ARE THE BENEFITS OF VEGETATIVE ROOFS OVERSOLD?

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In the past decade the use of vegetative roofs has grown by several folds. Numerous articles, publications, and industry organizations—not to mention system manufacturers—have promoted their use and touted their advantages. Several municipalities have also encouraged their use through code changes, tax credits, or other incentives.

Many of us in the industry, including consultants, contractors, and manufacturers, have jumped on the bandwagon, seeing the growth of vegetative roofs as an opportunity to grow our own businesses. However, in my opinion, there has not been sufficient discussion on potential drawbacks of vegetative roofs. As such, this article attempts to provide a few points for consideration.

It should be noted that there are several advantages to using vegetative roofs that are indisputable. Among those are many environmental benefits such as control of storm water runoff, reduced heat island effect, increased thermal mass of the roof, and higher property values.

Moisture Protection

Among the most discussed advantages of vegetative roofs is the protection the overburden provides the roof (waterproofing) membrane. Although damage to the membrane during installation can be experienced, strict quality control and quality assurance measures can ensure a leak-free membrane after initial installation.

It is often argued that the placement of insulation over the membrane reduces exposure of the membrane to thermal cycles, eliminates potential damage due to traffic in service, and eliminates its exposure to UV. Frequent traffic, UV exposure, and thermal cycles are all indisputedly detrimental to roofing and waterproofing membranes. However, placing the membrane below the insulation also results in the membrane being continuously exposed to moisture, similar to conventional split slab plaza assemblies and inverted roof membrane assemblies (IRMA).

In a conventional roofing assembly where the roof membrane is placed on top of the insulation, the membrane will be directly exposed to UV, traffic, and thermal cycles, but it will have a chance to dry out from time to time, reducing its exposure to moisture. There is little doubt that placement of the waterproofing membrane below the insulation in a vegetative roofing system will prolong its service life. However, in my opinion, it is unclear if such benefits will double the service life of the waterproofing membrane as compared to a conventional roofing membrane.

Many publications that tout the benefits of vegetative roofs claim that the roof (waterproofing) membrane in vegetative roofs can reach or exceed a 50-year life span. Our experience with split slab plaza deck waterproofing membranes or IRMA roofs does not support such claims. Furthermore, we do not have sufficient long-term data that supports that today's waterproofing membranes being used in vegetative roofs can last 50 years or more.

Reduced Maintenance

Another touted advantage of vegetative roofs is reduced maintenance. It is true that vegetative roofing systems will require little or no maintenance of their waterproofing membrane, provided the waterproofing membrane is installed and tested properly and that no damage is caused to it during installation of the overburden materials.

However, recent experience has shown that the growing media and vegetation on the roof will require maintenance, even in the case of intensive roofs that are sometimes claimed to be self-sustaining. Most vegetative roofs require maintenance in the first 1 or 2 years until the plants have been established. During that time, irrigation is likely required and the growing media will have to be maintained to overcome wind erosion and other problems. Maintenance of the plants may also cause damage to the waterproofing membrane unless the contractor responsible for maintaining the plants is strictly cautious.

It should be noted that the current draft version of the proposed 2012 International Green Construction Code (IGCC) will require initial maintenance of the vegetation on vegetative roofs. In addition, when leaks occur through vegetative roof waterproofing systems, they are very costly to diagnose and repair. Many intensive vegetative roofs become cost prohibitive to repair when leaks occur prematurely. Diagnosis of leaks in such roofs is also expensive and difficult.

Thermal Performance

It is also argued that the growing media and its thermal mass will improve the thermal performance of vegetative roofs, compared with a conventional roofing system with the same insulation R-value. It should be noted, however, that vegetative roofs may have diminished thermal performance during cold conditions with snow melt or rain.

Consider what happens with the thermal performance of vegetative roofs during a snow-melt event: As snow melts at or above 32 degrees F, its runs down through the growing media, filter fabric, and overflows the water retention mats. Then, the water runs down through the insulation joints down to the membrane. During this process, the cold water will diminish the benefits of the insulation and overburden it as interior heat is wasted to warm the water.

Cost-Effectiveness

Regardless of the benefits and potential downfalls of vegetative roofs, they will ultimately have to make economic sense for the building owners to invest in their implementation. There is no doubt that the initial cost of vegetative roofs is higher than conventional roofs. This is due to the additional cost to construct roof decks that can support the added dead load of the media and plants, the added costs associated with the required higher level of quality control and quality assurance, the added cost of overburden and plants, and in some cases the added cost of irrigation.

With touted advantages such as membrane service life exceeding 50 years, life-cycle cost analysis may show an overall economic advantage for vegetative roofs. However, if one considers more realistic assumptions such as a membrane service life of 30 or 35 years for vegetative roofs vs. 20 years for conventional roof membrane, the

continued on page 13

WILL THE GREEN CODE HAVE YOU SEEING RED?

Mark S. Graham

The International Code Council (ICC), the same organization that develops and publishes the *International Building Code* (IBC), is in the process of developing the *International Green Construction Code* (IGCC). When the IGCC is published in Spring 2012, it will provide minimum requirements for the sustainability of buildings and building sites—and buildings' roof systems.

Once adopted, the IGCC will significantly impact the construction industry, including most roofing contractors' operations. On the upside, the need to comply with the IGCC will likely motivate building owners and designers to specify higher quality, longer lasting roof systems that are more energy efficient (have higher R-values). Likewise, the IGCC will motivate building owners to consider incorporating renewable energy solutions, such as roof-mounted photovoltaic systems, into their buildings.

But the IGCC also will present some challenges to the construction industry. The IGCC's requirements for recycling construction debris will affect the roofing contractors' operations in re-roofing projects, likely complicating the process for sorting and disposing debris. The IGCC's requirements for procuring used content, recycled content, recyclable content, or indigenous materials have the potential to significantly limit roofing product selection.

IGCC Public Version 2.0

In November 2010, ICC released Public Version 2.0 (PV 2) of the IGCC. PV 2 is the second public draft of the IGCC and the final review draft of the document before final publication.

Review of IGCC PV 2 reveals it is an "overlay code," meaning it is intended to be used with ICC's other model codes, including the IBC and International Energy Conservation Code (IECC). In general, ICC intends the IBC to provide minimum technical requirements for buildings, while the IGCC will provide minimum levels of sustainability for the construction and operation of buildings.

IGCC PV 2 includes minimum levels of sustainability; it allows jurisdictions to adopt additional requirements providing even higher levels of sustainability. The draft includes a minimum provision that no less than 50% of nonhazardous construction waste be recycled. The jurisdictional requirements included within IGCC PV 2 allow jurisdictions to select higher levels for recycling, up to 65% or 75%, if desired. As a result, neighboring jurisdictions that adopt the IGCC may have noticeably different compliance levels.

The draft also includes options for project electives that become mandatory only as selected and indicated by a building owner or designer. Examples of project electives include use of highly reflective roof coverings, vegetative roof systems, and additional thermal insulation.

IGCC PV 2's Chapter 5, *Material Resource Conservation and Efficiency*, provides provisions for material procurement requiring at least 55% (by weight, volume, or cost) of construction materials be used content, recycled content, recyclable content, or indigenous materials. Indigenous materials must be recovered, harvested, extracted, and manufactured within a 500-mile radius of the building site. Where indigenous material resources are transported by water or rail, a 0.25 multiplier can be applied to the transportation radius, resulting in up to a 2,000-mile transportation radius. These indigenous material provisions will apply to most roofing products.

IGCC PV 2's Chapter 6—*Energy Conservation, Efficiency, and Atmospheric Quality*—provides provisions for reducing buildings' energy consumption. Multiple compliance paths are provided to allow flexibility. If the most popular prescriptive- or performance-based compliance paths are chosen, use of a renewable energy system would be required for most buildings. Rooftop photovoltaic (PV), solar water heating, solar thermal, and wind-generation systems are recognized in the draft as suitable renewable energy systems for buildings.

What's next?

ICC released IGCC PV 2 to allow the general public to review the final draft and offer public comments before final publication. ICC is accepting public comments on IGCC PV 2 using a process similar to the code change process used to update the IBC and IECC.

National Roofing Contractors Association (NRCA) established a task force that reviewed IGCC PV 2 and submitted 18 code change proposals according to the ICC process. NRCA's task force includes two members of MRCA's T&R Committee—Jim Barr and Jay Crisp.

ICC will consider all code change proposals received at their 2011 IGCC Code Development Hearing May 16–22 at the Sheraton Dallas Hotel in Dallas, TX. ICC final action and approval of the IGCC will take place at the 2011 IGCC final Action Hearing November 2–6 at the Phoenix Convention Center in Phoenix, AZ.

The IGCC, which will be published and available for jurisdictions' adoption in March 2012, will likely bring about fundamental changes in the construction industry. Is your company's current business model "sustainable" and will you be ready for these changes?

Mark S. Graham is NRCA's associate executive director of technical services. For more information on the IGCC and its development process, and to download a copy of PV 2, go to www.iccsafe.org/igcc.

added initial cost of roof decks, and the costs associated with maintaining the vegetation, one can conclude that the touted life-cycle cost advantages of vegetative roofs diminish. In some cases more realistic assumptions in life-cycle cost analysis will reveal that conventional roofs are still the best way to go.

Regardless of their potential downfalls, vegetative roofs are here to stay and are becoming an integrated part of the roofing business. However, rather than becoming immersed in the hype, roofing contractors, consultants, and manufacturers will need to remain objective and educate their clients and customers regarding the advantages and disadvantages of vegetative roofs in a realistic manner.

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