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ANALYSIS OF SPACE-PLANNING SOLUTIONS, THERMAL PROTECTION OF THE BUILDING FOR ENERGY CONSUMPTION AND COMFORT FOR ACCOMMODATION

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Annotation

This article provides information on the measures to be taken to increase energy efficiency in the reconstruction of buildings and their application.

Keywords: Project, building, reconstruction, solution, temperature, energy efficiency.

Introduction

In the second half of the XX century, mass housing construction was carried out on the territory of Uzbekistan in almost all large and medium-sized cities according to standard industrial series projects. Over the past 40-50 years of operation, most of these houses have become obsolete both morally and physically, and currently need urgent reconstruction. [1] The operational energy consumption of existing residential and public buildings in Russia is approximately 3 times exceeds similar indicators in technically developed countries with similar natural and climatic characteristics. Moreover, many buildings built in the late 1950s and 1960s are dilapidated and in disrepair today. Over the past 10-15 years, theoretical developments have been carried out, energy-saving programs have been actively discussed, and a number of experimental facilities have been built.[2] Studying foreign experience and individual examples of the reconstruction of residential buildings of the first industrial series in the cities of Russia, Belarus and other CIS countries, a group of scientists, architects and design specialists under the scientific guidance of Academician S. N. Bulgakov developed a concept, technical solutions and socio-economic justifications for the recoupment reconstruction of residential buildings of five or fewer storeys by the method of secondary construction of reconstructed blocks and neighborhoods without demolition or with minimal demolition of existing buildings and 2-3-fold increase in residential areas. [3] At the moment, there is a lively debate around these topics, during which a number of realistic recommendations have been developed that should help reduce the energy consumption of buildings and structures. In particular, in the field of urban construction policy, the following recommendations were developed, a brief summary of which is given in [4-5]:

- Establish a moratorium on the expansion of city borders for a period of 20-30 years.
- During this period, the development of cities should be carried out through more rational use of territories, compaction of buildings to regulatory level without the development of new suburban areas and without increasing the length of main heat pipelines, other power grids and transport routes.
- To develop feasibility studies for the integrated use of traditional centralized and non-traditional heat supply systems, including local ones, with the use of container-type boilers placed on roofs or near heated buildings.
- To develop programs for the completion of the development of residential quarters and micro-districts with the elimination of through wind-forming spaces and the organization of enclosed courtyard and intra-block territories.
- Develop master plans, programs and business plans for the secondary construction of reconstructed low-rise residential blocks.
- To workout issues related to the insulation of enclosing structures of existing houses, in accordance with the new thermal engineering standards.
- Develop plans for the transition to automated individual heating points and plans for the reconstruction of heating networks.
- To make the transition to the use of roof boiler houses for heating and hot water supply, taking into account the increase in residential areas.
- Implement a set of measures to save electricity with the organization of energy-efficient urban economy zones on the basis of these quarters.
- Develop programs for the use of underground space (underground urbanization) to accommodate car parking, storage and storage facilities using natural heat of the earth or artificial sources of air heating to a positive temperature.

Research Results

Their spatial planning solutions and, in particular, the following indicators have a significant impact on specific heat losses in residential and public buildings, the ratio of the area of enclosing structures and the total area of buildings;[6]

- the ratio of the area of window openings and the area of external walls;
- the configuration of buildings in the plan, their placement on the relief and relative to the countries of the world.

The Russian Academy of Architecture and Building Sciences (RAASN) has developed a system of so—called wide-frame residential buildings (SHKD) for mass construction (the authors are academicians of the RAASN A. G. Rochegov and S. N. Bulgakov). The Government of the Russian Federation has awarded this work and its authors with a prize.[7]

Wide-frame houses (SHKD) represent one of the latest high-quality developments. Their fundamental difference from the houses of the standard series that have been built so far is to increase the width of the house body to 18-20 m (theoretically — up to 23.6 m) in compliance with all norms of natural illumination, insolation, air exchange. Since the SHKD is almost 1.5 times wider than ordinary houses (Fig. 1.1), the ratio the useful living area to the area of the exterior walls increases. Due to this, those pilaf losses are reduced by 20-40%. For the same reason, as well as due to the possibility of bringing the housing area for one staircase-elevator block up to the standards and more rational use of building sites, the cost of a square meter of housing is reduced by 15-20% compared to the most economical series of mass-built houses. At first glance, a simple change in the planning parameters of the SHKD provides a whole range of their advantages. Firstly, it has increased planning maneuverability: The SHKD can be designed with any set of quart shooting ranges from 1 to 6 rooms in apartments located on both one and two levels. Secondly, the SHKD is 20-25% more economical in operation than ordinary houses. [8-9]

On the first (non-residential) floors of such houses without additional extensions it is possible to place commercial enterprises, and in the basement and basement floors — double-row parking lots. Houses can have any number of storeys and a different configuration in plan (tower, extended, angular), latitudinal and meridional orientation, be built on simple and complex terrain. The specified change in the planning dimensions, subject to all norms and requirements for housing, provides:[10-11]

- free multivariate layout of apartments on one and two levels with any number of living rooms, with possible subsequent transformation of premises;
- reduction of the cost of building a square meter of housing by 15-20%

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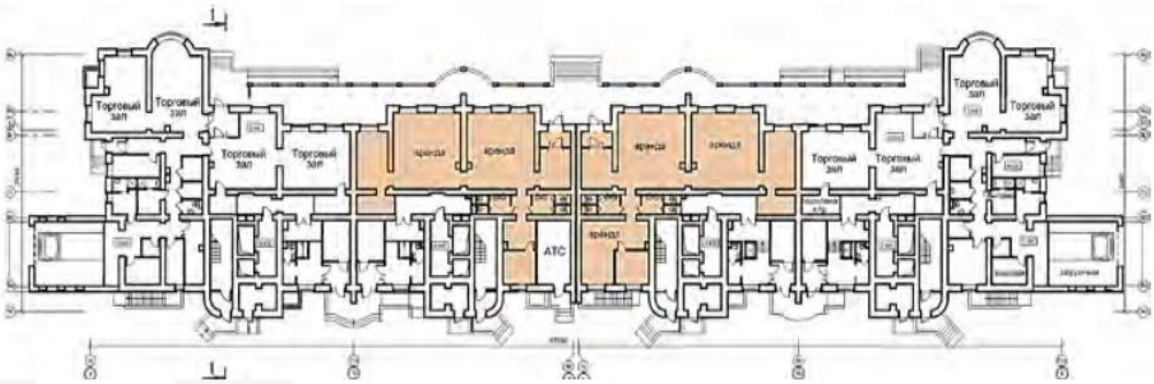
- compared to the most economical series of houses currently under construction, built from identical structures;
- reduction of the consumption of materials for external wall and translucent
- fences, attributed to the unit area of housing, by 40% or more;
- reduction of specific heat consumption for building heating by 25-30 %;
- the possibility of erecting a school with a height of 3 to 22 floors in any city
- made of prefabricated monolithic and mixed structures.

Ground floor plan



Typical floor plan

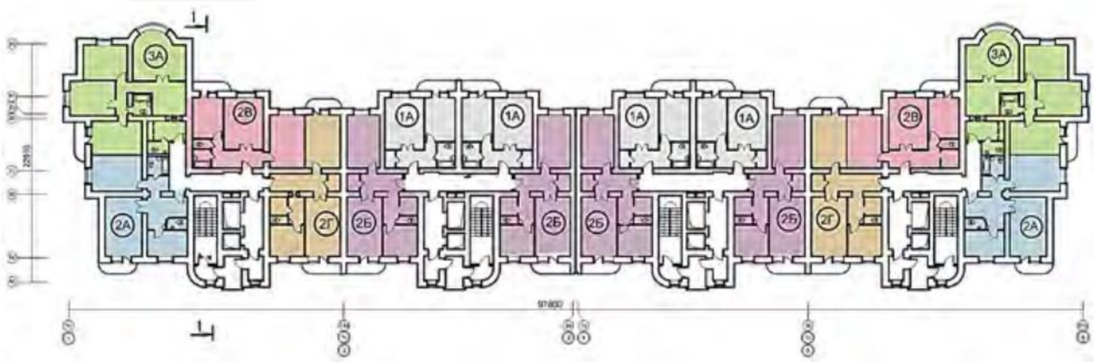


Figure 1. Typical plan of a wide-frame residential building

The space-planning and structural systems of houses of secondary buildings (DVZ) consist of two parts: a new part of a multi-storey building in a monolithic or prefabricated monolithic design and the old part of the house, which is a five-storey or lower-storey house to be reconstructed. Both parts are combined into a single architectural and construction composition (Fig. 1.2). Engineering systems and equipment of such a house are common (4). Structurally, the new part of the house is based on independent foundations (5), and loads from it are not transferred to the reconstructed house. On one side of the reconstructed house, pylons are erected to its entire height (1), on the other — a monolithic or prefabricated monolithic bookcase with a width of 5-6 m (2). At the level of the sixth floor, wall beams are concreted, along the upper belt of which a monolithic platform is arranged, which perceives loads from the built-in floors (4). The number of floors of the DVZ can be any (7, 10, 17 or more floors).[12-13]

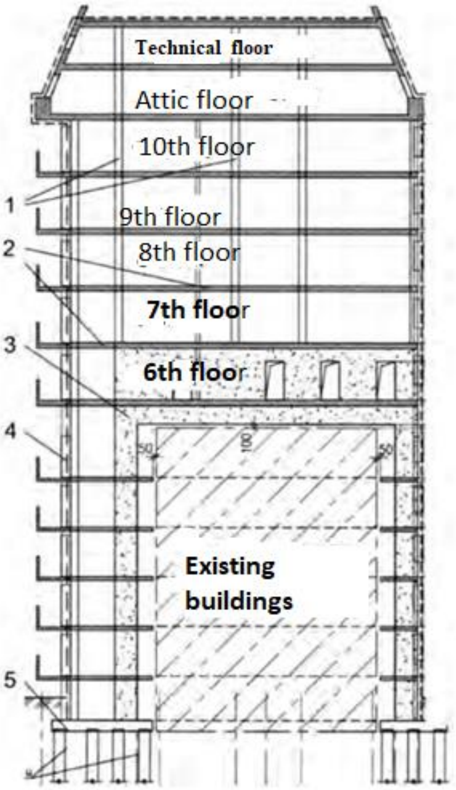


Fig. 2. Schematic diagram of the design solutions of the DVZ.

Conclusions

In conclusion, the frequency of overhaul and reconstruction for capital buildings built in Europe is about 25 years. Currently, in the total volume of the city housing fund, 90% of residential buildings were built more than 30 years ago, and they were not overhauled and more than 30% were outdated.

Violation of the regulatory deadlines for the periodicity of overhaul and reconstruction of buildings, the inconsistency of their indicators with the requirements of the standards of thermal engineering led to the fact that residential buildings in Nukus are among the last in the world in terms of thermal efficiency. Energy consumption for 1 m of housing in Karakalpakstan is 200-300 kWh or more per year, which is 2-3 times more than the regulatory costs in Russia. The cities of Karakalpakstan are dominated by large panel houses built on an industrial basis, which are characterized by high energy consumption.

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