintained during application. Too thin of a membrane at substrate peaks can result in no coverage. On the other hand, applying single-component, moisture-cured urethanes can also result in inadequate curing and blistering in the material.
7. Specify adequate surface preparation to ensure proper mechanical bond with the substrate.

TBM blistering due to moisture emission from the substrate.

Extensive blistering within the TBM base coat due to excessive base coat thickness.

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