Green Roof

Part 1  Introduction of Pamphlet

This pamphlet provides guidelines to the public, including headmasters of schools, with regard to the planning, design, construction and maintenance of green roof.

Part 2  Details and Community Benefits of Green Roof

Green roof is a vegetated space integral to the top of a man made structure. In Hong Kong, green roofs can be found on a podium deck, a “sky garden”, or at the top of a building. However, green roofs are not free-standing planters placed on top of a roof.

There are two types of green roof systems: “extensive” and “intensive”. Extensive green roof is also called an “Eco-roof”. It is created for ecological benefits – environmental benefits for the building, rather than recreational benefits of the building users (i.e. it is not made for public access). They are lighter, less expensive (minimal soil depth of 200 mm) and minimally maintained (plants are not kept to lush green appearance at all times). An example of an extensive green roof is given under Figure A below. On the other hand, intensive green roofs generally have greater weight and capital cost (with soil depths at least 1200 mm for tree planting), and are intensively maintained to produce a garden environment for the enjoyment of people. There are many examples of intensive green roofs in podium and sky gardens in Hong Kong (Figure B).

Figure A -- Extensive Green Roofs
The benefits of green roof are:

a. An increased vegetative space that attenuates the physical and psychological stress from living in a dense urban area, and gives visual relief against buildings.
b. An increased potential for enhanced biodiversity by being in themselves potential habitats for birds and insects, as well as “stepping stones” to nearby hillsides or parks.
c. Where green roofs are designed for public access, they can provide valuable recreational open space for people’s enjoyment.
d. At schools and institutions, green roofs can be an educational platform, where a wide range of natural sciences from elementary plant science to specialized taxonomy, ecology, and even aspects of medicine can be taught.
e. Reduce urban heat island effect through evapo-transpiration.
f. Reduce storm water run off.
g. Filter pollutants and CO₂ out of the air.
h. Filter pollutants and heavy metals out of rain water.
i. Reduce traffic and other sound pollution through sound absorption.
j. Increase roof life span by minimizing ultra-violet and temperature degradation on roof structures.
k. Reduce heating (by adding mass and thermal resistance value) and cooling (by evaporation cooling) loads on a building by providing insulation.

Part 3  Key Technical Issues

When creating a green roof, the first consideration is to establish the objectives of the green roof (e.g. is the green roof to be used for
environmental and green building benefits; or is it also accessible by, and to provide recreational amenities to, the people), and by inferring the objectives, to decide the green roof system – extensive or intensive – to be created. This decision has a direct bearing on the capital and long term investments to be committed. On the other hand, where green roofs are to be built on an existing structure, the review of the building capacity may limit the selection of extensive or intensive green roofs.

The following are technical issues to be considered:

a. Minimal green roof areas: the minimal green roof areas should be 2 m x 2 m to ensure the minimal green roof benefits are achieved.
b. Structural loading is heavily dependent on whether the building was built to withstand soil loading.
c. Wind loads have a greater effect on intensive green roofs where taller (e.g. trees) vegetation may be installed.
d. Fire protection is a concern with extensive green roofs where wilted grasses (an acceptable green roof characteristic) may impose fire hazards.
e. Protection against root penetration.
f. Protection against mechanical damage.
g. Protection against corrosion.
h. Integrity of joints and borders
i. Waterproofing
j. Water retention, storage and supply
k. Drainage capacity
l. Construction techniques and the use of proprietary products
m. Working layers: separation layer, protection layer, root barrier, drainage layer, filter layer, soil substrate
n. Vegetation species selection
o. Vegetation planting method
p. Completion, testing and monitory methods
q. Warranties and maintenance services of proprietary products
r. Recurrent maintenance regime
s. Erosion and run-off monitoring
t. Trafficable paved surfaces and other hard landscape amenities for intensive green roofs and associated loading

Part 4 Administrative Procedures

General

The client should first employ a landscape architect and/or an architect to
prepare a proposal with regard to the choice of green roof, technical requirements, building requirements, maintenance requirements, cost estimation and time schedule. The landscape architect may co-ordinate with a building professional to verify the building requirements.

The building requirements should be verified by a building professional such as an architect, structural engineer or building surveyor to consider the structural adequacy of the building or structure on which the green roof is constructed, any requirements for building alterations and the necessity of any statutory submission.

In case a submission to the Buildings Department is required, an Authorized Person and/or Registered Structural Engineer should be employed to prepare the plans and supervise the construction of building works.

For a green roof project in a school, approval by the Education Department may be required as well. Additional administrative rules imposed by ED with regard to appointment of an Authorized Person, and tendering procedures and appointment of a Registered Contractor should be followed.

Landscape Architect’s and/or Architect’s Proposal

The landscape architect’s and/or architect’s proposal should include the following:

a. landscaping issues, such as layout of landscape area, species of grass and plants, associated amenity features, and type and thickness of layers of soil
b. building issues, which include the filter layer, drainage layer, root barrier, waterproofing, light-weight fill and thermal insulating layer, and safety issues
c. maintenance requirements with regard to irrigation, inspections on plant health, inspections on drainage and waterproof, and electricity and lighting
d. cost estimation
e. time schedule

Building Consultant’s Report

a. approved building record, which includes accessibility of landscape area, structural loading previously allowed for, drainage provision, and fire protection requirements
b. structural and fire adequacy, with regard to loading induced by the new
proposal, load bearing capacity of existing building, structural and fire alteration required, and extra safety measures required

c. drainage and waterproofing requirement, such as supply of water for irrigation, waterproofing requirement, and drainage arrangement
d. requirements regarding submissions to relevant Government authorities

Submission to Buildings Department

a. Submission is required in case structural alteration, fire protection and/or means of escape are affected.
b. The plans should be prepared by an Authorized Person and/or Registered Structural Engineer. Construction is to be carried out by a Registered General Building Contractor and supervised by the AP/RSE.
c. The time for processing a new submission is 60 days, that for an amendment submission is 30 days, and that for consent to commence works is 28 days.
d. Details regarding the list of AP/RSE, retrieval of building record and procedures to obtain approval and consent to commence works can be obtained from the BD website.

Submission to Education Department

a. For school projects, submission to Education Department may be required.
b. Guidelines with regard to design, appointment of consultants and appointment of contractor should be followed.
c. Fund arrangement, regarding the new project and subsequent recurrent expenses, should be endorsed before commencement of works.

Useful Information

b. BD website (regarding new building works, and alterations and additions works): www.bd.gov.hk
c. ED website: www.ed.gov.hk
d. Hong Kong Institute of Landscape Architects www.hkila.com
e. American Society of Landscape Architects http://land.asla.org/050205/greenroofcentral.html