

Excessive Use of Self Adhesive Membranes in Standard Wood Frame Construction

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Introduction

Many changes have been introduced to the construction of building enclosures in an attempt to reduce the extent and severity of water penetration problems. One of these innovations has been the more prevalent use of self-adhesive bituminous membranes as a protected flashing material at interface and penetration details. As with any innovation, there is a need to be wary of unintended impacts of this change. With the focus clearly on keeping water out of the wall once in service, there can be a lack of recognition of the reduction of drying capability that is inherent in using vapor impermeable membrane within a wood-frame wall that is intended to otherwise dry to the exterior. In addition, the focus on exterior moisture (rain penetration) fails to acknowledge that a variety of moisture sources can exist and potentially contribute to an unanticipated moisture problem.

This bulletin applies to wood-frame wall assemblies designed with interior vapor control membranes, and relatively permeable water resistive membranes, as applicable to mixed and cold climates.

Balance of Wetting and Drying

In addition to rain penetration, several other moisture sources need be considered such as wet wood used to construct, wood wetted during construction, and condensation related to vapor diffusion and/or air leakage. Since wood decay is governed by moisture content, time, and temperature, the moisture tolerance of wood elements of a building assembly depend both on its tendency to retain moisture from a variety of sources, the speed at which it can drain and/or dry, and the wood's ability to resist fungal decay.

Drainage can be encouraged through the use of appropriate detailing that sheds water and assemblies that provide effective drainage behind cladding.

Drying potential is largely governed by the material properties and location of these materials within an assembly. Vapor impermeable exterior surfaces or membranes that are intended to reduce wetting from exterior sources may actually increase the probability of decay because they slow the drying process to the exterior. This unique balance of wetting and drying mechanisms must be considered for every project.

Construction Moisture

The combination of construction moisture and poor drying potential can lead to wood decay, even with well-designed wall assemblies. An example of this potential is the use of an exterior insulated rainscreen wall assembly that incorporates a vapor impermeable, self-adhesive membrane over the entire wall sheathing surface. While this assembly is arguably one of the most durable and high performing wall assemblies once in service with respect to control of rain penetration, vapor diffusion and air leakage, the presence of the vapor impermeable

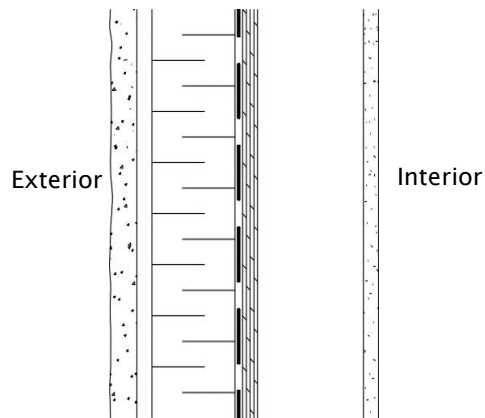


Figure 1: Exterior Insulated Rainscreen Stucco Wall

membrane eliminates drying of the wood sheathing and framing to the exterior. Therefore if wetting of wood components does occur during construction it may be necessary to take precautions to encourage drying, such as actively ventilating the interior side of the sheathing prior to the installation of any interior finishes (depends on the vapor permeability of the interior finishes).

Membrane at Details

Even when the use of vapor impermeable membranes is more limited, such as restricting its use to key details, it is possible to retard drying on a localized basis to the point where an elevated moisture content persists long enough to initiate decay. The use of vapor impermeable membranes at sensitive details should therefore be carefully evaluated. In particular, applications that restrict downward migration of moisture, such as rough opening returns at window head locations, should be avoided (tends to trap moisture that might otherwise drain or dry out of assembly or detail). The presence of adhered membrane and possibly polyethylene to the interior side of the walls creates a vapor impermeable pocket from which it is very difficult for any incidental moisture to dry. Therefore, while the use of adhered membrane is advisable at the window sills, and at least part way up the window jambs, its use at window heads should be used with caution.



Figure 2: Appropriate use of membrane at window sill and jamb

Figure 2 shows an appropriate use of membrane at the sill of a window. It is adhered only on the sill surface (necessary to hold it in place) and laps over the sheathing paper. It also only extends 8" up the rough opening at the window jamb, with the sheathing paper lapping over the membrane.

In the base of wall detail shown in Figure 3, wetting occurred due to a combination of failures in the membrane and the fact that the base of the wood wall was located too close to exterior grade level. The membrane restricts the drying potential for the bottom of the wall exacerbating the wood decay. While the use of membrane flashing at this detail is advisable, the detail should also have incorporated a concrete curb at the base of the wall so that the wood plate is elevated above the horizontal membrane level and minor leaks in the membrane will not saturate the wood framing.



Figure 3: Adhered membrane base flashing restricts drying

Another example of restricted drying and resultant decay is illustrated in the Figures 4 and 5. Figure 4 indicates a detail prior to the removal of all of the self-adhesive membrane, while the second detail shows a similar detail (different location) that has localized decay immediately under the area where the membrane was adhered. In this case a leaky walkway above was the source of moisture to the wall but it is clear that the decay is more significant in the areas where drying was restricted.



Figure 4: Membrane used at saddle detail



Figure 5: Decay worse under membrane location

The point of this discussion is not to emphasize the need to control water penetration (clearly this is important) as much as it is to emphasize the very sensitive nature of wood components of the building enclosure where drying is limited by self-adhered membrane.

Multiple Layers of Membrane

The use of an excessive number of layers of membrane can result in a significant build-up of material and the elimination of construction tolerances such that misalignment and even restricted drainage can occur. These multiple layers can usually be avoided without sacrificing the beneficial aspects of the self-adhesive membrane.

Many Details Equals Full Coverage

When focused on individual details it is easy to lose sight of the cumulative effect of self-adhesive membrane used at each detail. For example, if using self-adhesive membrane at all window-to-wall interfaces, as well as penetration details, a high percentage of the wall area can end up being covered with membrane. This is particularly true with highly articulated facades that utilize a high percentage of glazing. The result is a relatively continuous vapor impermeable surface located on the cold side of the wall, potentially leading to a vapor diffusion related condensation problem. See Figure 6.



Figure 6: Extensive use of self adhesive membrane results in almost complete coverage of wall area on ground floor of this building.

Membrane Placed over WRB

Placement of self-adhesive membrane directly on the sheathing restricts the amount of drying that can occur laterally. However, when membrane is placed over asphalt impregnated paper or vapour permeable sheet membranes such as Tyvek, wicking can

occur to remove moisture and the slight gap that exists between the WRB and the sheathing allows some minor air movement and therefore some vapor diffusion laterally that can reduce the build-up of moisture behind the membrane.

Summary & Recommendations

It is worth noting that the restricted drying of wood products caused by the use of self-adhesive membranes only creates a problem if moisture is supplied to the wood, it accumulates, and is stored within the wood product. Therefore, an emphasis on eliminating moisture sources in addition to creating assemblies and details that have better drying characteristics is key. In other words, the presence of self-adhesive membrane does not necessarily create a problem, however if used inappropriately it can create a higher risk of problems occurring because it creates an environment for the wood that is more sensitive to the introduction of moisture.

Self-adhesive bituminous membranes are a welcome addition to water penetration control strategies; however, they must be utilized judiciously so that other problems are not created. Some general guidelines for their use are as follows:

- Utilizing self-adhesive membrane over a high percentage of the wall area requires that it be kept warm to avoid condensation issues. This is normally achieved by placing insulating materials to the exterior side to the membrane.
- When utilizing self-adhesive membranes to provide continuous water resistive barrier at interfaces and details, its use should be limited to the interface gap plus additional material necessary to achieve effective laps with other materials.
- Avoid the creation of pockets or bathtubs with a combination of self-adhesive membrane and polyethylene vapor retarder materials that results in locations where wood products are not able to readily dry.
- Construction moisture (building with wet wood or moisture added due to rain exposure or vapor drives during construction) becomes more critical when using self-adhesive membranes. Additional drying practices may be required.
- Where feasible place self-adhesive membrane over vapor permeable sheathing membranes to facilitate better drying behind the membrane.

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