

# Green Roof Cost-Benefits Research Facts & Figures

## Thermal Properties of Green Roofs

Research by Nottingham Trent University has shown the following:

### Heat reduction under a green roof

Mean daily temperature	18.4°C
Temperature beneath membrane standard roof	32.0°C
Temperature beneath membrane green	17.1°C

### Heat reduction on the roof surface

Mean daily temperature	18.4°C
Roof surface temperature	32°C
Green roof temperature	15°C

### Winter heat loss reduction (less when saturated)

Mean Temperature	0.0°C
Temperature under membrane standard roof	0.2°C
Temperature under membrane green roof	4.7°C

### Comparative loadings for saturated weights

Gravel Surface (used on inverted roofs)	90 - 150 Kg/m <sup>2</sup>
Paving slabs (used on inverted roofs)	160 - 220 Kg/m <sup>2</sup>
Vehicle Surface	From 550 Kg/m <sup>2</sup>
Extensive Green roof	60 - 150 Kg/m <sup>2</sup>
Intensive green Roof	200 - 500 Kg/m <sup>2</sup>

### Sound Insulation Qualities

A study by Kalzip [www.kalzip.co.uk] compared sound insulation of their standard unvegetated roof system with that of the Kalzip vegetated 'Nature Roof':

Standard unvegetated	33dB
Vegetated [dry]	41dB
Vegetated [wet]	51dB
100mm Concrete Wall	43dB

The reduction in levels is sufficient to provide noise insulation to buildings under aircraft flight paths.

### Water Retention Properties

In summer green roofs can retain 70-80% of rainfall and in winter they retain between 25-40%. A study in Germany has shown that during a 10mm rainstorm, 200 litres of rainwater fell on an 18m<sup>2</sup> extensive green roof and only 15 litres actually passed from the roof to the ground.

## GREEN ROOF FACTS

- Professional green roofs must be and are watertight and structurally tenable.
- Green roofs increasingly feature in new developments.
- Green roofs can speed up the planning process, extend the life of the roof and deliver cost savings over time.
- Green roofs must be installed on top of a completely waterproof system.
- Green roofs are not just untidy turf. They can be roof gardens, parks, biodiversity habitats or just good to look at.
- Green roofs are most commonly installed on flat roofs but can be used on other roof types.

### Information

www.livingroofs.org - the first independent/not for profit organisation in the UK promoting green roofs in regeneration.  
www.greenroofs.ca - green roofs for Healthy Cities  
www.greenroofs.com - Atlanta based green roof website  
www.greenroof.se - the International Green Roof Institute's website

### Advice

www.livingroofs.org - see above  
Ecology Consultancy Ltd - www.ecologyconsultancy.co.uk  
Archetype Ltd - www.archetype.org.uk  
Blackdown Horticultural - www.greenroof.co.uk  
Ecoschemes Ltd - gary.grant@ecoschemes.com

### Green Roof Suppliers

Alumasc-Exteriors Ltd - www.alumasc-exterior.co.uk  
Blackdown Horticultural - www.greenroof.co.uk  
Erisco Bauder - www.erisco-bauder.co.uk  
Miller Roofing - www.miller-roofscapes.co.uk  
Sarnafil - www.sarnafil.co.uk

There are a number of other companies that can supply green roofs. Although there is no code of practice for green roofs in the UK, the above are known to follow guidelines as laid out by German FSL or Swiss guidance and most produce a complete system as opposed to buying in various elements. These companies are said to be the leading green roof suppliers in the UK.

The information in this leaflet has been reproduced from a report on the Costs and Benefits of Green Roofs prepared for Sustainable Eastside by Livingroofs.org in association with Ecologyconsultancy

## Sustainable Eastside

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# Sustainable Eastside

## Advice Note No.1

green Roofs - the facts & figures by

livingroofs.org in association with Ecologyconsultancy



### A - Sedum Mats

Retail Unit - Canary Wharf G.Kadas

Sedum Mat System



### B - Substrate based roof

Exhibition Hall, Basel Switzerland D Gedge

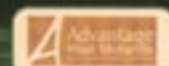
Extensive Hydro Seeded



### C - Green/Brown roofs for biodiversity

Hospital, Basel Switzerland D Gedge

Green System for Biodiversity



# Green Roof Cost

## Benefits in a Nutshell

- Green roofs installed for biodiversity reasons can help reduce delays in the planning process
- Green roofs can double the life of a roof
- Green roofs can slow down the rate of rainfall runoff, act as part of a sustainable urban drainage system and reduce the risk of low to medium term flooding
- Installation of green roofs can reduce the requirement for downpipes, installation of heating and cooling plant; reducing capital expenditure on these items
- Thermal insulation properties of green roofs can reduce on-going energy use for cooling systems and CO2 emissions
- Green roofs can help to reduce the production of ozone by reducing the heat island effect and improve air quality by absorbing airborne particles
- Green roof designs range from ornate gardens with intensive management, to limited access biodiversity rich amenity areas requiring minimal maintenance
- Green roofs designed for biodiversity benefit can pre-empt complex negotiations by providing the mitigation required as part of a development
- Use of recycled aggregates from site as growing mediums can help meet waste reduction targets
- The success of a green roof depends on the quality of installation and the appropriateness of design for the site. Installation costs are increased by failure to detail existing vents, glass roofs etc at design stage. Costs can be decreased by programming green roof installation whilst cranes etc are still on site.
- Green roofs are likely to add to the installation cost of a conventional roof but this does not take into account SAVINGS on installation of other capital equipment, REDUCED DEPRECIATION of roofing materials, REDUCED REVENUE COSTS for heating/cooling plant or ADDED BENEFITS from visual amenity, public access and biodiversity enhancement...



Detail of Roof of Cannon Street Station, London [M. Frith]

Green roofs fall in to two general categories: intensive and extensive. (In between these two generic types there are a number of other green roof solutions including semi-intensive and semi-extensive.)

### Intensive green roofs

Intensive green roofs have a deep growing medium, which allows the use of trees and shrubs. Some city parks are in fact intensive green roofs, such as the parks within the Canary Wharf Estate at Canada Square and West Ferry Circus, and the roof of Cannon Street Station in London.



Canary Wharf G. Kadas

The depth of the growing medium places extra loading requirements on the building structure and requires a complex irrigation system for maintenance.

### Extensive Green Roofs

Extensive green roofs have a thin growing medium and require minimal maintenance, and in general do not require irrigation [some require irrigation initially]. They are generally less costly to install than Lille Road, Fulham,

Lille Road, Fulham, London SW6 M Frith



Waitrose - Canary Wharf G. Kadas



## Factors affecting cost

Costs for green roofs are notoriously difficult to assess, as there are a number of factors affecting price per metre. These are:

### Size of roof.

There is an economy of scale here as small roofs can be very expensive. Biodiversity roofs = £20+/m<sup>2</sup>. Sedum roofs = £60+/m<sup>2</sup>. A small roof in the centre of London cost £185/m<sup>2</sup>. The larger the area the cheaper the roof will cost.

### Height of the roof.

This will affect the price in terms of the cost of raising the elements to roof level Type of green roof required. Roofs designed for biodiversity may well be cheaper as they will generally be seeded with an appropriate seed mix or allowed to establish their vegetation through natural processes.

### Initial maintenance and establishment costs.

Though sedum plug planted systems can cost less per m<sup>2</sup> there will be an extra cost over the first 2 years due to the need for irrigation and weeding etc.

### Type of waterproofing and insulation used.

A difference in labour costs can result from the type of waterproofing system used. Other factors. Roof elements that intrude above the roof such as outlets, roof lights and industrial plant and access hatches and safety lines can lead to increase in price per metre squared.

### Involvement of manufacturers and contractors.

Green roofs are often inaccurately priced as suppliers and contractors are not given detailed plans at an early stage or the roof has already been structurally designed. This can limit which system can be applied and therefore can increase cost.

### Installation methods.

There is often a need to ensure that installation is properly supervised and monitored to ensure that specific design and specifications are followed.

There are 3 types of extensive green roofs currently used in the UK: (see front cover for details)

A. Sedum mats - sedum cuttings are sprinkled onto 2cm of growing medium laid on a base layer of polyester, hessian or porous polythene. The cuttings grow into the substrate to maturity. When harvested, the sedum blanket is rolled up from the carrier upwards and delivered to site. When installed, the sedum blanket (including the 2cm growing medium) is rolled out onto either 5-7cm of growing medium (standard method) or direct onto a moisture retention blanket (ultra lightweight method).

B. Substrate based roof - 7cm of crushed recycled brick is placed on the green roof system and plug planted with sedums or with sedum mats applied. These are cheaper than sedum mat roofs and more beneficial for wildlife.

C. Green/Brown roofs for biodiversity - these are similar to substrate based roofs but can, in some case, use recycled aggregate from site and are generally left to colonise naturally or are seeded with an annual wildflower mix or local seed source.