

Criteria of comfort of housing in cities of future

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Abstract. The article presents the author's systematization of the requirements for modern comfortable urban housing in the Russian Federation. Particular attention is paid to compliance with the principle of environmental safety of home. This is a worldwide trend related to the increase in public attention to various factors associated with environmental protection issues and toughening requirements for environmental friendliness and energy efficiency. Promising areas and trends in the development of the concept of comfort of urban housing are given.

1. Introduction

Housing has always been and remains the basis of the well-being and welfare of people. The ideas about the comfort of housing are constantly changing with the development of society, and therefore, it is a fact that residential buildings erected at the same level of comfort, after some period of time, no longer meet the transforming evaluation criteria. In this article, the authors tried to systematize the requirements for modern urban housing in Russia and to note promising directions and trends in the development of the concept of comfort of urban housing.

At the modern social, political, economic and cultural level of the development of society and the building complex of Russia, the concept of "urban housing" includes not only the space of an apartment building or residential complex, but also adjoining territories intended for walking, recreation, games, travel and car parking, various types of daily business activities, etc. All this defines the concept of "residential environment". Residential building is considered as a complex structure that organizes living space for people, and is a system of social, technical and natural elements with their connections.

2. Methods

The dynamically changing political and socio-economic situation in Russia at the beginning of the 21st century led to a change in views on the methods of designing a home and the concept of comfort of a residential environment, which today is determined not only by functional planning and technical characteristics, but also by sanitary-hygienic and aesthetic characteristics, as well as security of residence.

The basic scheme "external environment - building - man" as a source concept includes a person with his biological and social needs and the external environment with a set of factors that affect a person. The external environment affects a person through the microclimate of buildings and development.



3. Results

The comfort of the external conditions of the designed environment is influenced by the following factors: natural, anthropogenic, urban planning, aesthetic and engineering systems [1] (table 1).

Table 1. Criteria for the comfort of a residential environment (external conditions)

Criteria for the comfort	Parameters of a residential environment
Natural	Insolation of territories Territory aeration Availability of green areas
Anthropogenic	Absence or remoteness of industrial enterprises Noise protection Absence or low level of the gas contamination and dustiness Permissible level of electromagnetic radiation Safe radiation regime of territories Permissible level of vibration in the territory
Urban planning	The presence of landscaped surrounding areas Availability of infrastructure facilities Convenient public transport system Ensuring safe pedestrian movement of all groups of residents (including people with limited mobility)
Engineering systems	The presence of parking lots, car parks Availability of engineering infrastructure modern in composition, capacity and technical level
Aesthetic	Architectural expressiveness of buildings Reflection of national architectural forms and traditions The lack of the monotony in the residential development Organization of harmonious space Planting of greenery the territories'

Table 2. Comfort criteria for urban housing (internal conditions)

Criteria for the comfort	Parameters of a residential environment
Constructive	Rational constructive decision of the building Strength Durability Fire resistance
Engineering and technicals	Availability of modern internal engineering systems and communications
Organization of the internal space	Convenient planning solution of apartments (composition, volumes, areas and proportions of premises) Zoning of premises The possibility of transforming the living environment by placing residential premises at different levels, floors; changes in the planning decision: the number of rooms, the size of the functional areas.
Sanitary and hygienics	Comfortable temperature and humidity conditions Sound comfort Light comfort Radiation comfort Ecological safety

The criteria for the level of comfort of the inner space of an urban dwelling are functional factors (structural and space-planning decisions of buildings, the level of their engineering improvement) and sanitary and hygienic factors: temperature and humidity conditions, light and noise modes,

environmental safety (table 2).

Sanitary and hygienic criteria for the comfort of a modern urban dwelling require more detailed consideration (table 3).

Table 3. Sanitary and hygienic parameters for assessing the comfort of residential premises (internal conditions)

Criteria for the comfort	Parameters of a residential environment
Thermal comfort	Air temperature The velocity of air Relative humidity Resulting room temperature Local asymmetry of the resulting temperature Кратность воздухообмена
Sound comfort	Noise Vibration Ultrasound
Light comfort	Daylighting lighting Artificial lighting Combined Lighting Contrast of the surfaces
Radiation comfort	Level of the heat exchange Electric and electromagnetic fields
Ecological safety	Biosafety Chemical safety Energy efficiency

Hygienic requirements for the thermal comfort, sound comfort, light comfort and radiation comfort are contained in the regulatory documents of the Russian Federation (SP 54.13330.2016, GOST 30494-2011, SanPiN 2.1.2.2645-10, SP 60.13330.2016, SanPiN 2.2.1/2.1.1.1076-01, SP 52.13330.2016, SanPiN 2.2.1/2.1.1.1278-03, SP 51.13330.2011), which regulate the optimal and permissible values of these microclimatic indicators.

4. Discussion

The criterion of environmental safety of housing has recently attracted increasing attention of property owners and buyers and, accordingly, is compelling the attention of builders and manufacturers of building materials. This is a global trend and it is associated with an increase in public attention to various factors related to environmental protection issues and toughening requirements for environmental friendliness and energy efficiency [2].

Ecological safety of a housing implies the use of structural and finishing materials with no foci of damage to materials and structures by rodents, insects and microorganisms (biological safety) and the state of the air environment containing a minimum amount of toxic substances (chemical safety).

Ecological and hygienic safety of a comfortable home, and in particular chemical safety should be ensured by the use of environmentally friendly materials and products. The main criteria for choosing building materials for housing should be their natural origin, the absence of negative effects on human health and suitability for reuse [3].

The modern requirements for the careful consumption of energy allow expanding the concept of a modern ecological housing by introducing another criterion - energy efficiency. The development and construction of buildings in which the comfort of planning decisions would be combined with environmental friendliness and energy efficiency is one of the trends in modern housing construction [4-7]. Ecological construction is gaining popularity around the world. This term refers to the use of

"green" construction technologies that promote the use of natural forms, means and sources to create healthy and comfortable human conditions.

The concept of "green house" includes both bionic architecture in which the laws of nature are applied, and the use of renewable energy sources (energy of the sun, wind, water) and the use of materials that create a healthy microclimate in the house and do not harm people and nature on throughout their life cycle. "Green" building can be defined as a close interweaving of ecology and economics: people care about the environment and reasonably save resources and funds [8-9].

Residential buildings are considered to be energy efficient, in which rational energy consumption is organized. By this we mean not only the reduction of energy consumption (energy saving), but also the use of measures aimed at reducing the amount of energy while ensuring the same level of energy supply to buildings. This can be achieved through the use of space-planning solutions, which allow reducing the area of external fences and thus reducing heat loss; choosing the orientation of buildings, allowing the most efficient use of solar energy; creation of sealed structures-thermoses for external fences; application of automated control systems for energy and water consumption; the use of air recovery systems, collection, accumulation and purification of rainwater, solar collectors and photoelectric panels; use of groundwater, thermal energy of the earth, etc. Innovative methods of applying "green" technologies in construction have been tested during the construction of many skyscrapers around the world: Hearst Tower and Bank of Amerika, New York, USA; Pearl River Tower, Guangzhou, China; Agora Garden Tower, Taipei, Taiwan; Bahrain World Trade Center in Manama, Bahrain and many others.

There is no doubt that the technology of building environmentally friendly and energy-efficient buildings, as one of the ways to solve the problem of rational environmental management, will be improved in the cities of the future.

5. Conclusion

Housing comfort is a multi-factor indicator, a category that is constantly changing over time. A change in the social, political, economic and cultural level of development of society, the emergence of innovative materials and technologies of the construction complex leads to a change in the criteria for housing comfort. Creating comfortable housing in modern cities and cities of the future is an urgent problem requiring an integrated approach. In order to solve it, it is necessary to attract the scientific potential of a team of specialists, which, in addition to architects, should include builders, power engineers and hygienists.

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