

PAPER • OPEN ACCESS

Principles of Renovation the Territory of Residential Buildings Dating from 1960s to 1970s: Coping with Modern Housing Crisis

To cite this article: O Ryzhova and A Khrichenkov 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **481** 012024

View the [article online](#) for updates and enhancements.



IOP | ebooks™

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the **collection** - download the first chapter of every title for free.

Principles of Renovation the Territory of Residential Buildings Dating from 1960s to 1970s: Coping with Modern Housing Crisis

O Ryzhova¹, A Khrichenkov²

¹Institute of Civil Engineering and Architecture, Ural Federal University, Mira str. 19, Yekaterinburg 620002, Russia

²Institute of Civil Engineering and Architecture, Ural Federal University, Mira str. 19, Yekaterinburg 620002, Russia

E-mail: av.khrichenkov@urfu.ru

Abstract. Large-panel residential construction was conducted in many countries worldwide; its peak was in 1960-1980s. By 2020, the majority of residential buildings built in the period from 1950 to 1970 will be more than 50 years old and their lifetime will be exhausted. In Russia the total living space of the buildings built during the considered period makes about 10% of all housing stock in the country. Housing that was built in the considered period, has become outdated morally and physically, it generates a housing crisis. In the majority of the European countries, residential territory renovation has already begun. In most cases, projects did not provide full demolition of residential buildings. In Russia, the only project that began to be realized is the renovation started in 2017 in Moscow. During the project full demolition of the existing building and new construction is provided. In other cities of the country realization of similar strategy is impossible and inexpedient for several reasons (lack of federal financing, the disinterest of investors). The purpose of the study is research of positive experience in coping with a housing crisis in Germany, France, Hungary and in other European countries. Methods: systematization, typology, comparative analysis, statistical data analysis. A result of a research: housing estate renovation principles are formulated; their classification and methods of realization are offered. These principles can be applied in the building renovation projects without full demolition and landscape modification and also in the complex sustainable development of the built-up territories.

1. Introduction

The beginning of panel housing construction in the USSR is considered to be 1945, when in Berezhovskiy (10 km from Yekaterinburg) a one-story panel house was built. Concrete panels for this house were produced in a factory that still functions in the town [1].

However the era of mass construction began when engineers of many countries, including Germany, the Netherlands and the USSR started looking into this mode of construction in the 1920s. In November 1955 the Resolution of the Central Committee of the CPSU, № 1871 "About elimination of excesses in design and construction" was signed. This document was the trigger for conversion from Stalinist neoclassicism to ascetic, standard and cheap architecture. New living spaces in huge amounts were required for the country: Khrushchev's plans ensured a norm of 9 square meters per person [2]. Barracks, dugouts and communal flats were inhabited. The shortage of housing and



unsatisfactory conditions of accommodation occurred because of the consequences of World War II, not only in Russia, but also in countries of Eastern Europe. Therefore architects and town-planners were directed to develop standard projects for buildings and micro-districts. In Russia the civil engineer Lagutenko [3] was the author of one of the first standard house series, K7. During the sixties the K7 series was the main unit of the micro-districts.

The peak of panel housing construction was from 1950 to 1970, depending on the country. For example, in Russia the panel houses called "Khrushchyovka" were built up to 1985. Depending on the series type (short-lived or long-lived) and the construction materials, panel houses were calculated to have a lifespan of 25 to 150 years [4,5]. The majority of panel blocks have a lifespan of 50 years, which will expire by 2020. The moral and physical wearing out of buildings was extremely high, which spoke to an urgent need for building renovation. Coping with the post-war housing crisis from 1950 to 1970 has generated the crisis of old housing stock today.

Research objective is studying the renovation experience in the countries in which mass housing construction was carried out. Approaches to renovation (full demolition and new construction, partial demolition, building consolidation and combinations thereof) are considered. Detailed study of renovation projects has allowed us to reveal and systematize renovation principles. Key principles responding to renovation without full demolition, which is recommended for residential districts where aggressive transformation (pointed building or building demolition) has not been conducted, are marked out.

2. Base materials and research methods

Maps, plans and satellite pictures of the cities where renovation was conducted are the base materials for our research. Research by Russian and foreign experts in the field are considered. Such methods as systematization, a tipologization and comparative analysis are applied. Statistical data on building in the USSR (in the territory of modern Russia), and in particular in the territory of Yekaterinburg (earlier Sverdlovsk), gleaned from Russian statistical yearbooks [6]. Information about the arrangement and number of the remaining residential buildings has been procured from open data of the 2GIS company [7].

3. The situation in Russia

From 1950 to 1970 city housing stock in the territory of modern Russia has grown by 597.7 million square meters. At the moment the percentage of buildings in this period in general across Russia is 10% [6].

Mass building by residential and public building standard series was conducted in all large cities of the country and also in the new cities that were created near large industrial enterprises. The percentage of five- and nine-story buildings (these make up most of the standard projects) in the million-plus cities of Russia for 2017 are presented in table 1 [7].

Table 1. Shares of five- and nine-story buildings in Russian cities

City	Population	Five-floor buildings, %	Nine-floor buildings, %
Moscow	12 380 664	30.3	16.5
St. Petersburg	5 281 579	33.3	11.8
Novosibirsk	1 602 915	30.3	14.2
Yekaterinburg	1 455 514	30.1	13.6
Nizhny Novgorod	1 261 666	26.4	18.9
Kazan	1 231 878	33.8	17.9
Chelyabinsk	1 198 858	33.2	10.9
Omsk	1 178 391	41.9	14.7
Samara	1 169 719	25.3	11.6

Rostov-on-Don	1 125 299	17.6	13.1
Ufa	1 115 560	22.8	20.6
Krasnoyarsk	1 082 933	36.9	11.7
Perm	1 048 005	54.1	18.4
Voronezh	1 039 801	25.4	15.3
Volgograd	1 015 586	31.0	17.5

In the research conducted in Yekaterinburg, more exact borders of the historical period were set from 1958 to 1975. In these years, standards of urban planning design radically changed. The dynamics of housing growth in Yekaterinburg are presented in table 2 [8]. Data on population are provided by the Federal Statistics Service [6].

Table 2. Dynamics of housing growth in Yekaterinburg

Year	Number of buildings	Total living space, m2	Population
1958	216	416 201,71	-
1959	314	621 304,30	778 602
1960	316	610 349,65	-
1961	339	663 381,85	-
1962	288	685 213,01	853 000
1963	234	652 045,87	-
1964	202	576 159,39	-
1965	185	584 552,05	-
1966	179	600 817,20	-
1967	168	615 549,30	961 000
1968	177	653 222,93	-
1969	164	602 778,12	-
1970	177	672 098,18	1 025 045
1971	148	627 801,80	-
1972	140	676 269,38	-
1973	136	724 127,72	1 099 000
1974	128	655 727,36	-
1975	117	694 532,07	1 163 000
In total	3 628	11 332 132	

The share of the buildings built from 1958 to 1975 in Yekaterinburg comprises 27,5% of the general housing stock of the city. The majority of buildings have physical wear of about 50%. Demolition and resettlement of inhabitants are impossible because the number of hazardous and shabby dwellings is very high and municipal or federal financing for realization of this strategy of renovation is not great enough. For this reason the question of the need for a renovation strategy, which is attractive to private investors and in which the interests of inhabitants and municipalities will also be considered, is particularly acute.

The pilot project of renovation began in Moscow in 2017. Full demolition of buildings, in most cases, and demolition of all micro-districts and construction of new buildings with a higher density and number of floors are considered. Residential districts will be transformed to quarters with the maximum density of the building, according to the project. During the first stage (2017-2019) 5,171 houses are included in the program, and 10,000 inhabitants will be moved from their apartments [9].

The renovation project has caused major controversy and discontent, both among experts and inhabitants. Many have negative thoughts about demolition and consolidation. Inhabitants are dissatisfied that they will be moved to more remote areas and to apartments on higher floors. Seminars and conferences on comprehending the opinion of the population at the implementation of the renovation program are being held [10].

4. Hungary

Destructions after World War II, collectivization and resettlement of inhabitants from villages to the cities were reasons for an acute housing shortage in the countries of Eastern Europe. In the early sixties Hungary investigated the sphere of large-panel construction in the Soviet Union [11]. In the late sixties Hungarian engineers created a local system of large-panel construction. Panel building in Hungary, as well as in the USSR by micro-districts, was carried out. [12].

The first residential districts were built in Dunauyvarosh, Pech and Debrecen from 1961 to 1963 [13]. The first plant making panels for mass construction was constructed in Obuda in 1965 [13]. Now, in Budapest, more than a third of the population lives in "Panelház" - the standard name of the Hungarian panel buildings. Only 8% of residential districts are located in the downtown area; the others are in suburbs [12]. A similar situation occurred in many Russian cities.

In the 2000s, Hungary's government started a nationwide program of renovation of buildings built between 1960 and 1970 [14]. However, in the Tímea Csaba research [12] it is noted that municipalities did not allocate funds for creation of a comfortable environment and public spaces in residential districts of panel construction. Attention was paid first to renovation of buildings. The author of a research paper suggests that we focus on advantages of micro-districts and increase their number. Such advantages include extensive free spaces between buildings, tall trees, existing playgrounds and a social service network.

The following principles of panel building territory renovation in Hungary are distinguished:

- creation of public spaces;
- revitalization and natural landscape using;
- improvement of buildings technical condition and their esthetic qualities;
- solution of the shortage of parking spaces problem;
- functional saturation of building and improvement of social service system.

In many projects of building renovation in Budapest there is a tendency toward intensive gardening on roofs, as well as creation of private terraces and public spaces on roofs of buildings.

5. France

Building renovation projects have been implemented in France since 1977 [15]. In 2003 the national program of upgrading cities (Projet de rénovation urbaine, PRU) which required demolition of about 250,000 buildings and renovation of 400,000 residential buildings, began [16]. Generally this program included the social building that appeared after World War II. In post-war years building in France began to be conducted via municipal funds [17].

The decision of the choice of renovation strategy for each district or quarter was accepted depending on the condition of buildings, structural materials, population density and other parameters. For example, brick buildings are almost always reconstructed, and not demolished. In the projects providing resettlement of inhabitants during construction or resettlement during demolition of residential buildings, equivalent housing in the same area was offered to inhabitants. In 2004 the national agency of reconstruction of the cities was created for upgrading 500 quarters of France's cities. By 2013 during renovation 250,000 square meters of living space were updated or constructed. Implementation of the national program of updating cities is calculated to continue until 2030. Renovation is implemented both at the expense of the state and with the involvement of private investors.

The basic principles of renovation of building of 1950-1970 considered in PRU:

- decrease in number of floors (buildings more than 10 floors were demolished, on their place five-floor buildings were built);
- improvement of quality and the number of gardening in inhabited territories;
- change of strategy of retail placement (creation of "live" streets);
- improvement of transport availability of the remote areas, local transport network reorganization;
- differentiation of housing (in areas of social building more high-class housing appears).
- increase in energy efficiency of building.

6. Germany

The first experiments with panel building in Germany began in 1926 when in the city of Lichtenberg the pilot area of panel buildings was built. After World War II historically developed quarter building in many Germany cities suffered. Both in East and West Germany residential districts called "New development area" began to be built. When after 1990 a mass outflow of the population from dysfunctional areas and shabby housing began, the federal authorities started the renovation program [18]. Unlike the USA and France, Germany is famous for renovation projects without demolition.

One of the biggest residential districts on the area, Märkisches Viertel, has appeared in the West Berlin. It was built between 1963 and 1974. It was designed for 50,000 inhabitants, but the planned infrastructure could not satisfy their needs. Therefore to avoid a rise in crime and an outflow of inhabitants, buildings and territories were modernized [19].

In recent years the SFA bureau [20] has realized several projects in the city of Leinefelde. A distinctive feature is the radical decrease in density of housing stock: parts of buildings and even whole floors have been demolished, which has created a more comfortable environment.

The renovation principles which were used in the realized projects in Germany are given below:

- regulation of urban planning parameters of building by decrease in density and demolition of parts of buildings;
- revitalization of a landscape, creation of a green framework of the area;
- providing inhabitants with necessary social infrastructure;
- creation of the barrier-free environment;
- formation of network of public spaces.

7. System of renovation principles

Besides the experience of the European countries mentioned, researches of Ivanenko [21], Dagdanova [22], Prusov [23], Daniel M. Muntean, Viorel Ungureanu [24] and Sille Sommer [25] are studied. In these studies renovation of large-panel building in the cities of Denmark, Czech Republic, Estonia, Romania and other countries is described. The most widespread principles are systematized and divided into five groups: urban planning, architectural, social, functional and economic. Classification is presented in table 3.

Table 3. Renovation principles classification (for building date from 1960 to 1970)

Urban planning	Architectural	Social	Functional	Economic
1. Creating of "live" streets	1. Improvement of buildings' technical condition (physical wear decrease)	1. Preservation and strengthening of social communications between inhabitants	1. Functional saturation of spaces	1. Increase in market value of housing

2. Creation of visual skyline and unique image of the district/block	2. Improvement of accommodation conditions (obsolescence decrease)	2. Territory differentiation on private and public spaces	2. Social service ensuring	2. Building consolidation
3. Exception of "impersonality"	3. Increase in esthetic quality of architecture	3. Decrease in criminality		
4. Improvement of urban environment quality	4. Creation of barrier-free access to buildings	4. Change of borders of the land plots and property rights		
5. Preservation and strengthening of the initial planning concept of the district	5. Increasing the energy efficiency of building			
6. Sustainable use of territories				
7. Urban-planning parameters regulation				
8. Modernization of transport service local system				
9. Revitalization of landscape				

8. Strategies of renovation for regions

As was mentioned earlier, in the majority of Russia cities, realization of a renovation strategy with full demolition and new building similar to what has been realized in Moscow is impossible. The lack of financing, unwillingness of investors to develop the built-up territories and the problem of utilization of garbage from demolition of buildings are the main reasons. Therefore, it is expedient to consider alternative strategies.

1. Renovation without demolition, which includes sanitation and reconstruction/repair of buildings without vast landscape transformations. This strategy can be applied in small cities in which there is no need for building consolidation and only for buildings in good conditions.

2. Renovation with partial demolition, for projects with less density in building and with buildings that were physically outdated. This strategy can be applied to territories with adverse ecological and

social situations, such as in the freed territories. It would be possible to organize green spaces and public spaces of various functionalities.

3. Renovation with partial demolition and new construction. This strategy can be applied in territories in which building consolidation will take place. It can include full or partial transformation of the local transport service system and a rather drastic change of the landscape. More detailed study is necessary for consideration of the applicability of this strategy to the idea of transformation of micro-districts into quarters.

9. Conclusion

In research, the analysis of buildings dating from 1950 to 1960 in Russia in general and in million-plus cities in particular is provided. The need for development of a building renovation strategy to be considered for Russian cities other than Moscow is evident. We studied the foreign experience of overcoming the crisis of moral and physical obsolescence of buildings. We also considered the principles of renovation that have been applied in various European countries. We offered classification of the most widespread and effective principles. The optimum renovation strategies for regions are based on our findings.

References

- [1] Architectural council of Moscow 2014 History of industrial housing construction: experiments with a framework and the panel https://stroim.mos.ru/builder_science/istoriya-industrialnogo-domostroeniya-eksperimenty-s-karkasom-i-panelu
- [2] Meerovich M G 2017 *Urban policy in the USSR 1917-1929: from the garden city to the departmental industrial settlement* (Moscow) p 352
- [3] Ogorodnikova O A 2018 Mass housing construction in the history of the Soviet daily occurrence *Universum Social sciences* **3**
- [4] Chazova O L 2015 A problem of the first mass series housing demolition in the complex housing estate reconstruction *Taurian scientific observer* **4** pp 95-97
- [5] Departmental construction norms BCH 53 1986 Rules of assessment of residential buildings physical wear
- [6] Russian statistical yearbook 2007 Federal State Statistics Service (Moscow: Rosstat)
- [7] International cartographical company 2GIS data <https://2gis.ru/>
- [8] Fund of assistance to housing and communal services reforming data. Reform of housing and public utilities <https://www.reformagkh.ru/>
- [9] Complex of urban policy and city building of Moscow <https://stroim.mos.ru/novaia-programma-rienovatsii-piatietazhiek>
- [10] Kosareva N B 2017 *Accounting of inhabitants' opinions about implementation of renovation projects in Moscow* (Moscow: City Economy Fund Institute)
- [11] Gabor Preisich 1998 *History of urban construction in Budapest 1945-1990* (Budapest) pp 77-116
- [12] Timea Csaba 2006 *How we really live in panel block* (Budapest) p 66
- [13] Timea Denes 2000 *Reconstruction of large-panel buildings* (Budapest: University of Technology and Economics)
- [14] Balazs Szabo 2013 Ten years of housing estate rehabilitation in Budapest *Hungarian Geographical Bulletin* **1** (Budapest:) pp 113-120
- [15] The state of National Urban Policy in France 2017 City Policy (Paris: Politique de la ville)
- [16] Christine Lelévrier 2008 Mobilities and residential trajectories of relocated households during urban renewal operations (Paris, Institut d'Urbanisme de Paris) p 46
- [17] Jean-Claude Croizé 2017 A time when France chose to use prefabricated panel construction systems (Cambridge: University of Cambridge) pp 877-886

- [18] Meerovich M G, Malko A V, Kozlova L V, Gladkova E A 2017 Renovation of panel building of the 1960-1980s in Germany *News of higher education institutions. Investments. Construction. Real estate* **7** (Moscow:) pp 111–119
- [19] Maerkisches-viertel district data <https://www.mein-maerkisches-viertel.de/maerkisches-viertel/>.
- [20] Stefan Forster Architekten bureau web-site <https://www.sfa.de/home/>
- [21] Ivanenko L V, Fayzrakhianova Y I 2012 *Foreign experience of the built-up territories management* (Samara: Samara state architectural and construction university) pp 77-83
- [22] Dagdanova I B 2014 Modern principles of the organization of the city quarter as a tendency of inhabited environment humanization (on the example of the cities of Western Europe) *News of higher education institutions. Investments. Construction. Real estate* **7** (Moscow:) pp 75-96
- [23] Dmitriy Prusov 2017 Principles of reconstruction the urban territory in dense building and complex geology conditions *Space & Form* **30** pp 189-202
- [24] Daniel M Muntean, Viorel Ungureanu 2017 Adaptive design of large prefabricated concrete panels collective housing *Engineering and Technology International Journal of Architectural and Environmental Engineering* **3** (World Academy of Science,) pp 299-308
- [25] Sille Sommer 2012 Soviet Housing Construction in Tartu Estonia [Master thesis in human geography] (Tartu: University of Tartu) p 67