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THE PROBLEMS OF RENOVATION AND RECONSTRUCTION OF PREFABRICATED PANEL BUILDINGS

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Annotation. The article deals with the problems of renovation and reconstruction of prefabricated buildings. More than 50 percent of housing in Ukraine has crossed the 50-year threshold and requires extensive repairs, and the communal infrastructure is 70 percent outdated. The problems of panel buildings stem from the need for rapid and budgetary construction of housing: high thermal conductivity, poor soundproofing. The size and layout of Soviet apartments were designed by architects on the basis that one family would live in each of them. An area of 8 square meters per occupant was allocated. Undoubtedly, the problem of worn-out housing is becoming more and more pressing for the country every year. Almost every third multi-storey building in the Ukraine is of the prefabricated panel buildings series. In Ukraine there is a law on the reconstruction of residential areas with outdated buildings.

Thus, if we consider path number 2 of reconstruction and renovation of buildings and structures, we can outline several ways to solve the current problem. There are options more cosmetic, and there are with an impressive reconstruction and superstructure floors, or their reduction. It all depends on whether we want to achieve a denser development and the number of apartments, or to reduce the load on a given residential building. It is important to note that in addition to reconstruction and renovation, there is another option - the demolition and construction of high-rise buildings on the site of the of prefabricated buildings. It would seem to be a good idea. Statistically, it is better for a person to live no higher than a tree, that is, up to about the 8th or 9th floor.

Having analysed the global experience, it is safe to say that there are plenty of countries and cities in Europe which were once built up with of prefabricated buildings. These are eastern Germany, Poland, the Baltic states, etc. In connection with the above, we can say that the reconstruction of prefabricated buildings, improving the quality of the housing stock and increasing the availability of housing implies a continuous process of reproduction of the housing stock.

Keywords: renovation and reconstruction, prefabricated buildings, modernisations, renovation of buildings and structures, the densification of development.

Problem statement. More than 50 percent of housing in Ukraine has crossed the 50-year threshold and requires extensive repairs, and the communal infrastructure is 70 percent outdated.

In Ukraine, there are around 25,500 buildings of the first mass series of large-panel, block and brick buildings, totalling 72 million square meters, which means that 23 per cent of the building stock is in dire need of renovation or modernisation. For example, in Kyiv there are 3 thousand five-storey Khrushchev houses and 1 thousand nine-storey panel houses out of 11 thousand multi-storey buildings in the capital [1].

There are also differences in the age and dilapidation of the housing stock in the regions. In Cherkassy, Kharkiv, Zaporizhzhia and Mykolaiv oblasts, approximately 30% of the housing stock consists of the houses that were built in the 1950s and earlier. And in Zakarpattya and Ivano-Frankivsk regions 18-20% of such housing [1].

Analysis of recent research and publications. The mass introduction of prefabricated panel buildings and structures began in 1954, when architects were required to solve the housing crisis with quick and low-budget prefabricated houses combined into neighborhoods. The new housing was not to be an architectural work, but an industrial one [2].

The problems of panel buildings stem from the need for rapid and budgetary construction of housing: high thermal conductivity, poor soundproofing. The size and layout of Soviet apartments were designed by architects on the basis that one family would live in each of them. An area of 8 square meters per occupant was allocated [3].

Purpose of the research: to highlight the problems of the renovation and reconstruction of prefabricated houses and outline solutions.

Objectives: to show how the renovation of prefabricated panel buildings can improve the living conditions of residents and make the architectural solution more interesting.

Main text. Undoubtedly, the problem of worn-out housing is becoming more and more pressing for the country every year. Almost every third multi-storey building in the Ukraine is of the prefabricated panel buildings series. In Ukraine there is a law on the reconstruction of residential areas with outdated buildings.

In recent years, the approach to the development of residential areas and housing construction has changed radically (comprehensiveness, quality and diversity of housing equally prioritized the former task of increasing the average provision of the population with it, increasing social guarantees in housing, elimination of emergency and dilapidated fund, comprehensive improvement, major repairs, reconstruction and modernization of buildings)". Thus, "the most important trend of urban development of various cities is the transition from the territorial growth of the city at the expense of new construction on the annexed land, to the reconstruction of the existing territories [8].

At the same time, some steps in this direction are already being taken, but the implementation of the new urban planning policy faces great difficulties. In this regard, along with the solution of socio-economic issues of reconstruction, it is necessary to address a number of important topics directly related to the architecture of the existing capital development in order to identify the reserves for improving its quality. Among the whole complex of problems, it is necessary to mention the following^

- improvement of the architecture of the areas of mass building;
- implementation of measures required by the housing and communal reform, aimed at improving the energy efficiency of housing;
- superstructure of houses to be reconstructed;
- improvement of neighbourhood infrastructure;
- creation of well-controlled and safe neighbourhoods;
- regularisation of parking spaces for private cars;
- increasing small and medium-sized businesses, including those in the neighbourhoods [8].

There are two ways to solve the problem with five-story apartment buildings:

1. Radical method - demolition of the building in order to free up the territory for the construction of new
2. Renovation of buildings and structures, using modern technologies and materials, taking into account the standards existing at the time of renovation, as well as the requirements for the quality of life of modern people [2].

The choice of reconstruction methods is based on a comprehensive approach reflecting urban planning, architectural, social and environmental requirements, while at the same time each object to be reconstructed requires individual solutions, which is explained not so much by the place occupied by the building in the urban development and its historical value but rather by its technical condition. The latter factor can be decisive in the decision-making process.

The methods of reconstruction depend on the age of the building, which in turn determines the structural-technological and architectural-planning features inherent in the given period of time, the materials of the load-bearing and enclosing structures, and the quality of the work.

It should be noted that the functional requirements are dictated by the sharp «obsolescence» of the extremely economical flat layouts in the «first generation» houses, which led to a drop in their use value. This requires that each of the structural systems used in these buildings be analysed when planning the refurbishment and the changes they allow in the load-bearing structures when modernising the flat and section layouts [7].

In turn, the operational requirements are dictated by the significantly increased thermal and acoustic insulation standards of the structures over the years. The renovation project should therefore also include measures to improve the performance of the external and internal building envelopes.

Thus, if we consider path number 2 of reconstruction and renovation of buildings and structures, we can outline several ways to solve the current problem. There are options more cosmetic, and there are with an impressive reconstruction and superstructure floors, or their reduction. It all depends on whether we want to achieve a denser development and the number of apartments, or to reduce the load on a given residential building. Reducing the number of floors and the number of apartments per stairwell. Development of a new design of apartments of different layout and capacity.

Reconstruction with the possibility of adding an attic is one of the easiest ways to modernise a five-storey building. But it has its supporters and opponents. In favour of such projects are the simplicity and not very high cost of their implementation, and against - the fact that all other flats practically do not undergo changes, and the increase in living space of the house turns out to be very small. If at least part of the attic is converted into housing, there will be many new low-cost flats in the city. Mansard construction, which can give a second life to "Khrushchev" buildings, is 20% or even 50% cheaper than conventional construction. There is no need to lay communications, dig excavations, or build foundations - everything is already there [6].

The densification of development through the superstructure of buildings and combining them with outbuildings and extensions in complex spatial compositions is required. These economic and urban planning solutions require the design of the reconstruction to analyse the bearing capacity of the building structures and foundations and their capacity to absorb the additional loads of the extensions and extensions.

Remodeling apartments and interior spaces (remove partitions, make the space larger). A small one-bedroom apartment becomes a large one-bedroom, and a small two-bedroom apartment becomes a large two-bedroom apartment. For example, turning a small one-bedroom into a two-bedroom apartment increases floor space by 16%. There is an increase in kitchens up to 8-9 m^2, creating spacious hallways with closets or built-in cabinets. In 2-3-room apartments, a separate bathroom is arranged with the possibility of placing a washing machine and a 170 cm long bathtub in the bathroom.

Reconstruction of a building by adding floors. Around the five-storey building, monolithic load-bearing structures are built, which take the load of all the superstructures. The body of the old building is put inside this «frame». Balconies are attached to the house.

Reconstruction of a building through partial reconstruction. The facade panels are removed from the old building, all non-load-bearing partitions are removed. A new foundation is built next to the former walls, on which the frame designed by the designers is placed. In other words, the building is made wider. And already on the new frame is built up to 9 floors, and the new 4 floors do not put pressure on the old five-storey building.

Allocation of mini-gardens in the first floor by the fencing structures for the occupants of the 1st floors. For a unified architectural composition, install continuous balconies. To increase

the area of balconies and loggias. Adding color and accents changing the composition of the residential sections. The color solution creates lively contrasts between the facades. Removing the top floor and sections from the line of houses, provided the building is long, to change the purpose and appearance of the building. Separate multi-family villas are created on the basis of the old house.

The transformation of a building into an energy-efficient building, for a more economical and environmentally friendly way of life. The goal of this project: to completely renovate the facades of the old buildings, equip them with solar panels, install new windows, insulation, heating and ventilation systems. The apartments in the buildings will be equipped with a «smart-home system» (Smart-Home-System), allowing residents to monitor and control their energy consumption.

To clarify the possibility of building on prefabricated panel houses, preliminary studies have established that in most cases (with the appropriate condition of the foundations) they allow for a two-storey superstructure without special reinforcement. In the case of a superstructure, as in the historic houses, it is necessary to build a continuous monolithic reinforced concrete band around the perimeter of the load-bearing walls of the storey to be superstructed. Additional space-planning possibilities are offered by the cross-wall construction system of small pitch, which provides the possibility of changing the main construction system in the superstructured storeys [7].

It is important to note that in addition to reconstruction and renovation, there is another option - the demolition and construction of high-rise buildings on the site of the of prefabricated buildings. It would seem to be a good idea. Statistically, it is better for a person to live no higher than a tree, that is, up to about the 8th or 9th floor. There is data, for example, on the growth of nervous diseases: there is a direct correlation with the floor on which a person lives - the higher the worse. Moreover, the higher the floor, the more problems the tenants have with pressure fluctuations, vibration. Our doctors at one point began to study this linkage of floor to health, but then such studies were curtailed [4].

Add to this the vulnerability of high-rise buildings in case of an emergency: if there is a fire, the staircases are immediately crushed and the fire escape stairs will not reach every floor. Therefore, skyscrapers are fine for a hotel or office, but it is better not to make them residential. The whole western world is now following the way of low-rise construction, and only in Ukraine, on the contrary, they are increasing the number of storeys [4].

Having analysed the global experience, it is safe to say that there are plenty of countries and cities in Europe which were once built up with of prefabricated buildings. These are eastern Germany, Poland, the Baltic states, etc. The 'problematic nature' of these one-generation residential districts, built in the 50-60s of the 20th century, had begun to be talked about in these countries on the eve of the collapse of the Soviet system.

In Germany, for example, they started reconstructing buildings as early as 1989 and continued to do so sometime in the early 2000s (Fig. 1). According to calculations, this route was 30% cheaper than demolition - the cost of the work in a house per flat was on average 20,000 euros. These funds were allocated from the budget and the tenants themselves were also involved [5].

It should be noted that German cities are now mainly engaged in quarterly renovation. Firstly, three decades have already passed since the start of the 1989 campaign. Accordingly, the lifespan of the of prefabricated buildings has already been exceeded twice (instead of 25-30 years it was 50-60). The technical condition of the houses has deteriorated simply because of ageing, and the Germans have decided that there is no point in modernising this housing - it is better to build new than to invest money in something that will finally collapse in 10-15 years [5].

Let's look at some interesting examples specific to Germany. One is a renovated five-storey apartment building (Linefelde, Germany) reduced to a three-storey building. During the

renovation of the block, the central segment was removed from the long row of sections, resulting in two separate buildings.

A continuous balcony was installed on the west side for a unified architectural composition. Inside the flats, the partitions were removed to create an open floor plan. The ground floor flats have their own gardens, and the entrance areas are enclosed by a masonry fence and the rhythm is raised on a vertical axis above each entrance (fig. 1).

Fig. 1. Example of building that were reconstructed in Germany

The design of this house is in sections 180 metres in length. One of the volume-planning solutions is the removal of the top floor and seven sections from the house line. The architects from Stefan Forster Architekten have changed the purpose and appearance of the building. Separate multi-family villas were created on the basis of the old house.

A continuous fence connects the eight blocks on the east side at ground floor level. The colour scheme creates lively contrasts between the facades (Fig. 2).

Fig. 2. Example of building that were reconstructed in Germany

Poland and the Baltic states have been trying to save money by reconstructing of prefabricated buildings rather than demolishing them. They conduct an audit, draw up a work plan, and implement it step by step.

In the mid-1990s, Gdańsk was one of the first cities in Poland to begin beautifying its dormitory districts: high-rise buildings were insulated, roofs and façades above all. Huge

drawings then appeared on the buildings - from pictures of ladybirds to a portrait of Lech Wałęsa, who lived in one of the Gdańsk blocks of flats for many years. But due to chronic rent arrears of many tenants, there are no funds for renovation, so sometimes it comes down to painting the house unconventionally [3].

Around 6,000 prefabricated panel houses were built in Estonia in the 1960s. The goal of the new SmartEnCity project is to turn some of them into energy-efficient houses.

In the long term, the SmartEnCity project intends to improve the quality of life in the urban environment and help residents live an environmentally friendly lifestyle. The following solutions will be used in the project: old buildings will have their facades completely renovated, equipped with solar panels, new windows, insulation, heating and ventilation systems will be installed. The flats in the buildings will be equipped with a smart home system (Smart-Home-System), allowing residents to monitor and control their energy consumption [3].

The aim is to reduce energy consumption by two-thirds. Typical Soviet-era three- or five-storey apartment buildings, painted white or yellow, will be redesigned to achieve energy efficiency class A, the highest level. In the meantime, the energy efficiency of most houses ranges between class F and H, the lowest level.

The financing scheme for reconstruction is based on the EU funds, the state budget, local budgets, funds of the tenants themselves, as well as donor funds from the European structures. The condition and stage of the renovation (what has been done, what needs to be done, how long it will last and what it will cost the owner) are all significant factors and influence the value of the dwelling.

Conclusions and prospects for further research. In connection with the above, we can say that the reconstruction of of prefabricated buildings, improving the quality of the housing stock and increasing the availability of housing implies a continuous process of reproduction of the housing stock. Each method of renovation improves certain consumer and economic properties of the dwelling - increases the value of the object, reduces the cost of operating the object, increases the service life of individual structures and the building as a whole.

To summarize the above, the reconstruction and renovation of houses must be systematic. It is necessary to look at the development as a whole and not each house individually, as there are too many of them. The urban and architectural environment should become more comfortable and livable. Of course, the demolition and construction of a 20-storey building will not solve the problem. The rule of storey and population density must be respected.

It should also be noted that when and after refurbishment is carried out, engineering upgrades are required. Often refurbishment or major renovation is carried out with complete or partial, temporary or permanent eviction of tenants. But more often they look for ways to reconstruct and modernise without evicting the occupants, due to a lack of temporary housing. Thus, energy efficient refurbishment and renovation is an important area of focus in solving housing problems

Also the renovation of housing will help to improve the quality of housing, reduce energy consumption and loss and the architectural quality of the development. It will be possible to improve the living and maintenance conditions of the housing stock for people with disabilities, to consider their needs and increase the size of flats, and to install new lifts and ramps.

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ПРОБЛЕМИ РЕНОВАЦІЇ ТА РЕКОНСТРУКЦІЇ ЗБІРНО-ПАНЕЛЬНИХ БУДІВЕЛЬ

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Анотація. У статті розглядаються проблеми реновації та реконструкції збірно-панельних будинків. Виділяється два напрямки реновація і реконструкція, які в свою чергу, мають позитивні і негативні сторони. Наводяться приклади європейських країн і шляхи вирішення цих проблем. Якщо порівнювати збірно-панельних будинки з сучасними будинками, то перші в свою чергу мають ряд недоліків: малогабаритність житлових кімнат, коридорів, низькі стелі, вузькі внутрішньо- і міжквартирні стіни, відсутність ліфтів, і звичайно ж знос і несправність інженерних і комунікаційних систем. Однак даний вид будинків має низьку вартість, розвинену інфраструктуру, і відмінно підійде для одиноких людей, пенсіонерів і студентів.

Таким чином, якщо розглядати шлях реновації та реконструкції будівель і споруд, то можна окреслити кілька шляхів вирішення поточної проблеми. Є варіанти більш косметичні, а є з вражаючою реконструкцією і надбудовою поверхів, або їх зменшенням. Все залежить від того, чи хочемо ми домогтися щільнішої забудови та кількості квартир, чи зменшити навантаження на даний житловий будинок. Важливо відзначити, що окрім реконструкції та реконструкції є ще один варіант – знесення та будівництво багатоповерхівок на місці панельних будинків. Це можна вважати гарною ідеєю та за статистикою, людині краще жити не вище дерева, тобто приблизно до 8-го або 9-го поверху. Проаналізувавши світовий досвід, можна з упевненістю сказати, що в Європі є чимало країн і міст, які колись були забудовані збірними будинками. Це східна Німеччина, Польща, країни Балтії тощо. У зв’язку з вищесказаним можна сказати, що реконструкція панельних будівель, підвищення якості житлового фонду та підвищення доступності житла передбачає безперервний процес відтворення житлового фонду.

Ключові слова: реновація та реконструкція, збірно-панельні будівлі, модернізація, реконструкція будівель та споруд, щільність забудови.