Solutions at a Glance

GREEN ROOFS: NORTHWEST DEVELOPERS ARE READY

Although grass and thatched roofs have been used throughout the world as traditional dwelling coverings, water absorbing, drought tolerant plants are helping to solve a pressing problem experienced by many cities.

A group of Washington and Oregon real estate developers, architects and engineers discovered that green roofs were simpler than they thought (Photo by Mark Huppert, Catapult Community Developers)

The Challenge

In cities throughout the world, the extensive use of non-permeable surfaces for buildings and infrastructure has created stormwater management problems. In metropolitan areas with buildings and streets comprising close to 100% impervious surface cover, the majority of the rainwater can become surface runoff creating flooding problems, overtaxing municipal storm water collection systems and degrading stream habitat. In many cities, including much of Seattle, storm drainage and sewage are collected in the same "combined sewer" conveying urban runoff to municipal wastewater treatment plants, which are similarly being overtaxed.

The conventional solution to urban runoff management has been the installation of costly underground storm water detention tanks that control the release of runoff from a building. Rain water races from the roof and pavements to the tanks, where it is then held until a storm event passes. This controlled release then passes through a cleansing device as the runoff is slowly released from the site. Virtually 100% of the runoff that lands on the site is still released to the downstream systems, albeit in a controlled manner.

The Solution

Low profile green roofs can provide these same storm water management functions while reducing the amount of runoff that leaves the site at the same time. Green roofs cleanse rainfall of airborne pollutants and reduce the rate and quantity of stormwater runoff. A green roof outfitted building requires significantly less conventional storm water detention and cleansing facilities, and benefits the downstream municipal systems that experience a reduction in flow amount in addition to the conventional reduction in flow rate. Rainwater is absorbed by the soil substrate and then taken up by the plants and returned to the atmosphere through transpiration and evaporation. It is common to decrease annual runoff of 50%, allowing reduction of stormwater detention facilities by a similar percentage. Seattle-based Magnusson Klemencic Associates has developed a modeling tool that predicts the stormwater management benefits of green roofs, taking factors such as green roof thickness and areal extent into consideration.

In addition to storm water benefits green roofs provide increased building insulation, resulting in decreased energy consumption, noise reduction, and reduction of the urban heat island effect. Furthermore, they prolong the life of roofs by protecting the roof membrane from damaging UV rays and thermal shock.

After seeing green roofs in Sweden, Greg Smith, a Seattle real estate developer said, "Having viewed green roofs in person, I am convinced it is the roof of the future. It's attractive, long lasting, cost effective over the long term and both socially and environmentally the correct application. I plan to install them in my properties." David Gold of Cathedral Park Place, a real estate development firm in Portland vowed to have a green roof on one of his buildings by fall. Duncan Chalmers, a project manager with Turner Construction, was impressed by how easy they are to install. "They're simple," he said. "They aren't rocket science." A problem in the U.S. is that contractors don't have experience with green roofs, and often times over-specify items such as the waterproofing layer, which unnecessarily increases the costs.

This scares building owners away from installing green roofs. Green roofs in Europe are often installed on top of ordinary roofs with no extra waterproofing or structural modifications.

Background

The use of green roofs for stormwater mitigation and other environmental benefits began about 30 years ago in Germany. Germany provides many financial incentives for the development of green roofs. These include direct subsidies from $.51 to $6.20 per sq. foot, which are based on the avoided costs associated with infrastructure maintenance and replacement. Taxes and use fees for stormwater management facilities are also levied. For example, in some cities buildings with impervious roof covers are required to pay a 100% utility surcharge. This can be reduced by up to 80% if the building owner installs a green roof. Another type of indirect subsidy lets developers use green roofs as mitigation for the provision of open space. Some land development ordinances allow green roofs to compensate for lost open space at a ratio of 0.50 to 0.70.

As a result of this carrot and stick approach, the green roof industry in Germany has grown from 15% to 20% per year. Other European countries have initiated similar programs and are also experiencing high growth rates.

The United States is benefiting from the European experience. Although green roof designs are generally regulated using existing standards for ballasted roofs by the International Code Council, the only accepted guidelines for green roof construction are those developed by Forschungsgesellschaft Landschaftentwicklung Landschaftsbau. e.V. (FLL), in Germany. These standards and guidelines are comprehensive, and include industry standard tests for medium weight, moisture, nutrient content, grain-size distribution and other considerations. Fortunately, there is an English edition.

Costs of Green roofs

Conventional roofs cost approximately $6 to $10 per sq. ft. The cost of installing green roofs in the United States is typically around $14 to $18 per sq. ft. including plants, growing media and roof membranes. This is largely because green roofs are new here and installation is somewhat customized. In European countries where green roofs are routinely installed, costs run between $8 and $15 per sq. foot even though labor costs can be higher. Some of the increased upfront capital costs for green roofs are recouped through the prolonged lifespan of the roof provided by the protection of the green roof layers. In Germany for example, the oldest green roofs are 30 years old and not yet in need of replacement. The green roofs at the Rockefeller Center, built in the mid 1930s, still have their original waterproofing membranes. Current estimates are that green roofs can last up to 70 years.

The increase in upfront costs can also be partially or fully recouped through energy savings. A building with a green roof becomes less susceptible to exterior temperatures. The insulating value of soil lowers the cost of heating and cooling a building. The Gap corporation, with its 195,000 square foot office building in San Bruno, California, expects to have saved enough money by 2005 from lowered energy costs to have paid for the green roof and all the other environmentally sustainable features of their award-winning building. (The building was built in 1995.) In general, it has been estimated that a one-story green roof structure can cut cooling costs by 20% to 30%.

For more information on green roof storm water modeling: Contact Drew Gangnes, Magnusson Klemencic Associates, dgangnes@mka.com.
Other Resources: An excellent 12-page brochure entitled, "Ecoroof Questions and Answers" *PDF by the City of Portland*

The 2004 Urban Sustainability Study Group to Sweden and Denmark

In March 2004, a group of architects, engineers, real estate developers and others from Washington and Oregon went to Sweden and Denmark to look at advanced urban sustainability projects.

During this trip, they visited the International Green Roof Institute in Malmö, Sweden, where over 100,000 sq. feet of green roofs cover city shops and warehouse buildings. The objectives of the institute are to promote increased use of green roofs, to provide evidence for the positive impact of green roofs on urban ecology, and to produce background materials for legislation, building standards, building instructions, and loans and grants. The institute operates the Augustenborg Botanical Roof Garden. For more information: http://www.green roof.se

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