

Dear reader,

Reliable and lasting green roofs are based on high quality materials, professional planning and installation as well as state of the art technology. However, regulations and standards which are applicable to green roofs are quite rare. The present newsletter features an overview of the German "Guideline for the Planning, Execution and Upkeep of Green Roof sites", which has served as reference for many countries. Another cutting edge topic is the use of plants for air pollution control. Although the method of Phytoremediation is still at the outset it offers great potential in the future. The quality of life for the urban population correlates strongly with the number of green spaces in downtown areas.

So, read on and find out what is affecting your quality of life!

Aart Veerman
President IGRA

Contents

The German FLL-Guideline for the Planning, Execution and Upkeep of Green Roof Sites – a review

Phytoremediation: Special advantages of using plants to reduce air pollution

Financial District "Banco de Santander" in Madrid, Spain – The largest Green Roof worldwide

National Green Roof Conference in Sheffield: What can Green Roofs Do for You

New Books:
Roof Gardens/Jardins Suspendus/Daktuinen

Preview

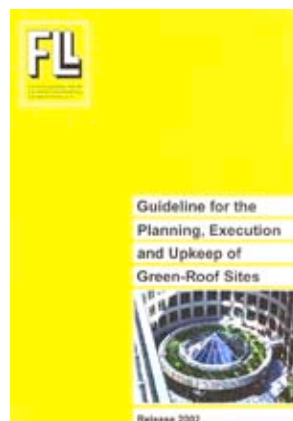
The FLL Guideline:

Planning, Execution and Upkeep of Green Roof Sites

In the last 25 years, the Landscaping and Landscape Development Research Society (FLL) has played a decisive role in setting standards for green roof technology in Germany. The guideline has proven to be instrumental for decision-making as well as a basis for discussion among green roof experts.

History

Modern green roof technology within Germany was developed at the beginning of the 1970s. The first green roof activities were supported by the growing number of private and public flat roof buildings being constructed. However, due to improper installation the popularity of the green roof idea struggled. As a result, the need for regulations, standards and quality criteria became apparent. In 1982 the research group "vegetation technology for green areas within urban centers" of the Landscaping and Landscape Development Research Society (FLL) published the basic "Principles of Roof Greening Sites".



These first regulations already differentiated between extensive and intensive green roof types; however, the majority of the information was based on intensive green roofs. The knowledge regarding extensive green roofs was limited at that time and the number of installed extensive green roofs was quite rare. The breakthrough of extensive green roofs in the early 1980s was based on the environmental movement in Germany, which created a demand of "more nature on the roof" and a desire for "green instead of gravel".

In order to promote expertise the German "Ministry of Planning, Building Construction and Urban Areas" gave the FLL the responsibility of researching cost effective methods for extensive and simple intensive green roofs. The results of this study were published in 1990 by the FLL as the "Guideline for the Planning, Execution and Upkeep of Green Roof Sites". Detailed specifications were provided for both extensive and intensive green roofs and were included equally in the guideline.



Trial containers for the root penetration test.

Contents

The guideline was revised in 1995 and 2002 and updated to incorporate the current level of technology. The regulations are now widely accepted technical standards and are regularly referred to by the German DIN Standard. The topic of root resistance of green roof sites is of major importance to the FLL. Therefore, the FLL testing method for investigating resistance to root penetration was included in the FLL-Guideline and has been widely accepted by the industry. To allow for comparability of results from different testing institutes, the FLL guideline also included testing methods for vegetation substrates and aggregate-type drainage materials as well as testing methods for density, maximum water capacity and water permeability. In 2002 the determination of the water run-off coefficient was included as well.

Purpose and benefit

The FLL Guideline for the Planning, Execution and Up-keep of Green Roof Sites aims to establish and harmonize standards and quality criteria for the benefit of the general public. The different guideline chapters deal with requirements for green roof materials, building methods, plants, greening types and maintenance measures. Green roof products offered according to the FLL Guideline ensure that they are based on the latest technology and meet the relevant quality standards.

As a result of the harmonized standards and ensured product quality, the use of the FLL guideline is advisable for green roof contracting. There is no obligation, nor is it imperative to use the guideline. However, the involved parties such as building owners, planners or companies can refer to the guideline as a basis for construction processes. This general acceptance allows for the simplification of the construction process since every party has a common set of standards, quality criteria and expressions.

The FLL Green Roof Guideline is also available in English and has been of great interest in many countries worldwide (www.f-l-l.de/english.html).

Abridged version of the lecture of Prof. Gilbert Loesken (Chairman of the FLL research group) at the International Green Roof Congress in Nürtingen.

Phytoremediation:

Special advantages of using plants to reduce air pollution

The positive effects of vegetation for the urban ecology are well known. Due to their benefits with regard to the urban heat island effect, stormwater runoff and biological diversity they are improving the quality of urban life. Within the last years a new application has attracted a great deal of attention: the use of plants as biological filters to remove health damaging air pollutants from urban atmospheres.

Phytoremediation is an emerging and prosperous technology. Defined as the use of plants alone or with associated microorganisms to degrade, contain or stabilize various environmental contaminants, the major application in the past was in the field of contaminated soil and water resources. However there have also been several investigations which proved, that plants can remove a large number of different pollutants (e.g. nitrogen oxides, sulphur oxides, particulate matter, ozone) from the air. This applies in particular for green areas in highly polluted urban agglomerations.

Admittedly it is not simple to find free space for natural landscape in the densely populated cities, yet aerial views reveal a great amount of wasted areas: the naked or gravelled roofage of the buildings. The installation of extensive or intensive green roofs on these buildings is a silver bullet to bring nature back to town in a very simple and cost-effective way.

Roofs and underground garages offer free place for air quality management by plants.



Natural air pollution reduction by plants occurs in three different ways:

- Uptake through the stomata of the leaves
-> gaseous pollutants
- Absorption by the plant surface (leaf, branch, trunk)
-> gaseous pollutants
- Deposition on the plant surface (leaf, branch, trunk)
-> particulate pollutants

In order to maximize the pollutant-harvesting abilities of green areas, plant selection criteria and vegetation design aspects have to be considered.

Plant selection criteria

The ability of plant species to cut down air pollution is determined by specific factors like leaf area, leaf morphology, surface characteristics and longevity. Of course, the tolerance to urban air pollution and urban climate are also prerequisites for the successful implementation of the plantings.

Aerodynamically rough surfaces are enhancing the deposition rate of particles. Therefore plants with rough bark and leaf surfaces textures are ideal as air pollution filters. This applies in a certain way also for leaves with hairs or sticky exudates. The greater the leaf surface area and density the more pollutants can be filtered by direct uptake, absorption or deposition.

Due to their evergreen canopy conifers are also very efficient biological filters in comparison to broadleaved tree species. However by accumulating higher loads of toxins in winter time the risk of physiological damage and greater plant injury is also increasing. So the decision between conifers and broad-leaves species warrants further study. The same holds true for the investigation of environmental conditions like soil moisture or air humidity which can modify the capture efficiency of plants in a substantial way.

Vegetation design aspects

The placement and design of the vegetation also affects the air filtration ability. A heterogeneous vegetation formation with herbage, shrubs, trees and a high variation of the canopies structural components should be sought. Within these vegetation stands the cool, moist microclimate and the small scale air turbulences are supporting the uptake, adsorption and deposition of the air pollutants.

The improvement of the local air quality can also be achieved by creating green sedimentation areas, which are able to intercept and capture airborne particles temporarily until they are washed off by rain or dropped to the ground with plant senescence and leaf fall. In comparison to sealed asphalt or concrete surfaces the amount of re-suspended material to the atmosphere from green areas is much lower.



Mitigation of car pollutants by roof plants.

Survey and Outlook

The use of Phytoremediation in air pollution control implies a lot of very unique advantages. Phytoremediation is a clean solar driven technology with minimal environmental disruption at the site. Furthermore the plants are able to decontaminate a broad range of hazardous substances, independent of these substances being of natural or anthropogenic origin. And last but not least the installation of the biological air filters is much more inexpensive in comparison to conventional physico-chemical methods.

We must not forget that urban vegetation also provides a number of further benefits for area residents. These include air cooling by transpiration, stormwater retention, noise reduction and fundamental experience of nature within the man-made cityscape. In the case of green roofs the protection of the waterproofing and the natural thermal insulation are offering tangible economical profits and enhance the value of the real estate.

Wolfgang Ansel, biologist, International Green Roof Association.

Green Roofs paid off – The Santander Group City in Madrid



One would not expect to find the largest Green Roof project in the world to be located half an hour away from central Madrid in the wilderness of Boadilla del Monte. The vast extensive and intensive greenings are installed on the roofs of a bank, thus proving that the ecological and economic advantages of Green Roofs convince even tough financial experts.

Aerial view of the lateral wing.

The 550 million Euro project was directed and financed by the Santander Central Hispano bank (SCH), one of the ten biggest financial syndicates in the world. The complete area of the new financial city covers more than 1.5 million m². After the completion of the building operations in 2004 the bank closed down several of its 23 offices in Madrid and 6700 bank employees moved to the new headquarter in the suburbs of Madrid.

The masterplan by top US architect Kevin Roche lays special emphasis on functional aspects and a flexible, ecological design which meets human needs. Kindergartens, medical offices, libraries, fitness centres, apartments, restaurants and shopping malls are available for the bank staff. In addition the extensive and intensive Green Roofs, which cover more than 100,000 m² of the roof's surface, offer areas of natural beauty for business meetings and creative breaks.

In this context the Green Roofs are a very important component of sustainable urban development. On one hand they mitigate the impacts of on site building operations; on the other hand, the green spaces create a motivating and inspirational working environment for bank employees. Further benefits include the protection of the waterproofing, water retention, improvement of the climatic environment as well as a natural lowering of indoor temperatures in hot summer months. No other architectural style provides such a wide range of positive effects, thus creating a classic win-win-situation for both environment and economics.



Combination of extensive and intensive greenings.

National Green Roof Conference in Sheffield: What can Green Roofs Do for You

Sheffield will be hosting a National Green Roof Conference in June 20th and 21st 2006. The conference will feature an internationally recognised group of speakers, focused discussions, and inspiring events to showcase the real and practical benefits of roof greening in Britain.

The Green Roof week (19th to 23rd June) will be held in association with the conference to promote the concept of green roofs to Sheffield and the region. Suggested events include a green roof garden festival, a city green roof trail and demonstration projects.

The conference will be hosted jointly by Sheffield Green Roof Forum and Livingroofs.org, the London-based green roof organisation.

For more information on either the Green Roof Conference or Week, please visit the website <http://www.shef.ac.uk/landscape/greenroof/index.htm>

Philippe Cols, landscape architect:

New Books: ROOF GARDENS

Roof gardens and roof terraces are an integral part of the „new way of living“. This book, Roof Gardens, shows examples of the integration of a terrace or plants into a loft or flat. The projects range from the small garden attached to a flat in the midst of the historical heart of a city, through the landscape garden on top of an industrial building, to the terrace with a broad view of a city and its river.

Clear and concise trilingual descriptions (E/F/D) capture the essence of each project, while the photos are appealing in their own right quite apart from conveying the atmosphere of each location. Every one presents

the reader with new concepts and ideas in architecture and greenery. The layout and pictures together make this an attractive book to browse through, to gaze at, to dream in and to form ideas of one's own.

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The next IGRA-newsletter will feature the following topics:

- Pitched Green Roofs:
a demanding technical challenge
- An artists vision becomes reality :
The Hundertwasser-Building in Essen
- Green Roofs and Water Run-Off:
A review

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The International Green Roof Association (IGRA) is a global network for the promotion and dissemination of Green Roof topics and Green Roof technology.

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