

# Tapping the Potential of Roof Greening and Building a New City-scape

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## ABSTRACT

Only do we have an earth! It is crucially important to improve our living environment and keep the sustained development of a city in the limited space. Some concrete examples will be analyzed in the paper, elaborating upon how to make full use of roof space and various plants to create a better green-scape.

To create different activity space with unique characteristics for people, various plants, roof-space, water and buildings in the style of garden should be used when local conditions and design requirements should be considered.

*Key Words : Exploration, Roof garden, New scenic spot, Load, Growing base*

With the development of city and increasing of buildings in the city, The available space for greening is getting decreased. we only have an earth. It becomes imperative for us to make full use of the limited space to keep sustained development and improve living environment.

## I. DEFINITION AND DEVELOPMENT OF ROOF GARDEN

Roof garden, one of afforestation, is laid out on top of building. Water can be stored and plant be arranged in the garden. As early as the 6th century B.C, 'the garden-in-the-air' of Babylonia. the garden, three-storyed, was 25 meters high. on which palace was built and famous plants arranged after the top layer of the garden was treated in terms of weight-bearing, roof-screed and water-proof .

Technologically, water supply and drainage facilities were equipped. The garden, known as the 7th wonder in the world, marked the great potential of roof garden. In 1959, a roof garden was built on the top of Kather center, Oakland city, California, United States. In 60s, the first roof garden was set up for production in Sichun province, lies in the southwest part of China. Another roof was established on the top of oriental hotel in Guangzhou, the capital city of Guangdong province.

With the roof garden emergence, The great change has taken place not only in land use but also in environmental improvement. Giving the potential of architectural space and plants a full play. Roof garden has become a perspective field of city afforestation.

## II. FEATURES OF ROOF GARDEN

1. Large area of green space would be increased in the limited city space

The conflicts between buildings and green space are unavioded with the more and more buildings being erected in modern city. Carrying out spatial greening on buildings is the only way to solve the problem, especially afforestation on roof space because it can compensate for the green space occupied by buildings, set up more "natural-space" and enlarge the green space in the city.

2. Improving 'micro-climate' and diversifying the components of urban architectural systems

Because excessive hard materials, such as concrete, asphalt etc., have been used for pavement, The actual ecological balance of land is ruined and the vitality of soil reduced. Roof garden can keep sufficient water and soil from loss to form a 'cushion-layer' between buildings and nature, creating a better "micro-climate for urban architectural systems.

3. Prevent the top temperature of roof from change

It is an effective way to low the temperature of roof when roof garden is established.

4. Reducing dizzy light and creating a better city-scape

With tall buildings standing everywhere, more and more people work and live in them. Roof garden provides space for people and gives people pleasant feelings when they enjoy the beautiful city-scape on roof.

5. Interacting between green space and architectural space

Modern people pursue the life style of "going back to nature". Roof garden makes people more access to green environment.

## III. THE DESIGN PRINCIPLE OF ROOF GARDEN

1. Local conditions should be considered when conducting the design of roof garden.

2. Safety plays an important role in designing roof garden. Especially, bearing-capacity of roof must meet the needs of roof garden, on the other hand water-proof should be taken into account when designing roof garden.

3. Giving the priority to plant-scape while ecological and environmental returns should be paid attention to creat a better living surroundings for the people.

4. The roof garden-scape should follow the principle of proper size & dimension, considering people's feelings and surroundings itself.

## IV. DESIGN OF ROOF GARDEN-SCAPE

Different conditions and elements, such as plants, water, and styles of garden-buildings should be considered when designing roof garden. meanwhile some methods, such as view -borrowing, view-arranging, and view-shield, can be manoeuvred to build garden. Generally speaking, Chinese garden-building is divided into natural, regular and mixed style.

Plant-scape plays a key role in garden building.

On the whole, natural and regular arrangements for plants are made in term of isolated-planting, batch-planting. Creating plant-scape with the feature of simplicity but beauty, colorful but not not stereotyped. Various woods and trees are arranged densely or sparsely in the garden to give the tastes of seasons' change.

Author will take the roof garden of Kunming Tai-Li hotel as an example to expound the design principle of roof garden.

The roof garden, located on the second platform of the main building, covers an area about 380 square meters. It takes shape of rectangle, linking with the thoroughfare in the east. The platform lies in the outside of the lobby. Considering the existing situation of the hotel and the characteristic of roof garden, designer tried to introduce a garden into the lobby and to lay out different garden space by means of Chinese traditional garden-building. The garden was divided into south court and north court. A rockery fountain was set up at the southeastern corner in the south court, on which stands a square pavilion, water keeps pouring and cascading under the pavilion to create a vigorous atmosphere. North court takes dried-up fountain in Japanese style as origin. The brook flows around the building.

The two courts are different in the styles. Each has its own unique feature.

Plants were closely arranged on the both sides of the roof garden. At the entrance of south court, a few pieces of rocks piles in the middle of grass, arranging a bunch of *Spathiphyllum kochii* around them, giving the rocks a vivid look. The brook serves as the main beauty spot, a batch of *lucidum*, plants of fern family, *Monstera deliciosa* were arranged.

After the establishment of the roof garden, The green space of the hotel has been enlarged. Living environment has been improved.

## V. EXPLORATION OF AFFORESTATION ON ROOF GARDEN

Roof afforestation is a new field in 21st century. Successful roof afforestation depends on the bearing-capacity of roof. what's more, some requirement, such as light, heat, moisture, etc., are made to grow plants.

### 1. Live load of roof

Whether the roof bears the load of roof garden or not plays an important role in roof afforestation. According to the specification of structure design of people's republic of China, the cantilever platform of any public architectures bears no more than 250-350 kg/m<sup>2</sup>. The total load of roof garden includes: a) the weight of buildings to be built on it. b) the weight of growing soil, the depth of soil must make the need of plant's growing. Generally speaking, the minimum depth of grass is from 15cm to 20-cm; that of woods 40-50cm; that of shrub 25-30cm.. Designer should count the additional load of roof garden in when conducting design.

### 2. The selection of growing base

Considered the growing requirement of plants and safety of building, Those materials, light in weight, with high water content, etc., should be given priority to choose. Usually, materials such as humus, saw, vermiculite sand and silt etc., can be used as growing base.

### 3. Water supply and drainage system

### 4. Selection of plants

1) Owing to the changes of climate on roof and soil layer poor in moister, drought-resistant and

cold-tolerance plants should be chosen. On the other hand, some short shrub and herbaceous plants can be selected so as to reduce the load supported by roof.

2) Because the sun light is so strong on the roof and vaporization is great, Helicophilous and shallow-rooted plants are utilized. To enrich the arrangement of plants, some plants, semi-helicophilous plants, can be arrayed near the wall or in shade.

3) Some wind-resistant and lodging-resistant plants should be chosen.

4) The aim to build roof garden is to enlarge the green space so that ever-green plants should be grown. To display the changes of seasons, other species can also be arranged. If conditions permit, some pot-grown fresh flower are planted.

5) Utilization should be given to priority to local plants because they adapt themselves to the local environment and climate.

The following plants can be used in Kunming area.

*Cycas taiwaniana*, *Phoenix dactylifera*, *Phoenix* spp, *Trachycarpus fortunei*, *Ficus benjamina*, *L. Ficus microcarpa* var. *pusilliflor*, *Camellia sasanqua thunb*, *Rhododendrom*, *Ligustrum*, *Agrve americana*, *Osmanthus frangans*, *Chrysalidocarpus lutescens*, *Michelia yuannanensis*, *nadina doestica*, *Asparagus mairei levl*, *Bougainvillea glabra chisy*, *Berberis thunbergii* cv. *atropurpures*, *Loropetalum chinese* var. *rubrum*, *Setcreasea pollida* cv. *Purple Heart*, *Begonia semperflorenshybr*, *Parthenocissus*

*tricuspidata*, Chinese wisteria, *Campsis grandiflora*, *Hedera nepalensis* var. *sinesis*, *Poa annua*, *Diichondrarepens* and *Euphorbia pulcherrima*. etc.

#### 6) Method of planting

There are mainly land-grown, pot-grown and bucket-grown etc. Function and results should be considered while taking different planting methods. What's more, taking full advantage of available space to expand the green area.

At the beginning of new century, The relation between man and nature is getting more and more closely. People pay more attention to be better the living environment. With roof garden emergence, existing green space has been enlarged and space been enriched. To accelerate the development of city, improve existing urban surroundings and perfect ecological system as well as keep sustainable development, we should try our best to create green space with its own unique features and provide a better activity area for city dwellers.

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