Green Roof Construction

Overview

The green roof designed for the PPL Plaza covers approximately 11,600 SF, or approximately 34% of the total roof area. It is located above the 7th floor, with building occupant access from the 8th floor.

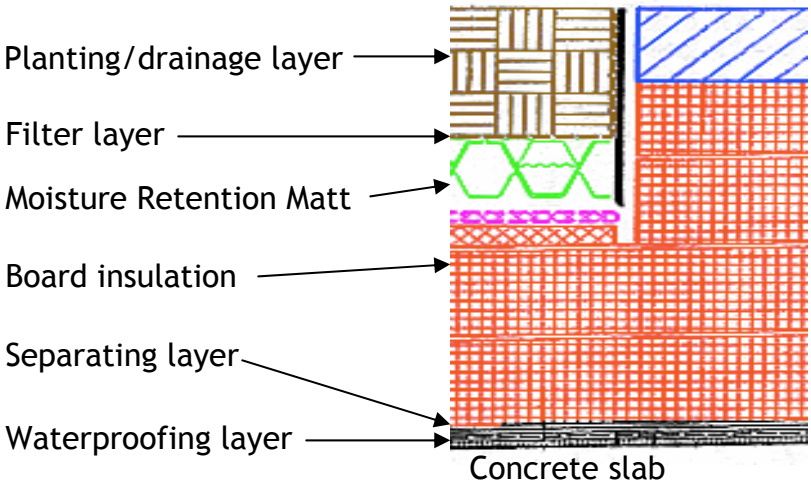
Green Roof Types

There are two basic types of green roofs, the extensive and the intensive. The intensive green roof is comprised of a thick growth medium and more traditional garden plants, such as lawn grass, shrubs and even large trees. The extensive green roof is primarily defined by a thin growth medium with a selection of hardy plants, usually grasses, flowers and other low vegetation.

While the intensive green roof is often designed for occupant access, the extensive is generally not. The intensive roof is designed to be tended in the same manner as a traditional garden, while the extensive variety is designed to require little to no maintenance once the plants are firmly established.

Green Roof Composition

The basic components of the Plaza green roof are the concrete slab, a waterproofing layer, a separating layer, board insulation, a moisture retention layer, a filter layer and the planting layer/drainage layer (combined for extensive insulations).



Installation Concerns

<u>Roof leakage</u>

The first and perhaps the most important concern with a green roof installation is that of roof leakage. A leaking roof is a large liability to any office building. For the Plaza, however, the resulting damage from a leaking roof is even greater due to the

high tech nature of the energy trading floors, one of which lies directly beneath the green roof.

The roof component most critical to protecting the interior of the building is the waterproofing layer. On the Plaza, first a surface conditioner is applied to the concrete slab. Hot applied water proofing follows, which is then coated in a protection course. To ensure that the waterproofing layer is watertight, it is important to test it for integrity. This is often done by flood testing the roof. It can also be done through the use of the electric field vector mapping technique (EFVM). This system, used extensively in Europe, is able to test waterproofing materials for pinhole sized defects. This system can not only be used for the initial testing, but can be used yearly to detect leaks before they become problematic.

Freeze/thaw cycle

The freeze thaw cycle has the potential to cause damage to a green roof installation. If properly designed, however, the risk of such damage should be very minimal. There are three places in a green roof system where water is stored. The most obvious of these are the plants themselves. Water is also retained in the growth medium (topsoil). Finally, the moisture retention matt, which is located just below the soil, is the only element designed to hold standing water. In a properly functioning installation, water that flows beyond these elements and reaches the waterproofing layer is drained away in the same fashion as a conventional roof, leaving no standing water to freeze. Therefore, even in the unlikely event that the moisture retention matt becomes damaged no further damage to the roof should result.

Excessive weight on structure

Because of the increased loads of a green roof, it is important to consider the loading on the structure. Because the Plaza was designed with a green roof in mind, this risk is not as great as for a retrofit project. Care must still be taken, however, to avoid overbearing the structure. Therefore, during construction, caution should be taken to ensure that soil is not placed in large piles but is adequately distributed over the roof.

Damage/Death of plants

The advantages of a green roof are largely derived from its plants. It is therefore imperative that the plant life survive. The Plaza's roof is designed as an extensive green roof. Therefore, although hardy and self sufficient plants are chosen, they still risk damage, especially while they are still becoming established.

Insufficient irrigation

As with any new plantings, a green roof must initially be kept watered until the plants have established themselves. If they are not properly irrigated before their root system is established they may die. Therefore, it is important that the owner is made properly aware of this need, and that the contractor is released from liability once the responsibility for maintenance of the plants is turned over to the owner.

Frost
While the plants on a green roof are being established, the potential for damage due to frost is increased. It is desirable to hold off the installation of the plants until spring or summer, allowing the foliage to become well established before experiencing the harshness of winter. When freezing temperatures are only expected at night, plastic should be sufficient as protection. Because the Plaza will be turned over during late spring, frost protection will be the responsibility of the contractor. Once the building is turned over to the owner, however, the contractor is to be released of any liability due to frost damage.

Trampling
The Plaza roof garden, as an extensive roof garden, is comprised of plants and growth medium which are not specifically designed to withstand foot traffic. It is designed, however, to allow occupants out onto this portion of the roof. This presents the possibility of the plants being trampled. Therefore, signs should be placed at all of the entrances to the garden informing people to stay off of the grasses. The contractor should be specifically exempted from liability for damages due to the trampling of the plantings.

Cost Impact
The initial cost impact of these preventative measures is negligible. Because the green roof is slated for construction during the late spring and early summer, costs associated with protection from the cold will be minimal. Also, the additional costs associated with the warning signage and the EFMV leek detection system are minor.

Schedule Impact
Each of these methods is either a replacement or a modification of another procedure already built into the schedule. Therefore, these preventative measures will not significantly affect either the green roof construction schedule or the overall project schedule.