Criteria of the estimation of residential appeal of the territories in the construction of high-rise complexes

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Abstract. Lots of documents governing the construction, urban planning and territory improvement have been enacted a long while ago and basically give little consideration to changes going on and current state of affairs. They are mainly related to the average cost of living in the country. This necessitates the development of a methodical base of increasing the output of the work of construction. The basic criteria for the evaluation of the appeal of objects while constructing are high-rise complexes. A method for the calculation of land needs for the general plan of an investment construction project with a yard (or condominium). The research carried out showed that urban planning standards are not really stuck to, i.e. should be. On top of that, the objections of land adjoining property are the painfully missing.

1 Introduction

High-rise construction is not a settled concept. In small towns high-rise buildings are considered from 16 floors, and in megacities - at least 20 floors. Specialists under high-rise buildings mean only those whose height is more than 75 meters, which is approximately 25 floors. These buildings can have different purposes: to be hotels, offices, apartment buildings, educational buildings. Most often they are multifunctional: in addition to the main premises, there are parking lots, shops, offices, cinemas, etc.

When building high-rise complexes, it is necessary to take into account the following factors: changing the social and demographic composition of the population, increasing the density of the population; increase in the number of cars; development of roads and public transport; the possibility of increasing the capacity of engineering facilities and communications. This circumstance makes it necessary to develop methodological bases for increasing the effectiveness of creating comfortable living conditions and solving practical problems in the design of general plans [1].

In the proposed formulation, the problem was hardly investigated, although some aspects were considered in the works of domestic and foreign scientists. Among the most famous researchers in this area are T.G. Maklakova, V.F. Kasyanov, L.I. Pavlova. Many aspects of the activities of construction companies, taking into account Russian and foreign experience, are considered in the works of S.I. Abramov, V.A. Kharitonov. In the works of Yu. B.

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Khromov and S.A. Khasieva lists of elements of the amenities of residential complexes, including the adjacent territories, were proposed. The most serious work of recent years in the field of landscape architecture is V.A. Nefedov's monograph [2], which highlights the features of modern urban development and their influence on a comfortable living environment, describes the means and techniques that ensure the stability of the residential environment, but there are no proposals for complexes of improvement of residential areas, preferences in the selection of elements and desirable priorities.

2 Experimental section

One of the main tasks of urban development is the provision of sustainable development of the territory.

The construction of high-rise buildings is the ubiquitous trend in the development of mega-cities of the planet. The relevance of high-rise construction in Russia today is very high. In particular, it is planned to erect high-rise complexes in Moscow, which will form the high-rise silhouette of the city.

The era of skyscrapers dates back to the end of the XIX century. Its pioneers are traditionally considered American architects, who after the devastating fire in Chicago (1871) erected here the first high-rise buildings. The cost of land plots grew, and to increase the amount of space, respectively, increased the number of floors. A new type of structure contributed to the emergence of new building materials and engineering solutions. The first high-rise office buildings numbered from 10 to 20 floors. In 1892 the highest building in the city of Chicago was the "Mezonik Temple", built by the architects D. Burnham and J.W. Ruth. It consisted of 22 floors and had a height of 92 m [3].

According to federal standards, buildings above 75 meters (approximately 25 floors and above) are considered high-rise buildings. According to the construction legislation, the storey of the residential building is adopted in accordance with the size of cities:

- for large and the largest cities mixed building is accepted by buildings with a height of 9 or more floors;
- for large and medium-sized cities - mainly 5-9-storey;
- for small towns - 3-5-storey;
- for rural settlements (in public housing construction) - mainly 2-storey.

The scarcity and high cost of land resources in Moscow dictate the need for intensification of high-rise construction. With the commencement of the Moscow City International Business Center (MIBC) construction program, the height records of the high-rise complexes are rapidly rising, characterizing the beginning of a new stage of high-rise construction in Moscow, Russia and Eastern Europe. According to experts, an average of about 10500 people live on every square kilometer of Moscow [4]. By population, this is the largest city in the country and in Europe (for comparison: in London for 1 km² is home to 5100 thousand people, in Rome – 2.2 thousand people, in Tokyo – 5.74 thousand people, and in New York - 2.05 thousand people. However, for one resident in Moscow now an average of 19 m² of housing, and on average in Russia - 22 m², while in Europe - 35 m², and in the US - 65 m² [5].

The problems of building high-rise buildings in general in Russia are associated with the lack of standards for their erection and operation. Urban construction issues of high-rise buildings are still the least illuminated, although they are important for both individual buildings and for the city as a whole. In the arsenal of professionals, there is practically no corresponding normative base, design schemes for bases and load-bearing structures of buildings over 75 meters high, fire requirements for them [6].

There are some contradictions in the solution of town-planning issues. Moscow plans to stabilize the population, increase the area of greenery, etc. The maximum indicators of population density and the balance of territories in the city are determined by the requirements of Construction Code and Regulations (SNiP) 2.07.01-89*. Meanwhile, it is obvious that the construction of skyscrapers suggests, on the contrary, an increase in the density of buildings and population. The number of high-rise buildings is large and this, of course, will significantly affect these indicators throughout the city. Taking this into account, we can roughly assume that the total number of residents of future buildings will be 200-300 thousand people, which is comparable to the population of an independent large and correspondingly large cities according to the graduation established by SNiP 2.07.01-89*.

Obvious advantages of building high-rise buildings in the old re-compacted urban development of large cities. Among the main advantages of high-rise buildings can be identified: high economic efficiency, savings in the supply of all types of communications, the availability of infrastructure, etc [7]. But what about the standards for insolation, air exchange and, finally, landscaping, without which there can be no talk about providing comfortable living environment conditions and observing sanitary and hygienic standards [8]. At yard sites of compacted buildings, where multi-storey buildings are being erected under natural conditions, landscaping and landscaping require a special approach [9].

- The main disadvantages of building high-rise complexes are:
- Creation of the maximum population density - more than 2000 thousand people / ha;
 - Reduction of the local area to the minimum size

Fig. 1. Residential complex "Tricolor" (Moscow, North-Eastern Administrative District, Rostokinskaya st, 2; total area of the plot is 2.802 hectares; building area - 3159 m2; the area of the adjacent territory is 2.5 hectares; number of floors - 31-46 with underground parking for 1359 cars; the density of the population on the site will be 2366 people / ha).

Estimated population density, people / ha, the territory of the residential area is recommended to take in accordance with SNiP 2.07.01-89*.

Table 1. Estimated population density of the residential area and microdistrict area.

Zone of different degree of town-	Density of the population of the residential area, people / ha, for groups of cities with the number of inhabitants, thousand people
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planning value of the territory	>20	20-50	50 -100	100 -250	250-500	500-1000	1000<
High	130	165	185	200	210	215	220
Medium	-	-	-	180	185	200	210
Low	70	115	160	165	170	180	190

When comparing the data from the example given with the data given in SNiP 2.07.01-89*, it can be concluded that urban planning norms are practically not observed, the maximum population density is exceeded several times.

The inevitable increase in the density of the population of the territory, caused by the urban development situation, should not reduce the level of comfort of living of residents and the quality of the urban environment [10-11].

Urban buildings and its surroundings are designed to provide for people's livelihood (living, work, recreation). Therefore, when designing reconstructive measures, all modern urban planning, architectural, sanitary and hygienic requirements must be taken into account. The level of improvement in the residential area primarily determines the comfort of living in the city [12]. Accomplishment of the territory of the residential building includes: the arrangement of courtyards, palisades; landscaping; the device of rigid coverings for movement of transport and sidewalks for pedestrians; the arrangement of sites for various purposes (children's play, sports, economic, parking for cars, etc.).

Compliance with regulatory requirements in cramped conditions is rather difficult, therefore design solutions for improvement should not be applied from an extensive but intensive approach [13].

3 Result section

In general, the definition of the need for land for a general plan of an investment and construction project within a courtyard (or condominium) can be made using a simple linear function:

$$y = ax \tag{1}$$

$$y = \sum P_M \tag{2}$$

y - the area occupied by the house (houses) and adjacent to it (to to them) objects of real estate (infrastructure);
 a - land requirement, m2 / person. (norm), for all real estate and the house itself;
 x - number of inhabitants in the house (houses).

$$\sum P_M = a \times N \tag{3}$$

$$a=N_{gp} \times k_{st}+N_{ah}/ k_p \tag{4}$$

N_{gp} - the norm of the need for a useful living space for 1 person with the system of settlement for social hiring (living space + useful space in the apartment) - in Moscow, for example, it is 18 m2 / person. - or predictive-statistical for homeowners;
 k_{st} - the coefficient of the number of storeys of the house, which reduces the amount of land required for the building itself, with an increase in the number of storeys. In the first approximation, the values of this coefficient can be taken as follows:
 - for a 1-storey building Cottage. = 1;
 - 2-storey building – 0.5;
 - 3-storey building – 0.33;

- 4-storey building – 0.25;
- 5-storey building – 0.20;
- 10-storey building – 0.10;
- 50-storey building – 0.02;
- 100-storey building – 0.01;

k_p - the coefficient of increasing the useful area for placing adjacent real estate objects when using 2 or 3 levels: underground, above ground. The value of this coefficient is determined by direct calculation using architectural drawings. In the source, a table of such calculated coefficients for some objects in Moscow and the Moscow region with their attribution to different categories of comfort and "residential groups" is given [14-15].

Table 2. Coefficients of increase in the useful area of development due to the creation of elevated areas.

Residential group	Comfort category					
	Moscow			Moscow Region		
	1	2	3	1	2	3
Low-floor	1.348	1.237	1.160	1.339	1.237	1.169
The middle-floor	1.262	1,234	1,166	1.259	1.260	1.180
High-rise	1.173	1.160	1.139	1.185	1.171	1.158

4 Conclusions

1. The study conducted by the authors showed that in the conditions of an acute shortage of free areas for construction, with the inevitable increase in the density of development due to the urban development situation, the construction of high-rise complexes is very relevant. But only the consideration of all requirements of the town-planning legislation and the creation of a new regulatory framework for the design and construction of high-rise complexes contribute to the emergence of comfortable living conditions for people.
2. The calculation technique developed by the author can be used in the future when forming a general plan for the development of the territory in the construction of high-rise complexes, taking into account the actual density of the population.
3. The results of research work can be useful to development organizations, as well as to state and municipal institutions dealing with the issues of implementation of investment and construction projects.

References

1. *The City-Planning Code of the Russian Federation* (2010)
2. V.A. Nefedov, *Landscape Design and Stability of Environment* (2002)
3. A.M. Karimov, *Urban Development* **2**, 18-22 (2010)
4. H.G. Jakubov, O.A. Manuhina, *Real estate: economics, management* **2**, 14-17 (2015)
5. Ye.O. Matukhina, *Architecture and Construction in Moscow* **1**, 24-27 (2008)
6. V. Belogolovsky, *Architectural Herald* **4(85)**, 168-177 (2005)
7. V.A. Lukinov, A.B. Mottaeva, *Science of Science* **2**, 54-69 (2014)

8. N.G. Verstina, E.M. Akimova, T.N. Kisel, E.Y. Chibisova, V.A. Lukinov, *International Journal of Economics and Financial Issues* **3(5)**, 217-223 (2015)
9. P.G. Grabovy, A.K. Orlov, *Procedia Engineering* **153**, 195-202 (2016)
10. S.V. Nikolaev, A.A. Magaj, N.V. Dubynin, V.S. Zyrjanov, *Housing construction* **12**, 3-6 (2016)
11. O. Kurakova, N. Khomyak, *Procedia Engineering* **165**, 1221-1228 (2016)
12. P.G. Grabovyy, R.V. Volkov, S.I. Beljakov, *Issues of state and municipal management* **4**, 211-219 (2016)
13. A.A. Magaj, V.S. Zyrjanov, E.Ju. Shalygina, *Housing construction* **11**, 17-20 (2015)
14. E.V.E. Sherbina, N.V.E. Danilina, D.N. Vlasov, *International Journal of Applied Engineering Research* **22(10)**, 43131-43138 (2015)
15. O. Levi, B. Tal, S. Hileli, A. Shapira, I. Benhar, P. Grabov, N. Eliaz, *Cytometry* **88**, 338 (2015)