ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 5, Issue 11, November 2018

The Planning Solution and Landscape Design of Courtyard Spaces in Multi-Storey Residential Buildings of Uzbekistan

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ABSTRACT: The article deals with multi-storey residential buildings in the climatic conditions of Uzbekistan. The principles of the formation of courtyard spaces of various planning structures is given, as well as their landscape design solutions depending on the region of construction (deserts and oases) and wind conditions.

KEYWORDS: Multi-storey residential buildings, courtyard space, facade, insolation, functional areas, landscape design, ground greenery, planning structure, dusty winds, aeration, insolation, wind shadow.

I.INTRODUCTION

Currently, in large cities of Uzbekistan, multi-storey residential buildings being built with 4-5 and 7-9 storey buildings. 12-16 storey houses make up a small part and they mainly play the role of town-planning accents. Given that the urban area with all its communications is expensive, an increase in the density of residential buildings is very important. In this regard, this article analyzes the normative distances (gaps) to the honey of the facades of residential buildings, established mainly according to insolation criteria and wind conditions. Important is the reasonable reduction of gaps between houses. Now, when establishing gaps between them, little attention paid to the presence of functionally necessary zones. The article touches upon the issues of organizing playgrounds, gazebos for adults and parking lots.
Another important issue - the decision of landscape design courtyard spaces in multi-storey buildings. In the courtyards, mostly monotonous varieties of trees planted; there are no interesting landscape compositions. Planting conifers has now become fashionable. However, this does not always correspond to the climatic conditions of the construction site, the orientation of the courtyard space, and the facades of buildings. In this regard, it is important to determine the characteristics of planting conifers in the courtyard space and make recommendations for their range.

II. SIGNIFICANCE OF THE SYSTEM

It is known that in residential areas of cities in Uzbekistan 70% of the territory is covered yard area. These courtyards determine the appearance of the neighborhood and how carefully they are designed, they respond to the functional and aesthetic needs of the population. First of all, designers should consider a compositional and landscape design solution for courtyard spaces.
Nowadays, in Tashkent and in other major cities of Uzbekistan, residential buildings are being built in 4-5 floors, and in the central districts of Tashkent - 7-9 floors. According to regulatory documents (ShNK 2.07.01-03), the distance between the long facades of houses in a 4-storey building should be at least 25m, in a 9-story building - at least 40m to ensure 2.5 hours of insolation of living rooms from March 22 to September 22. In the courtyards for access to each section parallel to the facade, at a distance of 4-5m from it for the transport and pedestrians pave a track 3.5-4m wide [1]. As a result, in the middle of the courtyard there is a space 10-12 m wide. In this area for children up to 10-12 years old they arrange playgrounds, for adults - gazebos.
If the length of the yard is more than 80-100m for parking in this area, you can arrange parking. At the present time in Tashkent and in other cities of Uzbekistan in the evening, private cars occupy driveways, playgrounds, lawns. Therefore, in the courtyards or intra-quarter territories, it is necessary to build not only parking areas, but also multi-storey garages. These garages should be erected along the street, limiting the quarter, or within the quarter from the end of residential houses, on sites that are not part of the courtyard space.

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In the courtyards of the nine-storey building, as noted above, the distance between the long facades of houses should be no less than 40m. Consequently, in these yards there are more possibilities for organizing playgrounds and parking for cars. In these yards can be identified 600-800m2 of parking space. In the yards of 4-5 storey buildings, large trees (up to 12-14 m high) are recommended to be planted along the driveways at a distance of at least 4-5 meters from the front of houses. In this case, during the day, tree branches can shade from direct sunlight, but do not obscure the living rooms. Diffused light from the firmament illuminates the apartments. At a specified distance, you should not plant trees with a spreading crown. In the cities of the desert zone (zone 1 on climatic zoning of Uzbekistan), coniferous trees (greenery) should not be planted with a pyramidal or conical crown, giving little shade [2].

From the building to the passage it is advisable device parquet landscaping. Trees gain height 25-30m and 12-17m width of the crown (Platanus orientalis, oak) should be planted at a distance of not menee10-12m from the front of the house, in the middle of the courtyard, behind the passage to prevent excessive darkening of the rooms.
If the 4-9 storey houses with the facade are oriented to the north, then in order to provide sufficient natural illumination of the living rooms, in front of this facade it is advisable to arrange parquet planting and planting coniferous trees that are gaining a small height (8-10m). The lack of direct sunlight allows young saplings to settle well. In summer, the sun almost misses the northern facade and the surrounding territory. Ground landscaping should organize a lawn, flowers and shrubs.
The shape or configuration of the courtyard of multi-storey buildings to a certain extent depends on the angle at which the streets intersect, restricting the territory of the microdistrict. This angle can be 90^0 or other. The planning structure of the yard is largely determined by climatic factors. For example, in the desert zone, where dusty winds, storms in the course of a year is 20 days or more, yard spaces of a closed structure are recommended. All sides of the four or multilateral courtyard are equipped with residential buildings. The distances between the facades and the end of the buildings should be taken according to town planning standards (13.5m - in 4-storey and 24m - in 9-storey buildings).

Fig.1. General view of the residential area (master plan) Zerafshan.

According to the above principles, we consider a multi-storey residential community built during the Soviet era in the city of Zerafshan. Zerafshan is located in the desert zone, sandstorms constitute more than 20 days during the year [3]. However, looking at the master plan (Figure 1) we see that the array is built mostly of open courtyards planning structure. Such planning structures do not respond well to the climatic conditions of the desert, that is, such a planning solution does not effectively protect against strong winds and dust storms.
If a multi-storey residential building mainly consists of 4-5 storey-houses, so 7-9 storey-houses are recommended to be used partially along the border of the microdistrict from the direction of the prevailing wind direction, where the average wind speed during the year or in winter is 5-7 meters / sec. and the number of days with dusty winds is more than 20. These tall buildings with a large façade area (two or more sections in the building), rhythmically planted along a wide street, will play the role of a town-planning accent. Such buildings allow the dusty wind to be directed not into the neighborhood, but along the street.

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International Journal of AdvancedResearch in Science, Engineering and Technology
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In the regions of oases and foothills, where there is enough water and landscaping (climate zone II in KMK 2.01.01–94), it is advisable to use semi-open planning structures of the courtyards. In other words, in a quadrangular courtyard one side is not built up, it is left open. This open side of the courtyard is heading towards the prevailing wind of the warm period of the year. In the region of foothills and valleys of Uzbekistan, where the average wind speed of the warm period is 2-3 m / s, open planning structures of courtyard spaces are recommended. In such courtyards are built only two of its opposite sides. The open side (or sides) is directed towards the prevailing summertime winds (Fig. 2).

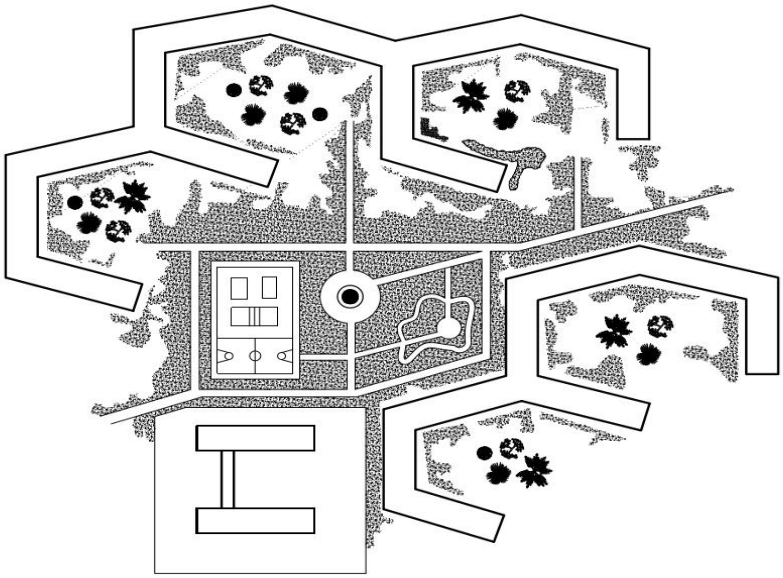

Fig.2. decision of half open courtyard space planning
in case of strong winter winds west and north orientation.

Thus, the planning structure of the courtyards of multi-storey residential buildings should be determined based on the urban planning situation and the climatic features of the construction region. Landscaping yards and plant species should be determined depending on the climatic zone of construction of Uzbekistan.
The organization of landscape design includes: consideration of local climatic features, the creation of landscape compositions of trees, shrubs, lawns, flowers, including both cultivated and local wild plant varieties; the creation of landscape compositions taking into account the shape of the crown, its color, density and shape of the leaves [4,5].

III. LITERATURE SURVEY

The main role in determining the gaps between the facades of houses played by the provision of standardized insolation of apartments for sanitary and hygienic requirements. The need for a three-hour insolation noted by the doctor of architecture I.S. Sukhanov [6]. Why exactly 3-hour insolation? In the “Petri dish” placed on the windowsill for double-glazing, E. coli die within 2-3 hours. In the case of the location of this cup on the window sill, E. coli under the influence of direct sunlight die in 5 minutes. The shortwave ultraviolet rays of the sun (310-320 nm) kill these harmful microorganisms. Therefore, it is so important that each living room in an apartment or a playroom in a kindergarten receive continuous insolation for 2.5 hours. Based on these considerations, the necessary gaps between the facades of residential buildings were established. An excessive increase in the gaps between houses to improve the ventilation of the courtyard space and increase the size of playgrounds and parking for cars leads to a decrease in the density of residential buildings [1]. The planning structure of yard spaces (closed or open), depending on climatic conditions, was considered by GK Goldstein [7]. Large studies on changing wind conditions in high-rise buildings carried out by L.F. Serebrovsky [8]. In the leeward side of the house, the wind speed is several times less than in the leeward. Usually

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
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behind the house, in the windward side, there is a zone of "wind shadow". "Wind shadow", depending on the shape of the building, observed at a distance of 4-6 heights of the building.

In the "Recommendations for determining the urban development agility of residential buildings, taking into account the landscape-climatic conditions of Central Asia", compiled by G.K. Goldstein and A.A. Saidov gave the necessary gaps between the facades of houses, depending on the orientation and latitude of the construction site. According to the schedule given in these recommendations, normalized (2.5 hours) insolation provided at a break of 1.2-1.5H, which is less than the requirements of ShNK 2.07.01-03 "Urban planning, planning and building urban and rural settlements "By 20-25% (Figure 3). However, when the facade of a house irradiated with direct sunlight is oriented at NE (NW) according to this schedule, the gaps between the houses should be at least 4H shading the house, which is 2 times more than the normalized values. These recommendations also give the shape of the courtyards in the plan (rectangular, square), the ratio of the heights of shaded and shading buildings.

In the "Recommendations for the design of residential buildings in the territory of the fourth climatic region with dust storms", compiled by I.A. Merport and Z.N. Chebotaryova provides principles for the formation of a residential development greening system in regions with dusty winds. There are varieties of trees, shrubs, and a number of rows of plantings in the protective strip, depending on wind speed [9].

The book, "Residential Landscape Architecture: design process for the private residence.", Edited by Norman K. Booth and James E. Hiss, analyzed various landscape compositions recommended for both residential development and, in general, for the architectural environment, examples of drawing up landscape groups, compositions of trees, shrubs of contrasting crown shape and leaf color are given [10,11]. Given the varieties of trees to protect the building area from dusty winds and traffic noise.

IV. METHODOLOGY

To determine the preferred planning and landscape-design solutions for courtyards in multi-storey residential buildings, a method adopted for analyzing domestic and foreign literature and regulatory documents. The distances between the houses were determined by calculating the normalized 2.5 hours (a) and the desired hour (b) insolation, depending on the latitude of the terrain and orientation on the sides of the horizon. The results given in the form of a graph (Fig. 3). By graphical constructions on the section and on the general plan of a group of buildings, yard spaces, the zones of wind shadow, zones of wind speed decrease by 60%, 50% and 40% for various planning solutions of yard spaces were determined (Fig.4). By calculating the number of residents in 4-storey buildings, limiting the courtyard space in terms of 100m x 25m, the area of landscaping per 1 person in this yard was determined. It was only 5m2 / person, while the norm in the oasis region is 15m2 / person. In general, it should be said that these standards are unrealistic and exaggerated, because in the courtyards, the dimensions of which are determined according to regulatory requirements, even when covering 100% of the yard territory with landscaping for one person, there is only 7.8 m2 of landscaping, which is 2 times less than standard values for ShNK [1].

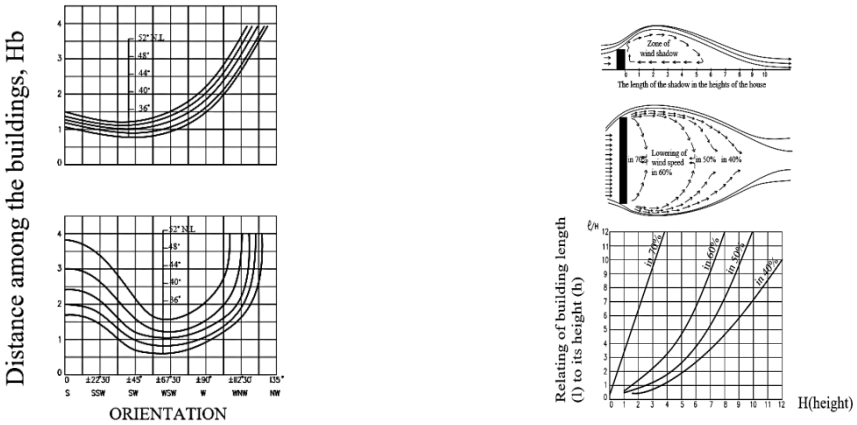

Fig.3. Definition of distance among the buildings

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 5, Issue 11, November 2018

Fig.4. Diagram of dependence wind shadow tale into consideration normal 3 hour's insolation length from relation building length to its height and desirable hour's insolation dependence from place latitude.

V. EXPERIMENTAL RESULTS

With the orientation of multi-storey residential buildings on the NE (NW), the gaps increased to 4H shading houses, as required by the "Recommendations" compiled by G.K. Goldstein [5]. This leads to a decrease in building density. To ensure the normalized time of insolation, it is enough to adopt the planning structure of an apartment with a two-sided orientation: living rooms are oriented towards two opposite facades of N-S, NE-SW, NW-SE. According to the norms of ShNK 2.08.01-05 in 1, 2, 3 room apartments it is enough to provide 2.5 hours of insolation of one living room, in 4-5 room apartments there are 2 living rooms [12].

Extended high-rise buildings recommended located in front of medium and low-rise buildings from the north-facing facades and within the horizon sector from east to west (provided this does not contradict aeration requirements).

In the case of a courtyard development system, the space-planning organization of residential groups should provide favorable microclimatic conditions for all courtyard spaces. Therefore, when placing buildings, it is necessary to take into account the nature of their influence on adjacent courtyards as well as the influence of adjacent courtyard spaces on buildings located on the border.

To increase the maneuverability of the closed space-planning structure, it recommended composing the courtyard spaces of two forms - rectangular and square. Square or near-square courtyards recommended for conditions when protection from winds of different directions is necessary.

Yards of rectangular elongated shape (more than 1.5 squares) are preferable for variable wind directions, when along with protection from the wind it is necessary to ensure the capture of favorable flows. In this case, it recommended placing the buildings on the windward side with long facades.

To solve the landscape design of multi-storey residential buildings, various landscape compositions adopted borders, mix borders, rockeries; a combination of coniferous and deciduous trees, shrubs, flowers, lawns. It is necessary to take landscape compositions of trees with contrasting in shape and color of the crown (pyramidal, spherical, and ovoid).

VI.CONCLUSION AND FUTURE WORK

Determining the necessary distances between high-rise public buildings on climatic conditions with simultaneous high-density construction is less studied and relevant. The issue of landscape design of courtyard spaces of public buildings is not resolved, taking into account its functional areas.

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ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 5, Issue 11, November 2018

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