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The Proof Is on the Roof

by **Sandy McCullough**

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For many, a drive on Chicago's famed Lake Shore Drive is an architectural adventure. One passes some of the grandest and most elegant high-rise apartment buildings in the city. Many of these were built in the early 1920s, and some include apartments with 10, 15 or more rooms.

However, a problem — or shall we say an internal conflict — found in many of these buildings centers around their windows. As the buildings age, their windows need to be replaced. And because this can be a costly project, even if it saves the homeowners money in the long run, it is not uncommon for some owners in these buildings to delay replacement for as long as possible.

"When qualified building engineers tell owners the windows must be replaced but the owners resist, there is only one thing we can do," says Sam Ambrose, a building engineer. "You have to educate them and reeducate them until they understand the problem and the benefits of installing new windows."

Many schools and universities are in a similar situation when it comes to green roofs. Building construction funds are often tight, and even though adding a green roof to a new or existing campus facility has many supporters, many administrators have difficulties accepting the added costs or recognizing the potential long-term savings. For those who support and know the value of green roofs, their only option is to educate and reeducate facility managers and school administrators as to the benefits and features.

Today, although most school administrators and facility managers know what a green roof is, many still consider it "European technology." They believe that green roofs are having little impact on the U.S. building or educational industries except in a few localized markets — and mostly on buildings developed by city and state governments.

Often, they voice concerns about green roofs, such as: Do they leak? What about the added weight load to the structure? Don't the costs of installing green roofs make them prohibitive? And what are the tangible benefits?

Compounding the problem is the fact that extensive research and studies about green roofs are still in short supply. Although green roofs have been monitored and studied in several North American cities, much of that data is only now coming to light. For instance, the Lady Bird Johnson Wildflower Center in Austin, TX, will soon begin a pilot program to explore the value of green roofs and hopes to raise enough money to perform one of the most comprehensive studies ever conducted.

For these reasons, it's necessary to address some of the concerns and issues related to green roofs — especially the cost benefits — to help educate building professionals and school administrators.

Return on Investment

Understandably, many colleges and universities are concerned about the costs of any new feature installed onto their buildings. And unfortunately, because so many of the "green" features incorporated into buildings in the 1970s and 1980s were costly and proved to have little return on investment, discussions of the installation of a green roof are often met with some skepticism.

However, a report issued in October 2003 by the California Sustainable Building Task Force states that adding green elements to facilities today can produce significant benefits. For instance, the task force found that, on average, a two-percent increase in upfront costs to help make a facility green could yield life-cycle savings of 20 percent of the total investment. In other words, an initial upfront investment of up to \$100,000 to incorporate green building features into a \$5-million project — such as the installation of a green roof — would result in a savings of \$1 million in today's dollars over the life of the building.

The actual costs to install a green roof can vary significantly and depend on a variety of factors. These factors include the following.

- Size and slope of the roof
- Depth and complexity of the system
- Climate and plant selection
- Height and accessibility from the ground
- Time and cost of labor to install and maintain the roof
- Whether elements such as drains, railings, pavers and related items must be installed

A built-in-place, extensive (six inches or shallower) green roof can cost anywhere from \$15 to more than \$40 per square foot, depending on these and other variables. A modular, extensive green roof system, in which the soil and plant media are placed into preassembled modules in a local nursery and then laid out on top of the existing roof, can reduce these costs to about \$9 to \$20 per square foot.

These costs are generally offset by the fact that green roofs can double the life cycle of the existing roof. This is because they help moderate the roof's temperature swings throughout the year. In the heat of summer, a conventional rooftop can approach more than 180° F. In the winter, the same roof can be below freezing. These temperature extremes cause the roof to expand and contract, which eventually causes the roof membrane to crack and need repair and replacement. Additionally, ultraviolet light degrades roof membranes not protected by green roofs.

A green roof can also help reduce energy costs. Scientists at the University of Toronto investigated the environmental impact of a green roof over the expected life of a building. They concluded that a green roof would contribute to a six-percent energy savings in summer, and that the savings could be greater when placed on facilities with a wider rooftop. These savings can also allow a facility to reduce the size of the air-conditioning equipment necessary for the building, another cost savings.

Storm Water Runoff

During heavy rains, especially in large urban areas, even extensive combined sewer systems can become overloaded. This is because a city block can generate as much as nine times the runoff of a woodland area,

