Duke Medicine Going Green with Roofing

A world-class academic and health care system, Duke Medicine in Durham, NC integrates the Duke University Health System, the Duke University School of Medicine, and the Duke University School of Nursing. Duke Medicine endeavors to “green up” its operations, in everything from large-scale construction projects (designed according to LEED standards) to housekeeping services. Green (vegetative) roofs support this commitment to sustainability.

Tim Pennigar, project manager for structural systems at Duke Medicine for 25 years, provides in-house consulting and project management for building enclosure construction and exterior rehabilitation. His experience spans ongoing expansion on the campus as well as restorations of complex and historical building facades and management of roofing assets. In this interview with *Today’s Facility Manager* (TFM), Pennigar discussed green roof initiatives.

>TFM: How many green roofs has Duke Medicine installed?

Pennigar: We have a 6,000 square foot green roof over the entrance and in a courtyard of the Duke University Hospital. That was our first site, installed in July 2008. A 6,000 square foot installation on the Duke Cancer Center was completed in October 2011.

>TFM: Why did Duke decide on green roofs? What criteria did you consider for selection?

Pennigar: Duke seeks to be a leader in stewardship of the environment. Green roofs are a natural complement to campus initiatives—particularly in the area of stormwater management and water quality. Our two roofs retain a total of more than 250,000 gallons of stormwater annually.

Operationally, green roofs are very much in line with our long-standing principles of roofing design. We protect waterproof membranes on roofs to extend their service life. As a protected membrane assembly, a well-constructed green roof provides greatly enhanced service life.

Early on, we created a roof test site with multiple plots to evaluate a variety of options, including build in place with plug plants, modular trays, and pre-vegetated mats. Principally, we wanted a system that offered minimal live load, rapid vegetation coverage, ease of installation and maintenance, and an established track record.

>TFM: What system did you choose?

Pennigar: We chose an extensive system with pre-vegetated mats based on a design engineered in Germany. It has been proven and refined over more than 40 years. The system is from Xero Flor America. The option we selected is 2.5″ in depth and fully saturated weighs only 10-11 pounds per square foot. The mats, pre-vegetated with Sedum, arrived in sod-like rolls. Installation yielded essentially a mature green roof with complete plant coverage. Immediate coverage reduces one of the biggest risks (that immature plants will not grow and fill in).

The roof over the Duke Hospital entry developed a leak around a defective roof drain, a condition we isolated with electronic leak detection. Being lightweight and designed with a permanent carrier layer, the mats were easy to roll back for repairs. This contrasts with other options we studied. The saturated weight of modular trays can approach 30 pounds per square foot. That makes them tough to lift.

And, with build in place or mat systems with bottom layers that decompose, we would have had to dig out and discard the section over the leak.

>TFM: What are the maintenance requirements?

Pennigar: With vegetative roofs, the goal is to keep maintenance to a minimum. You do this by paying attention to small routine chores before they become large, difficult tasks. Both our roofs get an application of an organic, granular fertilizer once a year in the spring. We walk the roofs every spring with four college interns to remove invasive weeds. In 2013, we spent about 30 minutes on the Duke University Hospital roof and an hour or so on the Cancer Center roof.

I should caution that it's difficult to generalize. Every green roof develops its own ecosystem. It depends on what type of system is in place and how long it has been established. The deeper the system is, the higher the maintenance.

Supplemental irrigation is important, particularly during the initial growing season. Thereafter, irrigation should be available to protect the plants during periods of summer drought and extreme heat. I think the hospital green roof had eight irrigation events last summer. Be careful not to overdo it. Sedum are drought tolerant. Overwatering can threaten plants even more than drought.

>TFM: Are there plans for additional green roofs?

Pennigar: We have six new installations, approximately 12,000 square feet in total, in final stages of construction on our new Duke Medical Pavilion and a dietary storage facility.

>TFM: What lessons learned would you share?

Pennigar: A roof, of course, must function as a reliable, waterproof barrier. Particularly on retrofit projects, conduct a thorough engineering study to identify existing and potential leakage pathways before installing any overburden materials. Become familiar with the roles of various team members such as architect, roofer, horticulturalist, irrigation contractor, and code official. Green roof success largely reflects how well these perspectives are balanced. And, two blind spots that pop up frequently are coordination of irrigation needs and building or insurance code compliance.

Monoculture planting of rows of single species may look good in a landscape design, but it is not a good idea. A green roof that blends different plants with 12 to 15 species promotes biodiversity and makes for a dynamic plant community that better adapts to the environment of each rooftop. That requires less maintenance.

Also, pay attention to where the plants are grown. Regional varieties locally grown and adapted to the particular area climate where a green roof is going up helps ensure success.

Finally, while the green roof industry is long established in Europe, it is still fairly new in North America. Do your homework. Get good advice from knowledgeable, experienced experts.

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