

# Present Status and Future Trends on Urban Greening at Special Sites

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## Abstract

This paper discussed the use of the urban greening space beside nature land----special sites of urban Greening. Consider: the special sites of urban greening are referred to the space formed by urban building and framing, where plants can grow under natural or artificial condition. Filly using those spaces will efficiently increase green area, improving ecological environment and landscape in urban area. A classification to special sites of urban greening was put forward, which are the habits of plant combine with the form of buildings. The present status and future trends on urban greening at special sites was discussed and analyzed. Consider: there are two developing trends of the research of urban greening at special sites. Firstly, it is more naturalize and ecologize greening landscape. Secondly, It will take form a techologize in the process of constructing and materials.

*Key Words : Urban Greening At Special Sites, Classification, Developing Trend*

## I. THE CONCEPT OF URBAN GREENING AT SPECIAL SITES

The increasing of buildings is a character of city development. In the city-system, buildings and facilities form many beautiful sights which contain humans wisdom and imagination, at the same time, they also produce living space for the plants which several times larger than the area of themselves. The habit of the new space is more complex than the natural one. During the developing of the city, the special living space brings great green potential for the urban greening. According to relative information, for a six-story building, the acreage of its five faces is

3.6 times as large as the square footage of itself. If we make full use of the space of buildings, the solid greening area would be increased 15 times than the ground greening space.

The special sites where plants can grow have various names, some call them 'Neo-green Space', the others call them 'city regenerative space'. On the base of ecology, we name them as 'urban special greening sites'.

Some researchers considered that the 'urban special greening sites' is the man-made place where plants can't grow with common cultivation techniques including the potential greening places. Some considered that its the surfaces of each entity produced by human. Some considered that its the various solid

spaces which can be used for greening. In the definitions above, some just considered the seeming characters of buildings, some emphasized particularly on plant living conditions only. In fact, the 'urban special greening sites' contents two parts, one is the place formed by the buildings, the other is the plants living conditions. So we can give it a definition like this: they are the places and surfaces formed by buildings and constructions where plants can grow under natural or factitious conditions. The special places are different from the natural ones. The changes of the ecological factors have many effects on the plants.

## II. THE CLASSES OF THE URBAN SPECIAL GREENING SITES

The urban special greening places are the places and surfaces formed by the buildings and constructions, plants can attach to them and grow on them. Different buildings and constructions have different shapes, various living conditions are formed by them, and so different plants grow on them. Studying and classifying they are necessary for the ecological research on the special living conditions, thereby make full use of the special greening space.

According to many Chinese correlative literatures, the common class methods are based on the greening form, as follow:

Wall greening: vertical surfaces of buildings and constructions

Roof greening: top of the buildings (flat or inclined)

Room greening: inside the buildings (including the hall, the cortile and the room) :

Shed greening: flower door, green booth, flower booth and so on:

Bridge greening: the fringe and entrance of the bridge:

Slope greening: slope of the roadside, bank, and rockery;

Other greening: balcony, cornice:

The classification of the urban special greening space is convenient for the planting in the special places, but it doesn't do well in the study of living conditions, the plant adaptability and the exploitation of potential space.

Japanese investigators classified them based on the greening objects and condition factors.

### 1. Sort on the Greening Objects

According to the structure and use of the buildings, we classified the special greening spaces to three classes:

On the roof: on the edifice, house, balcony, elevated road:

Surface of the wall: the wall of the buildings, house and fence.

Indoor: big dooryard of the high building, inside the office and shop, or the underground space (Table 1):

### 2. Sort on the Condition Factors

The main three factors are considered, they are: soil, water, and sunlight, according to these factors, we get seven space classes :

This classification system is useful to practice, because this definition involved series of design factors.

Analysis to the classification, we educe our class method that put the environment of plant growth first, same time, and consider the shape of the buildings and constructions. Mean: Living conditions is a main factor, as well as the characters of the vertical and plane space of the buildings. According to

Table 1. classes of special spaces  
(Quote from "Neo-green Space Design" 1995)

Space	Soil	Water	Sunlight	Example
1	×	0	0	Roof, groundwork, Pavement, bridge, balcony, terrace, wall, light semi-basement, cortile
2	0	×	0	Under the elevated road having sunlight, eave, bright cortilage
3	0	0	×	shady place around the buildings, sunless semi- basement and cortile
4	×	×	0	sunny indoor atrium
5	0	×	×	sunless place under the elevated road
6	×	0	×	shady roof, groundwork, Pavement, bridge, balcony, terrace, wall, semi-basement
7	×	×	×	underground, sunless cortile, cortile of high buildings

0 : have the factor, × : lack the factor

the classification system, the urban special greening sites are divided into:

Indoor green space: inside space of the buildings where plants can grow with cultivation techniques, such as the big indoor atrium of the business building,

hotel, library, and science museum. There are two planting types:

① potted plants, this kind of plants must be exchanged frequently. ② cultivated plants: they can grow long time as permanent scenery, also be ex-

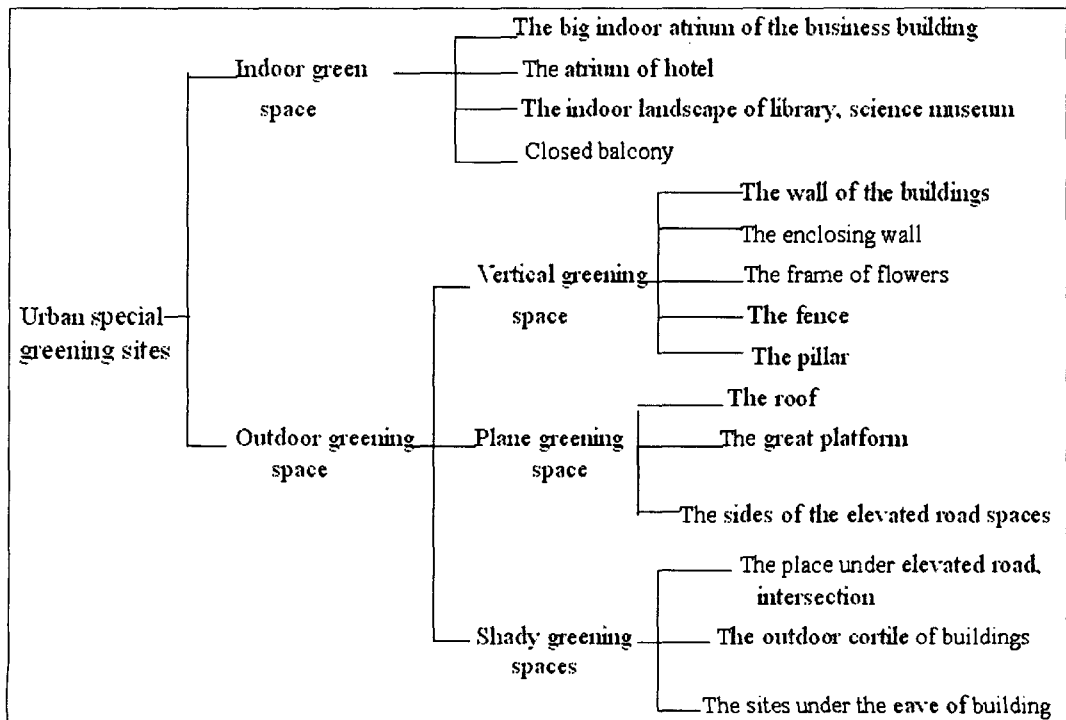


Fig. 1. The classification system of the urban special greening sites

changed regularly.

Outdoor greening spaces: it's the outer or the nearby space of the buildings where plants can grow naturally or semi-naturally, it can be classified into three species:

Vertical greening space: the plants can climb up the building or attach to it, they can grow naturally, like the wall of the buildings, the pillar, and the fence, correlative greening type is vertical greening.

Plane greening space: the plants can grow naturally depending on cultivation medium and some assistant measures, like the roof, great platform, two sides of the elevated road. Correlative types are roof greening and bridge greening.

Shady greening spaces: it's overshadowed partly, shade plants can grow in this condition. Correlative sites are the outdoor cortile, eave, elevated road, intersection, etc.

### III. THE HISTORY AND PRESENT STATUS OF THE STUDY ON THE SPECIAL SPACE GREENING

At first, the greenery at special spaces was a kind of gardening technology. During 604-562 B.C, "Hanging Garden of Babylon" was built up which is one of the Seven Wonders of the World. The garden was built on a 25 meters high platform. Inside of the plants, there are the roof rivulet and artificial fall. It's an architecture built for habitation and play, which is regarded as a wonderful work because of its useful functions.

In the 19th century, liana was widely applied to courtyard greening in Europe. Shelves for the climbing plants were built as a part of the new house. Grape shelf is not only seen in the buildings, but also set up as a courtyard. These shelves were named as "outdoor space art", Many plant species were used,

such as rosebush, bind wood, clematis, grape, and wisteria.

After the middle of the 20<sup>th</sup> century, because of the urbanize developing rapidly, many multi-storey buildings and mansions appeared, plants came to public green space from house garden. Above or inside the buildings, plants were widely used too.

In Auckland California, a 1.2 hectare large roof garden is set up on the KaiZe center building. It's regarded as a modern roof garden be comparable with Babylon Hanging Garden. It's built on the roof of a six-storey building with common planting technology and design idea. During the developing of cities, the greening of special spaces becomes more popular as a fashion in the developed cities. It achieved a harmony between art and nature. The greening special spaces make the potential spaces a part of the urban ecological system.

Planting on the constructions has a long story in China, according to the <Book Volumes of Olden and Today>, plants were cultivated on the Nanjing rampart at the age of Chunqiu 2400 years ago. Liable pines were planted on the Great Wall-Shanhaiguan which built at Ming dynasty 500 years ago. In addition, in the Shaihai Yuyuan garden built in 1526 A.D, big arbors were planted on the big rockery.

In china, environment problems were emphasized in late 20<sup>th</sup> century. Urban greening has made a great progress, people have paid great attention to the use of the special spaces. During the 1980's, the utilizing of green-space only limited in park shelves, few street walls and super hotel's roofs, in the early 1990's, with the developing of the elevated road, Shanghai began to utilize the special space in large. In the early 2001, the length of the elevated road reached 63.92 kilometers. After the 'inner circle-line' finished, the city began to build the elevated green-line. Because of the lack of the feasibility pro-research of the

ecological problems in these special spaces, after the green-line finish, lots of problems came out: the bad condition of the soil. The adaptability is never considered, right plants haven't been chose from a mount of species, all these problems made the plants grow badly. So after two years, we had to rebuild it.

For the demand of the environment and sustainable development, the ecological conception of "green building, green development and sustainable building" was brought forward. In the past time, people design the green space according to the existent building. Nowadays, when we design the building, we begin to consider the green space at the same time. The Jiushi mansion located on south Huangpu bund embodied the harmonization of the artificial intelligence and ecology. The German designer Foster Roman, the designer of the Hongkong new airport, the congress building of Germany and Century mansion in Tokyo, expressed a new conception of ecological building and design. On the 15-17F, 26-28F, 36-40F, conception of 'nature' is embodied. Beginning to recede from the 15<sup>th</sup> floor, a three storied hanging garden is formed. It has capacious space, we can see the blue-shy and white-cloud through the bright glass curtain wall, In this mansion, the plant isn't a accessory but a part of the building. It's a kind of ecological building.

The scenery named "Biology Realm" was built in Shanghai science museum, it's a 3000 M<sup>2</sup> indoor rain forest, and all the condition factors are adjustable, such as the light, temperature, humidity, wind and the fog. There are 300 species plants that come from Yunnan rainforest. This natural scenery is a combined system made of nature, artificial intelligence and ecology.

Comparatively speaking, China is behind in studying and utilizing of the special spaces. The more buildings, the more potential special spaces exist, especially in Shanghai, Chongqing and Beijing etc. At resent years, the people are going to do this kind of

work, but it's not enough from theory to practice.

#### **IV. FUTURE TRENDS OF THE STUDY OF THE URBAN SPECIAL SPACE GREENING**

On one hand, the city's development produces room for green, on the other hand, base establishment must be built for the city including population, employment, service and living quality. It's necessary to built colorful and multiform urban sights. Thick modern buildings appeared the ground spaces for green decreased accordingly, so we must utilize the special spaces for green. In other words, it's the development of the city accelerate the using of these special spaces.

In late 20<sup>th</sup> century, environment construction and sustain development became a global theme. All the large and middling cities must keep the urban ecological balance, afforest the city, and get a harmony between the city and nature. During the developing of cities, the conception of "ecological building and green building" is so popular that the architecture designer and the ecologist began to take notice of the city special space. The greening of the special site trends to be ecological and natural.

It's the American Ford automobile corp. who built the first "green" motor exhibition hall named "Green Zone". In this hall, all the energy resource is renewable, like the solar energy and wind energy. In order to save energy, sunlight and geothermic are gathered. As a green filter, the growing plants are used to purify the air. For the more, three buildings' roofs covered with green vegetation have benefited the local climate and water circle system. Greensward overspreads the road instead of asphalt. The plant ecological buildings are popular with Germans, they build the entire building with plant material, use the

green area to decorate their inhabitation, make the nature and the human a harmonious world.

In the year of 2000, the Hannover World Expo represented a new style and the development of the ecological buildings. "Human-nature-technology" was the theme of Hannover World Expo, "High-Bio is High-Tech" was their slogan. People were strongly impressed with the green ecological buildings, because all the exhibition area and the circumference were surrounded with green, especially the Holand and Romania's exhibition halls were covered with climbing plants and trees, the structure and function were so wonderfully mingled there.

Developed states have realized the importance of the special spaces. In many cities, the green plants on the roofs, walls, and balconies are seen everywhere. They plan to apply the plant materials to production in large. For example, the bricks for wall-parterre can be produced in Japan. They should be the first batch of correlative commercial products. Shaped parterre settled on the wall is very beautiful. The trees can grow in them depending on the cultivation medium-soil. A nice-looking bounding wall presents solid natural scenery. It's the technologic trend accelerated the developing of the urban special spaces.

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## Author Brief

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