GENERAL DESCRIPTION

Green roofs, also known as "green roofs" or "rooftop gardens", consist of a thin layer of vegetation and growing medium installed on top of a conventional flat or sloped roof. Green roofs are valued for their benefits to cities, as they improve energy efficiency, reduce urban heat island effects, and create green space for passive recreation or aesthetic enjoyment. They are also attractive for their water quality, water balance, and peak flow control benefits. The green roof adds to the roof structure, improves thermal performance, and extends the roof lifespan, energy savings, stormwater management requirements, and may be subject to a legally binding maintenance agreement. An incentive program may be offered to encourage property owners or managers to maintain existing practices.

CONSTRUCTION CONSIDERATIONS

An experienced professional green roof installer should be employed. The installer must work with the construction contractor to prepare the roof, waterproofing, and drainage systems. The green roof system must be installed in accordance with the manufacturer’s specifications. The waterproofing membrane installed is appropriate for use under a green roof assembly. Careful planning and coordination between the waterproofing installer and other tradespeople involved in the roof construction are required. Green roofs can be purchased as complete green roof systems from green roof system suppliers who distribute all the assembly components, including the waterproofing membrane. Alternatively, a green roof designer can design a customized green roof and specify suppliers for each component of the system.

SITE CONSIDERATIONS

Green roofs may be installed on existing roofs with slopes up to 10%. As a fire resistance measure, non-combustible materials should be used. The roof deck need to be sufficient to support the soil and plants of the green roof assembly, as well as the live load associated with maintenance staff accessing the roof. The green roof assembly weighing more than 80 kg per square meter, when saturated, requires consultation with a structural engineer. Green roofs may be installed on roofs with slopes up to 19%. As a fire resistance measure, non-combustible materials, such as stone or concrete, should be installed around all roof openings and at the base of all walls that contain openings.

HYDROLOGY


time for plant uptake; • A drainage system that consists of a porous medium capable of water storage for plant uptake; • A geomembrane that acts as the barrier between the waterproofing and the growing medium; • Soil with appropriate characteristics to support selected green roof plants. Plants with appropriate tolerance for harsh rooftop conditions and shallow rooting depths.

ABLE TO MEET SWM OBJECTIVES

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GENERAL SPECIFICATIONS

ASTM International released the following Green Roof standards in 2005:
- E2396-05 Standard Test Method for Saturated Water Permeability of Granular Drainage Media
- E2397-05 Standard Determination of Dead Loads and Live Loads associated with Green Roof Systems
- E2398-05 Standard test method for water capture and media retention of geocomposite drain layers for green roof systems
- E2399-05 Standard Test Method for Maximum Media Density for Dead Load Analysis of Green Roof Systems; and

OPERATION AND MAINTENANCE

Green roof maintenance is typically greatest in the first two years as plants become established. Plants should be monitored to ensure dense coverage. A warranty on the vegetation should be included in the construction contract.

Regular operation of a green roof includes irrigation and leak detection. Watering should be based on actual soil moisture conditions as plants are designed to be drought tolerant. Electronic leak detection systems should be installed on roofs with slopes up to 10%. As a fire resistance measure, non-combustible materials should be used to prevent roof damage.

Annual maintenance requirements from sections 2.4 and 2.11 of the 1997 Ontario Fire Code also require consideration.

COST

An analysis to determine cost effectiveness for a given site should include the roof lifespan, energy savings, stormwater management requirements, aesthetics, market value, tax, and other municipal incentives. It is recommended that green roofs can extend the life of a roof structure by as long as 20 years by reducing exposure of the materials to sun and precipitation. They can also reduce energy demand by as much as 75%.

ON PRIVATE PROPERTY

Property owners will need to be educated on their routine operation and maintenance needs, understand the long-term maintenance plan, and may be subject to a legally binding maintenance agreement. Careful planning and coordination between the green roof system supplier and other tradespeople involved in the roof construction are required. Green roofs can be purchased as complete green roof systems from green roof system suppliers who distribute all the assembly components, including the waterproofing membrane. Alternatively, a green roof designer can design a customized green roof and specify suppliers for each component of the system.

COMMON CONCERNS

- WATER DAMAGE TO ROOF: While failure of waterproofing elements may present a risk of water damage, a careful design process and testing in the laboratory will ensure that the entire system will be repaired. Leak detection systems can also be installed to minimize or prevent damage.
- VEGETATION MAINTENANCE: Extreme weather conditions can have an impact on plant survival. Appropriate maintenance and regular inspection to detect and treat disease and other disorder during the growing season. Application of fertilizers should not exceed 5 g of nitrogen per square metre.
- MODULAR SYSTEMS: Modular systems are a layer of vegetation in a growing medium that are prepared and grown off-site and placed on the roof for complete cover of the roof. Modular systems are flexible growing media structures, allowing them to be rolled out onto the green roof assembly. The advantage of these systems is that they can be removed for maintenance.

green roofs consist of a thinner growing medium layer (15 cm depth or less) with roofs contain greater than 15 cm depth of growing medium, can be planted with}

There are two types of green roofs: intensive and extensive. Intensive green roofs are required for buildings with spaces where the weight is not a significant factor. Extensive green roofs are required for buildings with spaces where the weight is a significant factor. Extensive green roofs can be planted with deep rooted plants and are designed to handle pedestrian traffic. Extensive green roofs are used on roofs that require cover in the wind or a protective layer. Green roof systems are designed to withstand the weight of the growing medium, roof structure, and live load when installed.

MODULAR SYSTEMS are trays of vegetation in a growing medium that are prepared and grown off-site and placed on the roof for complete cover. Modular systems are flexible growing media structures, allowing them to be rolled out onto the green roof assembly. The advantage of these systems is that they can be removed for maintenance.

modular systems are trays of vegetation in a growing medium that are prepared and grown off-site and placed on the roof for complete cover. modular systems are flexible growing media structures, allowing them to be rolled out onto the green roof assembly. the advantage of these systems is that they can be removed for maintenance. green rooftops are composed of:

- a roof structure capable of supporting the weight of a green roof system;
- a water management system to direct the building and roof structure; and
- a drainage layer that consists of a porous medium capable of water storage for plant uptake;
- a geomembrane that acts as the barrier between the waterproofing and the growing medium;
- soil with appropriate characteristics to support selected green roof plants. plants with appropriate tolerance for harsh rooftop conditions and shallow rooting depths.

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