The Green Roof Organisation (GRO)

‘Excellence in Green Roofs’



Guidelines to Green Roofing

GRO is a partnership of Industry and Stakeholders coming together to develop guidance for specification, design, manufacturing, installation and maintenance of Green Roofs

Green Roof Organisation (GRO)

Formed as an independent body representing the industry Trade Associations and the key players in the Green Roof Market.

GRO has 3 principal objectives

- **Promote the Green Roof concept**
- **Provide suitable guidelines to manufacturers and installers**
- **Recognise and promote correctly trained roofing companies**

Guidelines for Planning, Installation & Maintenance of Green Roofs

Green roofs technology is becoming increasingly used in the built environment for a number of wide ranging benefits. In London and Sheffield there are now distinct policies to increase the uptake of green roofs and therefore there is a need for guidelines to help consultants, specifiers, suppliers, installers and building owners to understand why and what are green roofs and how they should be installed and maintained.

Green Roof Benefits

Reduction of Urban Heat Island - Research in Tyndale Centre for climate change suggests we need a 10% increase in green space in our cities to combat climate change. This is particularly relevant to the reduction in the Urban Heat Island [UHIE]. Green roofs are recognized to have a positive effect on reducing the UHIE.

Biodiversity - Green roofs can provide important refuges for wildlife in urban areas. Research in Switzerland and the UK has demonstrated that green roofs can provide important refuges for rare invertebrate populations.

Water - Green roofs can significantly reduce the surface run off volumes and rates of rainfall leaving roofs. As a source control mechanism in the Sustainable Urban Drainage System green roofs can help reduce flash floods as a consequence of intense rainfall events. This will become increasingly important as a consequence of climate change.
Green roofs also improve the quality of water and although the amount of water is reduced it is possible to rainfall harvest from roofs that have been greened.

Thermal Performance - Green roofs cannot be given a U-value at present. However they have been shown to significantly reduce the need for air conditioning in summer and can provide a degree of insulation in winter.

Sound Insulation - The combination of soil, plants and trapped layers of air within green roof systems can act as a sound insulation barrier. Sound waves are absorbed, reflected or deflected. The growing medium tends to block lower sound frequencies whilst the plants block higher frequencies.

Protection of waterproofing - The original green roofs in Germany stem from covering wet bitumen with 6cm of sand, which became vegetated. This covering was to protect the wet bitumen from fire. Green roofs have now been shown to double if not triple the life of waterproofing membranes beneath the green roof.

Air Quality - airborne particles and pollutants are filtered from the atmosphere by the substrates and vegetation on a green roof.

Amenity Space - in dense urban environments there is often a lack of green space for residents. Roof Gardens and roof top parks provide important green spaces to improve the quality of life for urban residents.

Natural Daylight - people working inside the building also require a good working environment. Green roofs designed with 15% rooflights and coupled with automatic controlled artificial lighting inside the building, will considerably reduce the carbon footprint of the building and provide a pleasant working environment. Note; that all rooflights can be designed to be non fragile but should be sited or designed so as not to walk on them.

For more information: www.livingroofs.org

The Guidelines

(1) Introduction:

How does one set about planning, specifying, installing and maintaining a green roof, which is going to flourish rather than subsist?

To date there are no British Standards to guide Specifiers, Contractors, and their clients as to the best method to achieve this.
At present the most widely accepted standard amongst the leading green roof suppliers in the UK, is the German FLL standards (Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau).

Translated – The landscaping and landscape Development Research Society. This charitable foundation has set out guidelines, which cover:

- *Distinguishing between types of landscape - Intensive; Semi Intensive; Extensive; Brown/Biodiversity and the factors which are going to affect the flourishing of each type of landscape i.e. site conditions for the vegetation; weather dependant factors; structure dependant factors; and plant dependant factors etc.*

- *Root barriers - types and tests etc.*

- *Drainage layers - flow rates, water storage capacity etc.*

- *Growing Mediums - their porosity, weight, structure, water permeability, Carbonate and salt content. Nutrient capacity & pH value.*

- *Plant and vegetation requirements.*

- *Planting, cultivation & maintenance - dry seeding, wet seeding, hydro seeding, Sedum mats & Turf laying; Readiness for handover, post installation maintenance.*

- *Wind Loads - preventing wind erosion.*

- *Independent testing of products to ensure standards are maintained.*

In Germany and increasingly in the UK experience shows that if a green roof is specified, installed and maintained to the FLL guidelines the landscape will flourish. If the system becomes a "mix & match" for economic reasons en route from the specification – tender – installation stage in it will almost certainly not flourish, and will be a disappointment to the client.

(2) Specifying a Green Roof:

Before seeking advice on specifying a green roof it pays to arm oneself with some basic knowledge on the subject:

Planning a Green Roof:

There a number of fundamental principles which apply to any type of green roof system and its successful installation, whatever the proposed landscape and its locality or climate.

Vapour Control Layers:

When specifying a roof construction below a green roofing system the minimum performance requirements of the vapour control layer needs to be considered and calculated. The presence of water above the roof waterproofing membrane affects the rate at which internal moisture vapour is transmitted through the roofing system. If a vapour control layer with a low resistivity is used the vapour drive could be negative, resulting in internal condensation and poor thermal performance.

Health and Safety:

It should be noted that the CDM regulations place a legal responsibility on Clients and Designers to take into account the fact that a building must be designed to be constructed, maintained, altered and demolished safely. GRO, as part of its commitment to safe practice, strongly recommends that all those involved in the process take note of these responsibilities.

Waterproofing:

The waterproofing system beneath any green roof MUST be root resistant in the long term preferably to the German FLL standards. If the waterproofing is not root resistant then the green roof system must include a root barrier. The installation of the waterproofing and its

detailing to perimeters, outlets, protrusions through the roof etc., MUST take into account the depth of the green roof build up. The waterproofing should always be 150mm above soil level at internal upstands and protrusions, and at least 50mm at external perimeters. The waterproofing system must be leak tested and certified as such IMMEDIATELY before the installation of the green roof.

Green Roof System:

No matter what species of plants are specified, for them to flourish the green roof system **MUST** provide them with:

- Moisture
- Drainage
- Aeration to the plants root systems
- Nutrients

To achieve this, a successful system must basically replicate nature but within a very compressed build up. The build up should ideally consist of:

- Moisture retention/protection layer
- Drainage layer
- Filter layer
- Manufactured/Recycled Growing medium
- Appropriate components i.e. outlet inspection chambers etc. The type, size, and design of each layer will depend on the proposed vegetation; as will the need or otherwise for irrigation
- In the absence of a British Standard, green roof systems should conform to the German FLL standards. This standard is generally recognised as the benchmark for green roof quality, certainly within Europe

Biodiversity:

In the UK, there is an increasing need to provide specific biodiversity benefits from extensive and intensive green roof applications. It is possible

to ‘replicate’ habitat characteristics at roof level using commercial based substrates. In general the substrate that is supplied should support both the plants required, whilst not compromising the other benefits, in particular water storage and reduction in run off rates.

It is recommended that a commercial green roof substrate in line with the FLL approach be used.

Loading Weight:

It is fundamental that the saturated weight of the proposed green roof system is obtained and the information given to the client’s representative for issuing to the structural engineer. A reputable manufacturer/supplier of green roof systems will be able to supply product data sheets on each of the components comprising any particular green roof build up.

Installation:

Contractors who have been fully trained in their installation should only install green roof systems. It is COMPLETELY different to the installation of landscapes over natural ground.

Maintenance:

Client’s representatives are strongly advised to include the cost of post installation maintenance within the tender documents for an agreed period of time. This would ensure that the green roof is handed over in a healthy condition.

Warranties/Guarantees:

Companies who offer warranties/guarantees which cover the products and the contractors workmanship provide reassurance to the client. Additionally any design liability offered by the manufacturer/supplier of the green roof system underlines that provider’s commitment to the suitability of the system installed.
Before seeking advice:-

1. Decide exactly what landscape you & your client want – is it a low maintenance Extensive landscape? Intensive for recreational use? Ecological landscape to encourage wild life? Or some other?

2. What maintenance cost is the client prepared to pay for? Remember low maintenance does NOT mean NO maintenance! Even an Ecological landscape will require a twice-yearly inspection.

3. Be able to provide answers to structural questions from the Green Roof manufacturer/supplier such as, height, size and exposure of the roof, which direction is the roof facing, any loading restrictions, and in the case of large roofs, construction programme constraints, site access etc.

4. Have some idea, however vague, of the client's budget for the roofing package.

5. Does the client REALLY want a guarantee/warranty, which is insurance backed? And does he want it to cover the WHOLE package of waterproofing, insulation, and green roof system? And from a single source? Or will he back down under "value engineering" alternatives that inevitably come from the main contractor?

These points seem obvious but it is amazing how often they are glossed over – often resulting in tenders coming in over budget with the resultant "value engineering exercise" which can compromise the quality of the green roof products and their installation.

Choosing a Manufacturer / Supplier:

A manufacturer/supplier should be able offer the clients representative the following:

- The complete system build up of Waterproofing; insulation; green roof system including the growing medium and in the case of Extensive roofs the plants.

- The green roof components including the growing medium should conform to the German FLL standards.

- Provide detailed specifications including detail drawings if required.

- Provide an accurate budget price to the clients quantity surveyor for the cost of supplying & installing the complete system.

- Provide loading weights of all components within the proposed system to the client's structural engineers.

- Product data on their components and their performance, such as flow rates on drainage layers etc.

- Provide growing medium that conforms to the proven German FLL standards suitable to support the plants specified.

- Provide advice on plant options.

- Provide a list of approved contractors trained to install the system specified.

- On site assistance by trained members of staff to ensure standards of workmanship are maintained.

- A single source company/warranty/guarantee to cover the products workmanship. Ideally backed by design liability.

- Provide evidence of a successful track record within the UK of projects completed, which can be inspected by the prospective clients representative.

(3) Post Installation Maintenance:

Every type of Green Roof system will require maintenance in some form or another, (a) initially for a period following the installation of the plants, and (b) ongoing maintenance to keep the green roof flourishing.

The specifier should seriously consider including in the tender documents the following paragraph or similar:

"*Provision must be made by the contractor to include in his tender price, the cost of post installation maintenance for a period of two years, in order that a healthy green roof is handed over to the client*"

Following hand over, the client is strongly advised to make arrangements for continuing the maintenance regime.
A suggested post installation regime could be:

(a) Extensive Green Roof

This should consist of a minimum of two visits per year by the appropriate labour force, which will be dictated by the roof area. No irrigation will be required once the plant layer is established. Procedures carried out in the first twelve months could include the following:-

1. Removal of unwanted plant material

2. Correction of any localised plant system problems

3. Replacement of any failed plants exceeding 5% of total plants installed

4. Application of nutrients

5. Removal of dead flower heads (if required)

6. Checks on outlets and drainage

7. Replenishment of any areas of settled substrate

Points **2**, **3** and **7** are generally confined to year one. Subsequent years will see maintenance requirements reduce as the plant system establishes. At the end of year two we would recommend that the client consider negotiating a continuing programme of maintenance with the contractor on the basis that they will be familiar with what is required to maintain a healthy plant regime.

(b) Intensive Green Roof

The visits required to carry out maintenance will be dictated by the species of vegetation planted, and their irrigation and nutrient requirements. Procedures carried out in the first twelve months could include the following:-

1. Removal of unwanted plant material

2. Correction of any localised plant system problems

3. Replacement of any failed plants exceeding 5% of total plants installed

4. Application of nutrients

5. Pruning, mowing & removal of dead vegetation

6. Apply required irrigation in accordance with each plants requirements

7. Replenishment of any areas of settled substrate.

Points **2**, **3**, and **7** are generally confined to year one. Ongoing maintenance will be dictated by the requirements of the species of vegetation planted. At the end of the post installation period we would recommend that the clients considers negotiating a continuing programme of maintenance with the contractor on the basis that they will be familiar with what is required to maintain a healthy plant regime.

Finally having taken the plunge and specified a Green Roof after taking everything into consideration there is one rule that should be remembered by all concerned and is especially relevant to the client getting a flourishing green roof!

"It's unwise to pay too much, but it is worse to pay too little. When you pay too much you lose a little money – that is all. When you pay too little you sometimes lose everything, because the thing you bought was incapable of doing the things it was bought to do. The common law of business balance prohibits paying a little and getting a lot. It can't be done if you deal with the lowest bidder, it is well to add something for the risk you run, and if you do that you will have enough to pay for something better"
John Ruskin 1819-1906

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