ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 5 , May 2020

Enhancing resilience in residential development

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ABSTRACT:An immediate challenge for the modern architecture is reduction of the global risks and improvement of vital activities' security. Buildings and structures have a significant impact on the environment. While meeting their demand for living habitat by constructing buildings, spending non-renewable energy sources and manipulating with the ecology, people should strive to protect functioning of the Earth's ecosystem in general from their activities, ensuring stability of development for the future generations. An efficient tool for habitat sustainability improvement is green construction.

KEYWORDS: green construction, residential building, habitat sustainability rating, green standard

I.INTRODUCTION

An urgent problem of modern architecture is to reduce global risks and increase the safety of human life. Buildings and structures have a significant impact on the environment. Satisfying their needs in the environment through the construction of buildings, while spending non-renewable energy sources and affecting the environment, people should strive to protect the functioning of the earth’s ecosystem as a whole from their activities, ensuring sustainable development for future generations. An effective tool for enhancing habitat sustainability is green build

Green building is developing in many directions [1–7]. Innovative solutions for low-energy buildings are actively developed and implemented in modern practice. Elements of green buildings - green roofs and facades are

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 5 , May 2020

constantly being improved. The sustainable architecture of the city is being formed. Improving energy efficiency during the thermal renovation of civil buildings and their facade systems is of extremely practical importance. To more fully and accurately take into account the consumer characteristics of buildings, new rating systems for assessing the sustainability of the environment are being developed.

Define ways to improve the sustainability of the habitat in residential development.

Object of study

We will study a fragment of residential development with 5-story brick buildings of mass series 1–447 in Volgograd (Fig. 1). Such buildings were built in the late 1960s according to a standard design and have the following basic consumer properties.

Picture 1. Typical five-story building of a series 1-447 (Volgograd)

Advantages:

• Location in areas with good infrastructure and transport accessibility.

• Increased insulation of apartments from aircraft noise due to the massive separation of load-bearing walls and concrete slab.

• No load-bearing walls inside the apartment, which opens up opportunities for redevelopment of apartments.

• The presence of balconies.

• The presence in the apartment closets.

• High reputation among the population due to increased service life of brick buildings (at least 100 years).

Disadvantages:

• Interconnecting living rooms in two - and three-bedroom apartments.

• Small kitchen area (less than 8 m2).

• Narrow wall and floor in the stairwells.

• In most cases one-sided orientation of apartments to the horizon.

• Shortage of three-bedroom apartments due to the use of a shortened ordinary block sections.

• Reduced insulating properties of the enclosing structures.

On the basis of the analysis of consumer properties multifamily residential buildings this series the conclusion about the need to improve the sustainability of the environment.

Methods

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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Rating estimation of sustainability of the environment in residential areas made on the basis of STO NOSTROY 2.35.4–2011 "Green building. Residential and public buildings. Rating system of the sustainability of the environment" [7].

Requirements of the rating system is aimed at reducing energy consumption, use of untraditional, renewable and secondary energy resources, rational water consumption, reduction of harmful impacts on the environment in the process of construction and operation of buildings, including the local area while ensuring a comfortable living environment and adequate economic profitability of architectural, constructive and engineering solutions.

The specified standard:

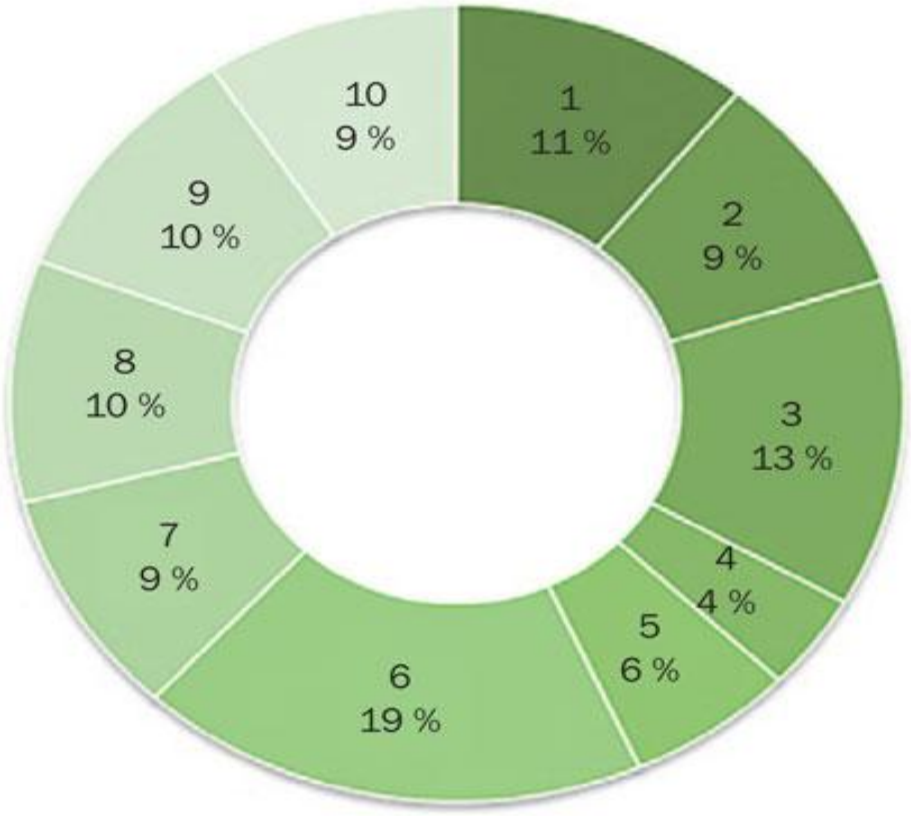
• defines the principles, categories, evaluation criteria, sustainability indicators of habitat, as well as weighting the indicator values for purposes of rating of the object;

• contains a system of benchmarks (indicators), which, if necessary, adjusted factors, and are supplemented by parameters that reflect regional or local climate, energy, economic, social and object features;

• establishes classes of sustainability of the environment for constructed, reconstructed or renovated residential and public buildings, as well as their design documentation.

The standard applies to all categories of designed, built and commissioned residential and public buildings of various functional purposes.

The sustainability of habitat in the system is estimated by a set of ten basic categories (Fig. 2). The greatest specific weight in this system, as can be seen from Fig. 2, has a category of "energy Saving and energy efficiency".



1	comfort and quality of the external environment
2	quality of architecture and object planning
3	quality and ecology of the internal environment
4	quality of sanitary protection and waste disposal
5	rational water use
6	energy saving and energy efficiency
7	use of alternative and renewable energ

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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8	ecology of building, operation and disposal of the facility
9	economic efficiency
10	quality of preparation and project management

Figure 2 Basic categories of habitat sustainability [7]

Each category is represented by a separate group defining its criteria. Each of the criteria is expressed by one or a group of indicators. Each indicator has its numerical determination as a parameter, parametreleri series or parametrului characteristics, which corresponds to a point value. The sum of scores by criteria defines the point value of the category as a whole.

The sum of the scores of all the categories determines the overall (integral) value of the stability of the quality of the environment, the numerical value of which is denoted as S-factor (Sustainability factor).

Final rating assessment of the sustainability of the environment is based on the total S-factor. Depending on the amount of points scored by the definition of the S-factor project (building) is assigned the grade of sustainability of the environment.

The system of rating estimation of sustainability of the environment is an innovative tools that stimulate green building.

Results and discussion

According to the analysis of the basic categories of rating systems were outlined policy recommendations to improve the sustainability of the environment of the object of the research: the improvement of the local area, the structuring of the domestic space, creating Parking spaces for vehicles, availability of Parking spaces for people with limited mobility, accommodation of bike lanes on residential areas, the design of Parking areas for bicycles and prams, the establishment of a water environment on the territory of the domestic space, the location of separate waste containers, insulation of external enclosing structures of buildings, the superstructure of the building through the attic (Fig. 3A), the deployment of elements of the solar systems on the roof of the building (Fig. 3b) and on the railings of the balconies.

Figure 3 Examples of increasing the stability of the living environment of an object: a) a superstructure of a building using the attic, b) placement of solar elements on the roof of a building

Based on a comprehensive assessment by the authors of the urban development potential of the considered building fragment, calculations of insolation and natural light, assessing the availability of infrastructure, determining the architectural, planning, structural and engineering characteristics of buildings, calculating the geometric, heat engineering and energy indicators of buildings, a rating assessment of the stability of the environment (fig. 4).

The calculation established that, before increasing the stability of the habitat, residential buildings on the construction site have class E (S-factor is 209 points). After increasing the sustainability of the habitat, a class upgrade to level C is expected (S-factor is 341 points).

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 5 , May 2020

Figure 4. U.S.A Energy Efficiency Criteria

Thus, the principal paths outlined by the authors create wide opportunities for increasing the sustainability of the living environment in residential buildings with mass series 1–447 in order to preserve the quality of the environment for future generations.

Conclusion

Based on the results of studies based on a calculated assessment of the sustainability of the environment in the development of residential 5-story brick buildings of mass series 1–447 in Volgograd, the following main conclusions are formulated:

• Prior to increasing the sustainability of the living environment, residential buildings on the construction site have class E (S-factor is 209 points).

• After increasing the sustainability of the habitat, a class upgrade to level C is expected (S-factor is 341 points).

• Systematization and synthesis of data on green building allow us to outline the principal ways to increase the sustainability of the living environment in the building and maintain the quality of the environment for future generations.

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ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 7, Issue 5 , May 2020

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