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Policy Briefings

Green Roofs
Managing Urban Density

Introduction

A green roof system is a proven way to tackle urban heat, with benefits for the residents of an individual building and for a city precinct more broadly. In particular, green roof systems are an effective approach to urban heat management in densely populated cities such as Hong Kong where heat has major impacts on the local climate and on liveability.

Green roofs have been used since ancient times with the modern day green roofs evolving in Germany during 1950s.

Constructing green roofs can benefit the urban environment by reducing urban island heat effect, improving air quality including by converting carbon dioxide into oxygen, reducing noise, impeding water runoff, increasing wildlife and biodiversity, extending roof life by reducing thermal stress in the membrane, increasing energy efficiency by reducing solar heat absorption including through evapotranspiration by plants, reducing roof maintenance, improving visual amenity, and improving human health by reducing stress and providing cleaner air.

The study on which this briefing draws:

- identifies the differences between intensive green roofs and extensive green roofs
- investigates the experiences of using green roofs in Hong Kong
- explores the conditions and constraints of using extensive green roofs
- recommends solutions for reducing the constraints of applying the extensive green roofs.

Background

A green roof is a vegetated space where a layer of plant grows on top of a roof. There are two types of green roofs: intensive and extensive. The intensive green roof is a traditional-style roof garden consisting mainly of large trees and shrubs. This type of green roof is obviously more labour intensive requiring regular irrigation, maintenance and care. Intensive green roofs are often made accessible to residents of a building and sometimes to the general public. In contrast, extensive green roofs are low maintenance usually consisting of hardy plants such as succulents and moss. In general, extensive green roofs are not made accessible to human use or traffic.

The characteristics of the two types of green roofs is summarised in Table 1.

CHARACTERISTICS	EXTENSIVE GREEN ROOF	INTENSIVE GREEN ROOF
Weight	Lower	Higher
Capital Cost	Lower	Higher
Maintenance	Minimal	Higher
Soil Depth	50mm - 150mm	200mm - 2000mm
Type of plant	Sedum and grass	Trees and shrubs
Irrigation	Limited	Regular
Vegetation layer	Thinner	Thicker
Expertise	Minimal	Significant
Structural support	Lower	Higher

Table 1 Characteristics of extensive and intensive green roofs

The study

The study evaluated take-up issues for green roofs in Hong Kong.

Instalment of green roofs in Hong Kong commenced in 2001. Take-up rates have been variable. The major constraints to the use of green roofs have been:

- lack of knowledge and awareness of installation techniques
- lack of incentives including from government subsidy schemes
- higher design and construction costs compared to orthodox roof systems
- higher costs
- technical issues and risk mitigation involving waterproofing, wind load and structural load, need to be considered
- maintenance demands.

The study identified 53 buildings in Hong Kong with adopted green roof features These were located predominantly on governmental buildings including offices, police stations, schools and hospitals.

The study incorporated a survey to assess the knowledge and acceptance of extensive green roofs in Hong Kong. 600 questionnaires were sent to university academics, government departments, consultants, contractors and the general public. 426 respondents were received with a response rate of about 71%.

The survey examined issues that had been previously identified in the literature as affecting the take-up of green roofs. The following factors or influences were uncovered: (i) Government incentives to developers; (ii) Government incentive to owners of existing buildings; (iii) Planning provisions allowing bonus floor to developers in return for green roof areas; (iv) Regulation making green roof spaces compulsory (v) Design guidelines and education programs for developers (vi) Education programs to encourage the public to demand green roofs when purchasing new accommodation.

Most survey respondents were aware of major constraints in the installation of extensive green roof systems. Major constraints to take-up were identified as the lack of promotion from the government including the lack of incentives from the government to owners of existing buildings. Maintenance costs and management difficulties were also highly ranked concerns. Interestingly, design and structural engineering issues were not seen by those surveyed as major constraints to the installation of green roofs.

Conclusion

The study finds significant benefits are available from the implementation of extensive green roofs including improving visual amenity, reducing urban island heat effect and improving air quality. However, lack of promotion from the government, in this case the Hong Kong government, and insufficient incentives owners to retrofit existing buildings were found to be major constraints.

Further reading

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Source

Vivian W. Y. Tam, (School of Engineering, University of Western Sydney, Australia) Xiaoling Zhang, Winnie W. Y. Lee and L. Y. Shen, (Department of Building and Real Estate, The Hong Kong Polytechnic University, Hong Kong), "Applications of extensive green-roof systems in contributing to sustainable development in densely populated cities: a Hong Kong Study", *Australasian Journal of Construction Economics and Building,* 11 (1), 15- 25.

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