

Defining Green Roofs: Response to Workshop Input and Recommendations

This section recommends a definition of a Green Roof for the purposes of a City policy, to ensure that City resources are directed as intended by the policy. It also revises the recommended criteria for Green Roofs for Toronto’s policy, based on the input of the workshop participants.

For the purposes of promoting, encouraging, or requiring green roofs, a definition of a green roof is needed. A green roof should include the following components: vegetation, growing medium, filter layer, drainage layer, root resistance layer (if necessary), and waterproof membrane. It is a system where the vegetated area becomes part of the roof.

Coverage

Criterion presented to workshop participants

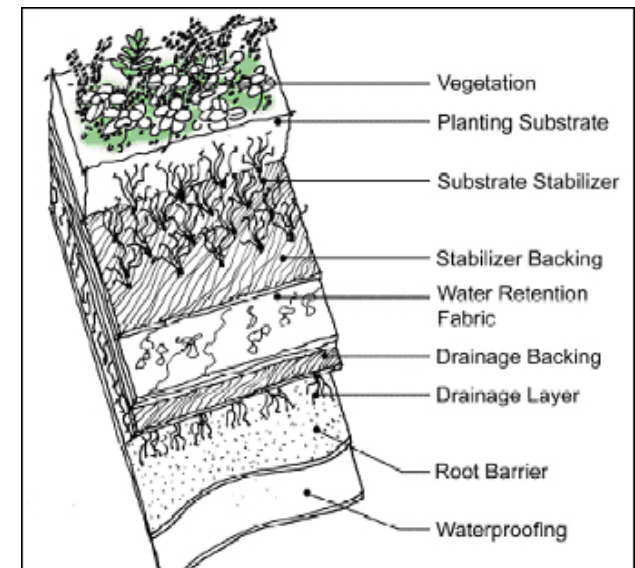
Extensive (passive) green roofs should have continuous coverage of growing media over at least 75% of the roof footprint of the building.

Discussion

The workshop participants have shown that 75% coverage of the roof footprint of the building is high for a minimum standard for a City policy. Such a high minimum requirement could discourage green roof development, particularly amongst retrofits, where structural limitations are common. Nevertheless, it is necessary to set a minimum standard for coverage because otherwise the administration of a green roof policy could become over-burdened by applications for roofs with very little coverage, which are unlikely to provide significant benefits.

It is recommended that a minimum standard of 50% coverage be used to consider a roof “green”. This standard is consistent with LEED, and would allow more buildings

Section FOUR



Xero Flor System cross section (adapted from Xero Flor Canada)



Mountain Equipment Co-op, 400 King St. West (50% rooftop coverage)
Source: Green Roofs for Healthy Cities
www.greenroofs.org



York University Computer Science Building's green roof (10% slope)
Source: Green Roofs for Healthy Cities
www.greenroofs.org

to qualify, while still encouraging a level of coverage that provides significant benefits. A sliding scale could be adopted to provide greater rewards for roofs with coverage greater than 50%.

Recommended Criterion

Green roofs should have continuous coverage of growing media over at least 50% of the roof footprint of the building.

Slope

Criterion presented to workshop participants

Green roofs should be installed over "flat roofs" (with a slope of up to 2%) as a priority. Where roofs are dead flat with zero slope, green roof systems should be designed to drain water away from the roof.

Discussion

It is recommended that Toronto's green roof policy focus initially on fairly flat roofs. Although pitched roofs can still provide many benefits, there are concerns about the practicality and safety of installing pitched green roofs, and this matter requires more study before it would be advisable to include pitched roofs in Toronto's green roof policy. Nevertheless, green roofs can be installed safely on gently sloped roofs. For example, York University's Computer Science building's green roof has a slope of 10%. At this time, 10% should be the upper limit for sloped green roofs in Toronto's policy.

Recommended Criterion

Green roofs should be installed over roofs with a slope of up to 10% as a priority. Where roofs are dead flat with zero slope, green roof systems should be designed to drain water away from the roof.

Runoff Coefficient

Criterion presented to workshop participants

The green roof system should have a maximum runoff coefficient of 40% based on annual average rainfall retention of 60% for Toronto conditions.

Discussion

The runoff coefficient of a green roof refers to the proportion of the water that falls on the roof that runs off the roof. Although the figure of 40% is based on the average rainfall retention of 60% for Toronto conditions, recent observations from green roof monitoring in Toronto have indicated that average rainfall retention for a green roof is more likely to be 50%-55%, and so a more practical runoff coefficient would be 50%. This coefficient is for the green roof system as a whole, rather than just the growing medium and vegetation. This would allow green roof designs that collect and store rainwater to irrigate the vegetation as necessary.

Recommended Criterion

The entire green roof system should have a maximum runoff coefficient of 50%.

Depth of Growing Medium

Criterion presented to workshop participants

In general and where possible, a green roof should have a depth of at least 150mm (6 inches) to permit flexibility in the type and variety of vegetation that can be incorporated, and to ensure greater survivability of plants. For retrofits of existing buildings, a structural analysis should be conducted to determine the thickness of growing media that can be accommodated. There is often flexibility for new buildings at the design stage with regard to the structural design.

A green roof with a growing medium thickness as low as 75 mm (3 inches) can provide some of the benefits of deeper roofs, and should be considered acceptable where structural loads on existing building would not permit a deeper green roof.



Stormwater Overflow





Manulife Centre, 44 Charles St West
(Intensive green roof, 4 feet deep)
www.greenroofs.org



215 Spadina Avenue
(Extensive green roof, 5 inches deep)
urbanspace PROPERTY Group

Manufacturers of such systems should be required to submit test data attesting to the performance of these systems with respect to water runoff.

Discussion

Workshop participants differed widely on the desirable minimum depth of the growing medium to allow the roof to be both effective and practical. Some participants suggested that if City's criteria were performance-based, it would not be necessary to stipulate the minimum depth of the growing medium.

A green roof depth of at least 150mm (6 inches) is ideal, because it is known that 150mm generally permits flexibility in the type and variety of vegetation that can be incorporated, and ensures greater plant survivability. However, green roofs with growing media of 80mm can still provide significant benefits and also allow more flexibility in application to retrofitted buildings. It is not clear that green roofs with a depth of less than 80mm could provide significant benefits or can ensure survivability of plants.

Since deeper green roofs are known to provide greater benefits than shallower green roofs – for example in reducing heat island effect and providing insulation for the building – a sliding scale could be adopted to provide greater rewards for roofs with depths greater than 80 mm.

Recommended Criterion

A green roof with a growing medium depth of at least 150mm (6 inches) is preferred, since it permits flexibility in the type and variety of vegetation that can be incorporated, and ensures greater survivability of plants. However, a growing medium depth of as low as 80mm is recognized to provide significant environmental benefits and allow greater flexibility for retrofitting existing buildings.

Qualifying Buildings

Criterion presented to workshop participants

Green roofs should be installed over air-conditioned spaces that are heated and cooled. Green roofs that are not installed over heated and cooled spaces (e.g. over underground parking garages) will not provide all the benefits. In general, green roofs should be excluded where public and/or vehicular access would be possible from the grade level.

Discussion

Excluding buildings that are not air conditioned would exclude a considerable proportion of buildings from the City's green roof policy unnecessarily, and limit opportunities for green roof development that could still provide significant environmental and social benefits (such as stormwater management and an alternative means for temperature moderation). However, it is recommended that the policy apply only to buildings that are heated, since this still includes the vast majority of buildings in the City, and would allow the policy to be focused where more benefits can be derived.

Although there are environmental and amenity benefits of greening roofs of structures that are at the grade level (such as underground parking garages), this greening is technically different and considerably easier than creating a green roof on a building above grade. Moreover, such greening can be accomplished through existing site plan requirements, and therefore it is unnecessary to include at-grade roofs in the City's green roof policy.

Recommended Criterion

Green roofs should be installed over buildings/structures that are heated. The amenity and stormwater benefits of green roofs on surfaces at grade are recognized, and they can be encouraged through parkland dedication and site plan requirements, but they should be excluded from any incentive program.



Green roof in Robson Square, Vancouver.
Photo courtesy of Terry Meyer, Associate Professor of
Architecture at the University of Waterloo



Green roof on Vancouver's Public Library.
Photo courtesy of Terry Meyer, Associate Professor
of Architecture at the University of Waterloo

Following Manufacturers' Instructions

Criterion presented to workshop participants

Green roof systems should be designed and installed according to manufacturers' recommendations.

Discussion

Many workshop participants were concerned that this criterion would “privilege” the recommendations of manufacturers of certain components of a green roof over the professional advice of a qualified green roof designer. It should be understood that the manufacturers of a green roof system include the professionals involved in designing the whole green roof. Therefore, designs should follow the recommendations of component manufacturers, as well as the recommendations of professional engineers, architects and horticulturalists with respect to the various components for which they are responsible.

Recommended Criterion

Green roof systems should be designed, installed, and maintained according to manufacturers' recommendations and designers' requirements.