6. Breadth Analysis 2 – Green Roofs and Sustainable Concepts

Analysis Introduction

The economic benefits of rapid and dense commercial development, similar to the Liberty Center project, often come at a high cost to the environment. Buildings in the United States account for approximately one-third of all water, energy, and materials consumption, as well as similar proportions of contribution to air pollution. Concepts from early 20th century architecture, with slight modernizations, offer an excellent opportunity to reduce these environmental impacts while increasing the aesthetic appeal any building. Two Liberty Center, and the accompanying projects, are ideal candidates for the addition of green roofs and roof gardens on the large flat spans of concrete roof slab.

Green Roofs

Le Corbusier and Roof Gardens

As part of his declaration: *Five Points Towards a New Architecture*, the famous 20th century architect Le Corbusier describes the aesthetic and functional reasoning for including roof gardens in the design of every building. The beginning of the argument for roof gardens declares that flat roof surfaces demand to be utilized for domestic purposes. Typically flat roofs serve only as a protective outer shell, but these areas can easily be converted to functional spaces that maintain the same protection for interior space below. Le Corbusier goes on to describe the demands of a reinforced concrete roof surface to be protected and the capability of the roof garden to maintain ideal conditions at the surface of the slab. The final and most significant argument for roof gardens on every building is one of a more ecological impact. Corbusier declares that a garden on every roof is a way for a city to recover space lost to buildings, and restore some balance to the eco-system of that city.

Modern Green Roofs

Trends towards more sustainable building designs have led to the evolution of the old roof garden concept into a more advanced system referred to as a green roof. These landscaped roofs have been implemented in a wide variety of situations and configurations, from office buildings to homes and from trees to grass. The picture to the right shows the innovation in these systems, with the roof being converted to a small golf course for a corporate office building, where employees can escape their offices for a quick hole of golf or some putting practice.

Modern green roofs have come a long way from the roof gardens of Le Corbusier. Vegetation is planted in a top layer of soil, but below that layer lays the filtering layers, drainage layers, and waterproofing layers that turn an architectural garden into a functional system for stormwater management and building insulation. Vegetation for these green roofs is carefully selected and grown to match the climate conditions of the target building as well as the aesthetic desires of the owner.

Building Benefits of Green Roofs

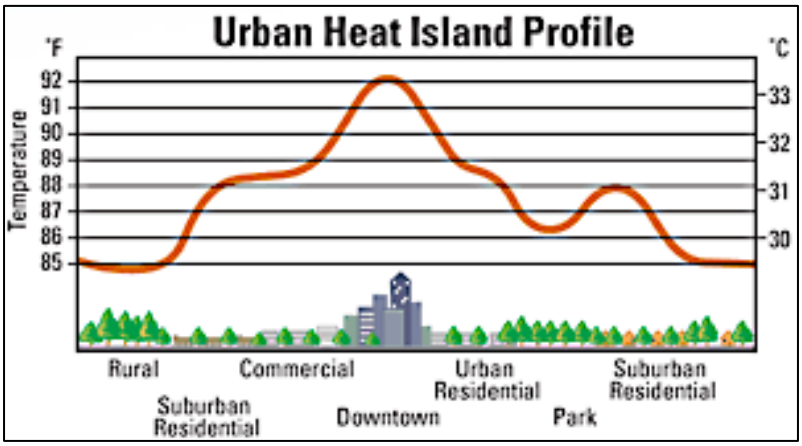
Other than the luxurious appeal of the garden-like roof environment, the modern green roof offers a variety of performance benefits for the buildings they serve. Considering first the direct performance of a green roof as a roofing membrane, it is estimated that a green roof will last nearly twice as long as most conventional roofing membrane systems. Green systems also perform exceptionally as roof insulation and natural cooling sources, with great potential for savings in both cooling loads and heating

loads. Certain applications have even provided substantial enough heat gain reductions to allow for downsizing of mechanical equipment. Additional design savings from green roof benefits often include a reduction of roof drainage due to the absorption and evaporation of rainwater and depending on the location there may also be continued savings in stormwater/wastewater utility charges. Other potential benefits exist and have been demonstrated in existing green roof applications, and with research innovations in design there may be even more benefits to be found.

Environmental Benefits of Green Roofs

Aside from the advantages for the building performance, green roofs can change the way that a building impacts the environment. Urban development not only adds to the consumption of resources and production of pollution, but there is also a displacement of natural habitats. Green roofs can replace, nearly in entirety, the amount of habitat space that is displaced by the building footprint, and the roof itself can even be designed to mimic the affected habitats. Green replacement can furthermore counter the addition of carbon dioxide emissions from the new building construction.

Another major effect of dense urban development is commonly referred to as the heat island effect. This term refers to the increase in mean temperature of heavily developed areas as illustrated in the image below. Increased temperatures can be attributed a combination of the high thermal masses of the buildings, reduced air flow from narrow streets and tall buildings, and the excessive waste heat from the concentration of cars and building



mechanical equipment. Green roofs are very effective at reducing the heat island effect in any developed area. This roofing method mitigates the heat island through two methods. The vegetation on the reduced the heat absorbed by the building as well as providing a natural cooling effect through evaporation of moisture.

Green Roof for Two Liberty Center

Green Roof as an Architectural Feature

Two Liberty Center is intended to serve high-end tenants with expensive taste in interior finishes and quality of spaces. Lobby spaces for the office tenants are finished with terrazzo floors with natural stone details, exterior finishes also boast natural stone accents, and courtyard spaces between the buildings feature trees, flowers, fountains and again natural stone accents. The featured glass tower and large windows provide interior office spaces with plenty of sunlight and further adds to the luxurious feel of the building. The architectural language of this building and others in the complex speaks to a tenant with a taste for high-end natural materials and well landscaped spaces.

The addition of a well landscaped green roof to Two Liberty Center would continue the architectural styling of the interior and existing exterior spaces of the building onto the roof and help integrate the building with the environment. The picture to the right illustrates the Liberty Center site, with Two Liberty Center in the bottom left corner. With trees lining the streets, heavy vegetation in the courtyards, and planters and swimming pools on the neighboring roof, a green roof on Two Liberty Center would tie together the site and communicate more of a community feel for this mixed-use complex.

Green Roof as a Benefit to the Owner

Since a green roof would fit so well with the architectural language of the Liberty Center complex, the owner should work with the architect to incorporate one into the design and reap the benefits of the modern green roof system. While energy savings for the building would prove beneficial to the tenants paying the utilities, most owners would not be inclined to pay for a green roof that does not benefit their own interests. However, there are some benefits of a green roof that would advantage the owner of Two Liberty Center.

The most direct benefit of the green roof to the owner is the reduction of future costs for roof repair and replacement. As mentioned earlier in this analysis, life spans of green roofs have been proven to nearly double those of more conventional materials and methods. Added durability of that magnitude would cut roof maintenance costs, which are the responsibility of the building owner, in half.

A less quantifiable, but equally valuable benefit to green roof addition for Two Liberty Center is the marketability of a rooftop garden environment. Distinct spaces, like the proposed green roof on Two Liberty Center have a marketability factor, especially when dealing with high class corporate tenants. Employee satisfaction with their working environment has shown to significantly increase productivity and job satisfaction. This marketability factor would allow the owners of Two Liberty Center to not only reduce their vacancy rates, but they could also increase the rent per square foot of office space without loosing tenant interest.

Conclusions

As an added architectural feature, a courtyard style green roof for Two Liberty Center would round off the architectural concept of the building and integrate it with the surrounding courtyards and neighboring buildings to complete the community of the mixed-use complex. Additional costs for this feature would be more than compensated for through maintenance savings and marketability to potential tenants.