

Protected Membrane Roofing Assemblies Gain Widespread Acceptance for Sustainability



Figure 1 — This Protected Membrane Roofing Assembly features a moisture barrier covered with multiple layers of XPS insulation, in turn topped with a fabric covering and finished with spacers and a layer of paving material. Photo courtesy of Kingspan.

A new generation of commercial roofing systems is gaining widespread acceptance under the designation Protected Membrane Roofing Assembly, or PMRA (Figure 1). This issue of *Technical Insights* answers the questions: What is a PMRA? What is its Origin? It is first in a special series of *Technical Insights* on PMRAs.

Protected membranes set the bar for cost-savings, labor efficiency and life span. A PMRA extends the life cycle of a roofing system by protecting the moisture barrier itself. For this reason, sustainability experts with an interest in long life cycle building design are counted among the strongest advocates for PMRAs.

At first glance, the benefits of layers above the waterproofing membrane may appear counterintuitive: Common sense suggests that the roof's waterproofing covering needs to be on top, protecting all the other components of the assembly from the elements of Nature, including the insulation.

Ironically, the primary moisture barrier (or waterproof roof covering) itself tends to be the weak link when exposed to environmental stresses.

Whose Idea Was It?

The first "insulated roof membrane" or "protected membrane roof" assemblies were asphalt built-up roofs (BURs) with extruded polystyrene placed on top of the asphalt flood coat. This arrangement protected the asphalt roof from ultraviolet radiation; furthermore, placing the insulation on top of the asphalt BUR reduced thermal cycling of the roof membrane.

According to a comprehensive account by Watts [1], in the early years of PMRAs, these roofs consisted of XPS insulation embedded in the flood coat of an asphalt built-up roof. This technology was quite successful in extending the service life of built-up roofs. By the 1980s, much was known about the performance of these "upside-down roofs," which had the waterproofing membrane underneath the insulation rather than on top.



Figure 2 — Shown here is the 14-story base of a proposed 34-story building in Downtown Chicago. The architects developed a PMRA blue roof to meet the water retention and detention requirements of their building permit. The 14-story base of the building meets storm water management needs for the entire building through use of blue and green (vegetative) PMRAs. Photo Courtesy of American Hydrotech.

Roofing materials were also changing. Modified bituminous roofing membranes were gaining in popularity.

Protected Membrane Roof Assemblies (PMRAs) have benefitted from more than a half century of innovations and improvements. PMRAs developed in sophistication along with new building materials such as modified bituminous roofing membranes and single-ply roofing materials; and new applications such as vegetative roof assemblies (VRAs, or green roofs) and stormwater retention and detention assemblies (blue roofs).

Why Upside Down?

The most important lesson was that roof membranes benefit from being protected from weathering and mechanical damage. Ultraviolet (UV) radiation and heat cycling in the presence of moisture, oxygen, and contaminants can chemically degrade a roofing membrane, shortening its useful life.

Also, when the waterproof membrane is on top of insulation, the relative expansion and contraction of the roofing assembly that is due to thermal cycling can be detrimental to roof longevity. On a roof with the waterproofing membrane on top, hailstorms and maintenance foot traffic can mechanically damage the exposed roof membrane. Also, the waterproofing membrane on top of the insulation can act as a vapor barrier, allowing moisture to accumulate in and around the insulation beneath the membrane, causing a whole different set of problems.

For these and many other reasons, protected membrane roofing assemblies are beneficial and desirable in modern building and construction.

References

1. Mike Watts, "PMR Systems: The Forgotten Solution," *RCI Interface*, May 2000. pp. 4-7.