Brown Roofs

DEFINITIONS. DESIGN CRITIERIA. SPECIFICATION

DEFINITIONS

The term 'Green Roof' refers to a waterproofing layer with a covering of plants. The plants are supported by a number of layers on top of the waterproofed surface that could include all or some of the following:

1. Protection layers. It is vital that the waterproofing layer is protected from damage.
2. Drainage layer. Ensuring that water can move laterally across the roof is important for both the plant layer and the integrity of the waterproofing. The drainage layer may also have some retention capacity to improve plant growth.
3. Filter layer. Ensures water can reach the drainage layer whilst protecting the drainage layer from blockage.
4. Substrate layer. Growing medium formulated to requirements of site and plant layer.
5. Plant layer.

Green roofs can be split essentially into two types:

Intensive

Deep layers. Heavy system (300kg per sqm+). Suitable for flat roofs only. Suitable for lawns, herbaceous perennials, shrubs and trees. System design and construction with little or no regard for roof environment. High maintenance. Requirement for irrigation. Can be used for recreation purposes. Environmental benefits but also environmental costs with regards increased structural support requirement and maintenance resources.

Extensive

Thin layers. Lightweight (typically 90+kg per sqm). Suitable for flat and pitched roofs. Suitable for retrofitting. System and plants selected to flourish on the roof with minimum intervention at construction and development stages. Naturalistic planting schemes. Low maintenance. No requirement for irrigation once established. Environmental benefits with minimal environmental cost with regard to structural support requirement and maintenance resources.

The term 'Brown Roof' originated in the UK to highlight the failings of some extensive green roof installations. As part of the Kyoto agreement, support for biodiversity within the built environment was a key objective. This has been largely ignored within the construction industry. Where green roofs have been considered the systems specified and finally installed can be more tuned to fitting seamlessly within the construction process rather than providing long term environmental benefit and support for local species. Thin layer, substrate free green roof systems are particularly poor performers with regards these characteristics. 'Brown' roofs are essentially substrate based green roofs with an emphasis on design aimed at reinstating the ecology that was present prior to development. Within built up areas that ecology is often only present on brownfield sites. In spite of being only isolated remnants, brownfield sites are often species rich. Unfortunately, the ecological importance of brownfield sites has generally little impact because of the following:

- High economic value of the site. The pressure to re-develop brown field sites is intense.
- Education. To the general public a brownfield site looks less like a species rich island of indigenous biodiversity and more like a wasteland that needs tidying up.

The term 'Brown Roof' was coined to address the following:

- Differentiate between inadequate substrate free pre grown vegetation blanket style extensive green roof coverings and substrate based systems that do encourage local biodiversity to use roof space as permanent or transient habitat.
- Raise the profile of brown field sites as valuable ecological reserves that should be protected, included or replicated as part of the development of our densely populated areas.

It should be noted that 'brown' and 'green' roofs are not mutually exclusive - a 'brown' roof is simply a 'green' roof with key design critieria. 'Brown' or 'green' specifications should result in naturalistic, environmentally relevant installations with dynamic and long term performance. Ideally, these installations should be multifaceted and should aspire to provide variance across the roof area – particularly for large projects. This may be a battle as within the construction process, variation and complexity can be viewed as risk and expense. It is key that at the specification stage the core values of the roof covering are protected

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BROWN ROOFS. KEY CRITIERIA

Fundamentally, a brown roof aims to reinstate habitat conducive to local species on the roof. These species would include:

1. Plants
2. Insects
3. Birds

Design criteria:

1. Assessment of site (ground level): Soil type(s). Species present. Species not present but supportable.
2. Assessment of structural capacity of roofing elements and building.
3. Inclusion in the brown roof specification of measures compatible with site ecology.
4. Selection of waterproofing material and design of roof.
5. Design of brown roof build up to include: Measures to support local biodiversity. Protection of waterproofing integrity. Maintenance of roof performance (insulation performance, drainage, access to roof surface).
6. Monitoring of roof development following installation and feedback into design process.

The general philosophy is that components should be selected and included that will create 'ground' conditions on the roof that are as close as possible to those of the undeveloped site. The roof substrate should be constructed using mineral/aggregate material. This material should ideally have an association with the site. The material should be well drained and have a low nutrient status. Where insufficient appropriate mineral/aggregate material is available the pragmatic response will be the formulation of a substrate layer composed of transported in materials and site sub soil as a blinding layer. Further measures that can then be taken include:

1. Rested site sub soil. Inclusion of site soil that has been allowed to rest on site during development will allow the colonisation of that sub soil with site specific micro-organisms, plants and invertebrates.
2. Variation in installed substrate depth. Variation in system depth will affect diurnal temperature within the substrate profile and water content. This diversity of substrate conditions will encourage localised variation in species across the roof.
3. Inclusion/omission of drainage layer. Localised ponding areas on the roof are beneficial for the encouragement of biodiversity.
4. Provenancing of local/site plant material. Collection. Propagation. Reintroduction by plug plant or seed.
5. Dry seeding with appropriate seed mixes.
6. Shelter stones. Large flat locally sourced stones placed on the roof will provide shelter points for invertebrate species.
7. Dead native timber laid on substrate surface. Timber will provide perching points for birds and also food/shelter points for invertebrate species.

Please note that with regards the whole process of brown roof design we would advise the following are critical:

- Make all involved parties fully aware of the drivers and expected finished appearance of the brown roof. The brown roof may have valuable environmental benefits, however, the finished and developing aesthetic element can be challenging to the uninitiated.
- Create context with the local residents/end users. Information on how the built environment is limiting our natural environment, limitations of standard landscaping as to support for native species, ongoing information as to ecological performance of **their** brown roof over time.

By this point it should be appreciated that specification for brown roof build ups are driven by site requirements, site materials and building structural capacity. Any generic specifications should therefore be viewed as a start point. With this in mind the following is a sample specification for a 'Brown' roof type build up as part of an inverted roof project:

SAMPLE SPECIFICATION. BROWN ROOF. WARM ROOF CONSTRUCTION

This specification assumes that the waterproofing material is manufacturer guaranteed against root penetration and bacterial degradation. This specification includes the supply and fitting of all components above the waterproofing layer by BHC

1. 500g per sqm protection and moisture retention fleece. Loose laid with minimum of 150mm overlaps.
2. 25mm drainage layer with integral filter fleece. Loose laid, close butted with minimum 100mm overlaps in filter fleece. Drainage layer omitted locally in build up to increase diversity of habitat created.
3. 500g per sqm geotextile upstand protection fleece. Loose laid with minimum 200mm overlaps onto the filter protected drainage layer. Fleece to extend up any upstands to at least 25mm above the finished substrate level (BHC 500PMM).

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4. Substrate consisting of local aggregate, recycled build materials, mineral, organic and inorganic components sourced to BHC specification (50-100mm consolidated depth). Materials screened to ensure no metal or sharps content. Particle size in the range 0 –150mm. Substrate applied as all in mix and locally as particle size ranges.
5. Vegetation breaks to roof perimeter, penetrations and erosion susceptible areas (300mm wide, 20-40mm rounded pebble in fill) separated from substrate system by 150g per sqm UV resistant filter fleece.
6. Substrate layer mounded so that contours flow evenly into surrounding planting pattern.
7. As appropriate apply blinding layer of 5-20mm (site sourced) sub/top soil to installed substrate.
8. Install appropriate lying organic matter and locally sourced shelter stones appropriate to native species.
9. Apply dry grassland wild flower seed mix locally at a density of 0-5g per sqm

Built up height of system (waterproofing to substrate surface): Mean 100mm. Range 55mm-125mm.

Saturated weight**:** Dependent upon constituent elements. Typical mean 124kg per sqm. Typical range 88-160kg per sqm. To be confirmed against final materials

Plant cover at installation: None. System to be allowed to colonise naturally and through germination and growth of applied seed.

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