Podium landscape of residential zones

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Abstract. The density of the population in big cities is so great today that it inevitably leads to a strong cramping of urban spaces and deterioration in the quality of the residential environment. Yard spaces are getting compacted, green areas are replaced by parking, shops, service enterprises, courtyards are crammed with cars, so pedestrian can hardly walk along the sidewalk through the parked cars. It is an extremely important task for both Russian cities and most major cities and megacities of other countries to find solutions to the organization of landscaping and greening of residential areas in such conditions. The article considers the organization of courtyard podium as a possible solution of the problem. With a similar organization of the adjacent space, the raised courtyard becomes a recreational zone. There is a possibility of its additional gardening, which contributes to the reduction of noise and air pollution, the formation of a cozy and chambered living space that improves the social living environment. The article contains the results of systematization and analytical review of the most successful design solutions of the world experience in the field of landscape design of residential yards on the podium level. At the same time, the economic and climatic features of the territories are analyzed, their architectural and planning specificity was considered, and the design options for both the podium itself and its upper part for planting are discussed. A number of recommendations on the architectural and planning organization of spaces of this type for residential areas of the Moscow metropolis with suggestions for the selection of plants corresponding to the climatic conditions of the central Russia are proposed. These recommendations could be useful for other cities and regions with similar social and climatic conditions. The results of the research described in the article can be useful for architects, constructors, landscape designers, public service workers, as well as representatives of the management team engaged in the formation of a set of architectural and building norms and rules for the design of objects of this type.

1. Introduction

The process of urbanization in modern cities leads to a compression of spaces and increase in the number of inhabitants per square meter. In the conditions of large cities and megacities, new principles of the organization of adjacent territories appear. Yard spaces are compacted; green areas are given for parking, shops and service businesses. The yards are crammed with cars; the pedestrian can hardly walk along the sidewalk through the parked cars. The podium building can be the solution to these problems.

The organization of podium will help to functionally divide the public zone of the residential area. High-density development encourages architects to use each square meter with maximum efficiency,
so various functional areas, such as parking or shop, are located inside the podium, and the roof of the podium turns into a comfortable yard. There is a safe exit from the building directly into the pedestrian zone, but also the entrance from the side of the street, which can be reached by car, can also be provided. Where necessary, a podium could be an excellent solution for yards without cars.

A dwelling yard is often a faceless space; one territory does not visually differ from the other. People, tired of monotony, want to see the unique image of their home, individual environment. Builders strive to create a memorable look of neighborhoods so that a person can find a place for himself that corresponds to his worldview. Nevertheless, it is necessary to identify the basic principles for the formation of a new type of adjacent territories, so that the yard space is understandable and convenient, and the functional basis is not lost in the pursuit of visual diversity.

Landscaping plays a crucial role in modern society, as environmental problems are very acute. Talking about buildings on a podium, we face certain difficulties with landscaping courtyards, since the vegetation is located on an artificial relief with a concrete base. However, modern technology can solve this problem. Also it is necessary to remember that point at the stage of design development, since the concrete overlap and the foundation must withstand a heavy load.

The advantage of gardening on the podium is that the level of vegetation rises above the planning level of the land. At the same time, if there is a possibility to plant trees, the inhabitants of the upper floors, the windows of which go out into the courtyard on the podium, turn out to be surrounded by greenery, as well as the inhabitants of the lower floors, whose windows face the yard on a natural base. This forms a much more favorable environment than the construction of high concrete towers, the owners of apartments on the upper floors of which are completely divorced from the natural landscape.

One of the new trends in architecture is sustainable development. The principles of ecological construction include a wide range of requirements for buildings in large cities, where the environment needs serious changes for the better. Green standards, such as LEED, BREEAM, etc., are today the most important factor forming the opinion of society on emerging problems and improving the comfort of living in megalopolises. In Europe, the US, China, Singapore and other countries of Southeast Asia, the green roof is one of the main solutions for improving the environmental situation in megalopolises. In recent years, the popularity of such systems is increasing in countries with a temperate climate, such as Norway and the Netherlands. [1]

The economic benefit from the application of ‘green’ technologies is increasing due to the purchase of an additional exploitable area and improvement of the aesthetic appearance, environmental attractiveness and increase in the rating of the real estate object with the certification according to green standards.

Construction of green roofs is characterized by a number of objective global advantages: energy efficiency and savings in the process of exploitation achieved by reducing heat loss through the external coating of the building; improving the living and working conditions of people; increase the aesthetic level of buildings. In addition, the green roof protects the waterproofing material, which is the main one in the roofing ‘pie’, from overheating and ultraviolet radiation, which makes it possible to increase its longevity by several times.

2. Materials and Methods
Classification of podiums was developed based on the study of world experience in the field of podium building design. Four main types of podiums were identified: linear, island, surrounded and complex. Schemes and examples are presented in Table 1.

Linear type represents a small lip of the podium along the extended facade of the building. Podium projection in the linear type should not exceed 18 m, which allows excluding a run for firefighting equipment on podium according to Russian fire safety standards. This rule applies to residential buildings with a height of no more than 48.0 m in the presence of crossings on balconies (or loggias) from one-sided apartments oriented towards the podium to the apartments of a bilateral organization. [2]
| Name       | Scheme        | Example                                                                 |
|------------|---------------|-------------------------------------------------------------------------|
| Linear     |               | ‘Litsa’, Moscow, Creative Production Union ‘Reserve’                     |
| Island     |               | ‘Dancing towers’, Seoul, Studio Daniel Libeskind                         |
| Surrounded |               | ‘Garden Quarters’, Moscow, ‘Sergey Skuratov Architects’                  |
| Complex    |               | ‘The Interlace’, Singapore, OMA/Ole Scheeren                            |
There are usually small cafes, shops, pharmacies, hairdressers, repair shops and other service enterprises inside the podium. The roof is often covered with gloomy tar, and the inhabitants of the upper floors watch an unsightly picture from their window. This type of podium is one of the most popular techniques for the Soviet period architecture (Figure 1).

![Figure 1. Podium part of the building on Novy Arbat Street](image)

To enhance the aesthetic qualities of this type of building is recommended the planting of greenery on the podium. ‘Green roofs’ are of two types: intensive - when the roof provides an exit for the tenants, and extensive - providing only decorative landscaping. In the case of a linear type, an extensive type of gardening is preferred.

The formation of extensive landscaping is not technically complex and usually does not entail heavy loads on the structure of the building. If necessary, the base of the roof is treated with various compositions: primers, fungicides, hydrophobic agents. Then the root-protective membrane is laid on it. Roofs with a slope of less than 4 degrees must necessarily be equipped with a drainage system. The fertile layer of earth 5-20 cm high is used as a basis for planting, the same as for an ordinary lawn. To prevent mixing of the drainage layer with the fertile soil, they are separated by a geotextile. [3] Since a flower garden of this type on the roof exists by itself, dendrologists choose plants that require minimal maintenance. Lawn on such roofs gradually grows, other plants germinate on it and even birds can settle, as plants growing on the roof attract insects, and they attract birds. (Fig.2)

![Figure 2. The scheme of extensive technology](image)

The island type is characterized by the presence of two or more ‘towers’, located on the podium, which significantly exceeds the size of the area of the ‘towers’. At the same time parking is usually located inside the podium, since in the central part there is no natural lighting. However, it is possible to accommodate various service enterprises and stores along the perimeter of the podium. The possibility of passing for firefighting equipment must be provided for this type of podium. The structures of the podium must be designed for a heavy load of fire trucks of not less than 16 tons per axle. [4]
It is preferable to construct courtyard territories with different functional zones on a podium of this type – playgrounds and recreational zones. At the same time, the roof of the podium becomes exploitable and an intensive type of gardening is applied. It is necessary to strengthen the structures not only in the area of the fire passage, but also to create a full-fledged gardening, since the load makes from 150 to 750 kg per square meter. Therefore, this type of formation is possible only with new construction unlike extensive landscaping. It is necessary to arrange a fertile layer of land at least one meter for planting coniferous or deciduous trees up to 4 meters high; the drainage layer should be at least 20 cm with this thickness of the ground layer. The same principle is used for creating intensive greening on the roof, as in the extensive one, but a larger layer of fertile soil is poured and a special drainage cellular material is used. Another difference from extensive landscaping is the need for artificial irrigation and plant care. Many roof gardens made in this technique can be found in New York, London and some cities in Germany. [5] (Figure 3)

![Figure 3. The scheme of intensive technology](image)

For the competent design of roof structures it is necessary to calculate the following characteristics:

- volume of average annual precipitation (according to local meteorological services);
- timing of summer periods of drought;
- air flows, turbulence zones and vortices.

All materials used for the organization of drainage and other layers of roofing construction are calculated in their saturated state. In the case of the organization of extensive landscaping with the planting of trees, it is necessary to carefully calculate the wind loads. It is worth paying attention to the signs of extreme loads on the plant layer:

- degree of sunlight (especially for pitched roofs);
- wind loads (‘wind rose’, a zone of strong winds);
- danger of frost;
- strong gas contamination in the center of the city. [3]

Greening the roof not only improves the quality of the air, but also protects against electromagnetic and ultraviolet radiation, has excellent noise insulation, delays and filters rainwater, reducing the load on storm sewers. Correctly mounted ‘green roof’ will last more than 60 years, which is much longer than usual roof, because it has additional protection, so the initial costs for its device pay off in the process of operation. [6]

Surrounded type is characterized by the presence of a completely or partially closed courtyard, along the perimeter of which are residential buildings. An elevated courtyard is isolated from cars and casual passers-by. This type is one of the most popular in Russian modern architecture. Parking is usually located inside the podium, while engineering communications are displayed on the roof of the podium. It is necessary to provide that any site (recreation, playgrounds) should be located no closer than 15 m from the ventilation shafts. [7]
It is also important to ensure the possibility of pass through the podium for emergency services. The access of private cars to the podium courtyard is often prohibited. The layout of the yard area can be completely free. To ensure that the fire passage does not violate the aesthetic qualities of the local area, a special lawn grid is used for the passage of fire equipment, on which grass and various perennials can be planted (Fig. 4).

**Figure 4.** The organization of fire passage with the use of a grid ECORASTER

Nowadays, a variety of complex spatial solutions of courtyards are gaining in popularity. They can be at different levels, partially located on a natural base. An interesting solution is the construction of bridge-transitions, under which passes the roadway. With this organization of the transport scheme, you can walk the entire territory on foot, never meeting a car. Special ramps are also being built for the entrance to the building of emergency services, which also serve to move between tiers of people with disabilities. The courtyard usually remains closed and only residents of the complex have access to it. This allows you to maintain order and security on the local area. However, sometimes public areas remain accessible to visitors. For example, in a residential complex ‘Garden Quarters’ the central square with a shopping gallery, cafes, restaurants and an artificial pond will be accessible to any pedestrian, but only local residents will be able to climb to the upper levels directly to the local area (Fig. 5). [8]
Complex type is characterized by the presence of various combinations of podiums. This can be a complex multi-level system that combines both linear, island, and surrounded types. A variety of complex combinations of coatings are roofs with inclined surfaces, including curved surfaces (Figure 6).

![Figure 6. Yongsan International Business District – R2 Block by Riken Yamamoto & Field Shop - Seoul, South Korea](image)

When tilting up to 30 degrees along the perimeter of the roof, there is usually being arranged the threshold, which will keep the vegetation from slipping. If the slope of the roof exceeds 30 degrees, then several thresholds can be set at equal distances from each other. They are located perpendicular to the roof slope for soil retention with abundant and prolonged precipitation. It is possible to use special holding cells (Figure 7). One of the features of gardening of steep slopes of roofs is the selection and planting of plants that do not need special care. These include a limited set of herbaceous vegetation and a variety of ‘carpet’ type. [9]

![Figure 7. Scheme of landscaping of the sloping roof](image)

3. Research
The moderate climate of the middle zone of Russia does not allow enjoying luxuriantly flowering greenery all year round. To create a garden that will be decorative throughout all seasons, one should use evergreen plants, trees and shrubs with a colored bark and structural crown, as well as perennials that retain their decorativeness in the winter.
When choosing a range of wood and shrub plants for intensive stationary roofing gardening should be guided by their winter hardiness, the development of the root system, heat resistance (including the ability to withstand drought or quickly restore decorativeness after withering in hot weather), wind resistance (trees and shrubs should have an anchor to resist wind loads, typical for Moscow conditions, taking into account the limited root layer), stability crowns to forming pruning.

The assortment of perennial herbaceous plants for intensive stationary roofing gardening should be chosen on the basis of their winter hardiness, heat resistance and decorativeness. The assortment of annual herbaceous plants for intensive roofing gardening should be selected on the basis of decorativeness and heat resistance. If the projected object of intensive roofing gardening is supposed to be equipped with an automated irrigation system, the heat resistance of plants is not a limiting factor in the selection of the plant assortment.

The choice of annual and perennial plants for intensive roof gardening is also determined by the ability to meet the requirements of plants for environmental conditions at the stages of planting and maintenance. Preferences should be given to species recommended for use in rock gardens and rockeries. In addition, it is desirable that the height of the plants is not more than 50 cm, and the stems of the plants would be resistant to lodging. [10]

When choosing planting material for trees and shrubs for roofing gardening, preference should be given to those grown in the Moscow, Smolensk, Tver, Vladimir and other more northern and eastern regions, in the Urals and Siberia. The use of planting material of southern, eastern European, West European, Chinese origin should be limited and justified only with the appropriate justification (winter hardiness is confirmed by field tests or by experimental freezing in freezers). An example of the selection of plants is shown in Table 2.

**Table 2. An example of the selection of plants for the greening of podiums**

| Coniferous trees          |
|---------------------------|
| Picea pungens            |
| Picea obovata            |
| Thuja occidentalis       |
| Pinus sylvestris         |
### Deciduous trees

| Tree Name       | Image |
|-----------------|-------|
| Amelanchier canadensis | ![Amelanchier canadensis](image) |
| Betula pendula   | ![Betula pendula](image) |
| Sorbus aucuparia | ![Sorbus aucuparia](image) |
| Acer negundo    | ![Acer negundo](image) |

### Coniferous shrubs

| Shrub Name      | Image |
|-----------------|-------|
| Pinus mugo      | ![Pinus mugo](image) |
| Juniperus sabina| ![Juniperus sabina](image) |
| Juniperus virginiana | ![Juniperus virginiana](image) |
| Microbiota decussata | ![Microbiota decussata](image) |

### Deciduous shrubs

| Shrub Name      | Image |
|-----------------|-------|
| Cornus alba     | ![Cornus alba](image) |
| Berberis thunbergii | ![Berberis thunbergii](image) |
| Spiraea x cinerea | ![Spiraea x cinerea](image) |
| Spiraea japonica | ![Spiraea japonica](image) |

### Perennials

| Perennial Name   | Image |
|------------------|-------|
| Alchemilla mollis | ![Alchemilla mollis](image) |
| Iris pseudacorus | ![Iris pseudacorus](image) |
| Golden Cowberry  | ![Golden Cowberry](image) |
| Geranium Dalmatian | ![Geranium Dalmatian](image) |

### 4. Conclusion

The design of the adjacent territories located on the podium level is a popular solution in Europe, the United States, and countries of South-East Asia. Russian architects are just beginning to master the design of podium spaces. Despite certain difficulties in creating a garden on the podium in the climatic conditions of the central Russia, modern technology and a wide range of ornamental plants can solve the problems. [11] Domestic designers, relying on world experience and supplementing it with their own, prove that in our region it is also possible to create a garden that is decorative throughout the year. (Fig.8)
Modern requirements for construction are based on the principles of sustainable development and careful attitude to the environment. The arrangement of the adjacent territories on the podium meets these trends. Podium of various types can be an excellent solution for the arrangement of the yard area where necessary, to improve the ecological situation and increase the comfort of the residential environment.

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