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Green Roofs – Evolving From Amenity to Performance in Green Infrastructure

Richard Hayden // American Hydrotech

It's an exciting time to be in the Green Roof industry. Education and interest have grown exponentially in recent years, and usage of green roof technology is constantly expanding on a global scale. Efforts to promote green infrastructure as a viable and cost-effective alternative to traditional "grey" infrastructure continue to create new opportunities for Landscape Architects to incorporate green roofs into their projects.

"Green" elements have long been used on roofs, though in the early days very sparingly, and very cautiously. Designers and engineers employing the technology had no official standards or information to work with. Soil weight, root ball weight, and plant selection decisions were based on trial and error, as well as preliminary information and suggestions from engineers, horticulturists, and nurseries. Important design considerations were to avoid roof overloading, keep trees on the columns, and not interfere with drainage on the roof; all critical concerns that remain important today as well.

The industry proceeded cautiously, and as expertise and experience with the techniques grew, building owners became more comfortable with the concept of plants growing on their roofs. Horticulturists, growers and designers developed plant selections and technologies that addressed a wide range of rooftop growing conditions. Over time, the thin veneer of media and plants became much more stable and affordable, and the industry continued to develop the systems needed to promote plant growth in this thin, harsh environment. Green roofs began to evolve, growing from a simple amenity to a high performance component of modern building design.

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Along with this evolution in performance came the need to develop a common set of standards to govern and guide implementation of the technology. The "Forschungsgesellschaft Landschaftsbau Landschaftsentwicklung e.V." or "FLL" guidelines - first authored in Germany - form the foundation on which much of the US green roof industry is based. The FLL guidelines cover numerous aspects of green roof design, including media standards for different applications, plant selection, and drainage management. Despite their comprehensive


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nature, however, these guidelines do not address the broader range of technical and environmental issues present in the US. In response, a modified set of standards have been developed for use in the United States, including the ANSI/SPRI Standards for Root Barrier Penetration (VR-1), Wind Uplift Standards (RP-14), and Fire Resistance Standards (VF-1). There are also a set of additional ASTM standards designed to test the performance of the various media, drainage components and other green roof elements. Continued work with ASTM will be conducted, pending issues that naturally arise as an industry matures and advances.

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Today, green roof technology is an integral part in the overall design of a building, and is often tasked with reducing costs while fulfilling a range of programmatic needs. For instance, hospitals are incorporating healing gardens on rooftops to aid in patient health and reduce recovery times, among other benefits. Schools are using green roofs as a core component of ecological and urban agriculture curricula. Employers create green roof spaces to encourage active lifestyles and increase office productivity. Further, many cities and governmental agencies have taken note of the advantages and environmental benefits of green roofs, offering incentives such as FAR bonuses and tax credits, expedited permitting, stormwater and zoning credits, and even outright financial assistance in some cases, all in an effort to encourage use and development of the technology.

Most municipalities have regulations that require some form of stormwater impact mitigation, and green roofs are more frequently being used as part of a system to satisfy these regulations. Green roofs have been recognized by the US-EPA as one of several "best management practices" (BMPs) for handling stormwater on a site. Their ability to mimic natural hydrology and to delay or eliminate portions of stormwater volume makes green roofs a very valuable tool in comprehensive stormwater management systems. Carrying this message to our engineering colleagues is an important part of expanding the design professions into this realm. The work that has been done to date in getting the ANSI and ASTM data provides credentials that other professions will appreciate.

Importantly, green roofs can reduce the amount of stormwater that reaches a city's storm sewer infrastructure. Water stored in pipes and underground storage tanks must eventually be pumped out to the standard stormwater system, and while water stored in bioswales and permeable pavement systems may infiltrate into lower strata, in many locales – especially urban areas – these permeable soil stratas may not exist. Green roofs, by contrast, can retain large amounts of moisture in their growing media, and large quantities of stormwater can be released into the atmosphere through transpiration and evaporation, rather than being allowed to go down the drain.

Green roofs store water in several ways. The engineered media is a blend of sands and fine to medium aggregates designed to provide large amounts of water storage during storm events. In addition to the media, a number of systems provide for synthetic drainage layers that store water in plastic "egg-crate" style panels. Finally, the plants themselves can often store large amounts of water; sedum is a species well known for this trait. The plants also serve as the critical interface between the storage media and the atmosphere, releasing volumes of moisture through the process of transpiration.

Finally, it is fundamental to acknowledge that green roofs can have a very important function for the building itself – protecting the waterproofing membrane from UV damage and mechanical damage due to maintenance or foot traffic. This is a widely accepted roofing concept that has been adopted by the City of Chicago, the GSA and other agencies for use in buildings where long term integrity of the waterproofing is expected. By including green roofs in green infrastructure plans, precious dollars can be leveraged to not only provide aesthetic and quality of life benefits, wildlife habitat and energy savings, but to prolong and sustain the life of one of the most valuable components of a building – its roof.

Richard Hayden is the national Garden Roof Department Manager for American Hydrotech, an international supplier of waterproofing, roofing and green roof materials and accessories. He has had a very broad range of project experiences and brings his 30-plus years as a practicing Landscape Architect to bear on the issues that face the green roof industry. Green infrastructure in all its forms, including green roofs, has often been an integral part of these projects.