

# The Housing Renovation Program and the Demolition of Five-Storey Buildings in Moscow

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**Abstract.** The part of the Russian housing stock built during the first industrial era is analysed and the drawbacks are pointed out. The problem of the dilapidated housing in Moscow is discussed. Currently in Moscow, 1700 residential buildings of the first period of industrial housing were demolished during 20 years with a total area of 11 million square meters (dating to the period of April 2017 - 1722 residential buildings & 6/6,3million square meters) - some of them at the expense of the city budget and others by investors in construction. The program of the demolition for the period of 1995-2015 and the housing renovation program are given.

## 1. Introduction

The total area of the Russian housing stock is over 2 billion square meters -more than 30% of buildings were erected between 1954 and 1963.

The main types of buildings were five-storey prefabricated buildings and brick ones erected under the projects of K-7, I-32, II-32, "I-MG-300", 1-605-AM, etc. [1; 3].

## 2. The structural characteristics and design aspects

Prefabricated houses were built according to the standards of new series with the unified design components. The basic features are given in the Table 1.

The floor height is 2,48 m or 2,60 m. The crawl spaces for the utility supply lines were designed. The heating - central hot water heating; water supply system - cold and hot - water supply offered by municipal networks; extract ventilation through vent units.

The structure schemes include prefabricated flat blocks and frame and panel buildings. Buildings with the 2,65 m or 3,2 m wall spacing were erected under the projects of K-7, 1605 AM; 2,65 m spacing - for the 1-515 series of standard design. The simplicity of assembly on the one hand and low work labor input on the other made the construction really attractive for that time.

The buildings under the series 1-335A, 1-335, etc. with frame and panel structures scheme had 2,65 m and 3,2 m wall spacing as well [2; 4].

Five-storey blocks of flats were built during the mass housing construction era. The houses were built at breakneck speed in the late - 1950s and early 1960s. The overage time of building construction beginning from the project drawings till finishing was only 45-50 days. Thus, over 55 million people received their own flats.

The new housing was fairly of low-density, had common areas and green space facilitated socializing among neighbours.



The working life was expected to be about 40 years. But many of them still exist turning into dilapidated eyesores.

**Table 1.** The parameters (specification) of the structures.

№	Structure	Description of the structure
1	Foundation	<ul style="list-style-type: none"> <li>- strip foundation (prefabricated concrete blocks);</li> <li>- pile foundation (prefabricated concrete grillage);</li> <li>- pile foundation (monolithic grillage)</li> <li>- thin concrete walls with insulation</li> <li>- self-bearing long concrete walls;</li> </ul>
2	External walls	<ul style="list-style-type: none"> <li>- expanded-clay lightweight concrete panels;</li> <li>- self-bearing panels of vibrated brickwork with insulation;</li> <li>- slag concrete blocks;</li> <li>- brick walls</li> <li>- double-ply concrete panels;</li> </ul>
3	End walls	<ul style="list-style-type: none"> <li>- load-bearing vibrated brickwork panel;</li> <li>- wall construction of two rolled casing panels with insulation</li> <li>- concrete panels;</li> <li>- load-bearing construction of vibrated brickwork with insulation;</li> </ul>
4	Inner walls	<ul style="list-style-type: none"> <li>- load-bearing construction of two rolled casing panels;</li> <li>- panels of breeze blocks;</li> <li>- brick wall partition;</li> <li>- expanded-clay lightweight concrete panels</li> <li>- reinforced concrete curtain walls;</li> </ul>
5	Curtain walls	<ul style="list-style-type: none"> <li>- rolled gypsum-concrete curtain walls;</li> <li>- gypsum-slag-concrete curtain walls;</li> <li>- gypsum-sandust compression rolled panels</li> <li>- load-bearing multiribbed concrete plates;</li> </ul>
6	Roof slabs	<ul style="list-style-type: none"> <li>- ceiling rolled concrete panel;</li> <li>- construction of two rolled casing panels with insulation;</li> <li>- concrete core units</li> <li>- flat roll roofing with internal downpipe, frieze panels, slab roof and roof beams;</li> </ul>
7	Roofing systems	<ul style="list-style-type: none"> <li>- flat roll roofing with internal downpipe, parapet plates, slab roof and heat insulating;</li> <li>- flexible metal wood deck roofing, roof timbers, downpipe, heat insulating</li> </ul>

### 3. Structural appraisal of the prefabricated housing.

It should be noted the flats were the compact life flats with low ceilings, walkthrough rooms, small lobby. The single-room apartments were typically only 30 square meters with the 4 -5 square meters kitchen and full bathroom. In addition, the similar design decisions were used and as for facades - facades were monotonous.

The first years of the commission of such mass-produced buildings had drawbacks: walls freezing, roof leakages, low level of the sound isolation and heating, etc.

One of the main reasons for this was an inadequate wall thickness equaled to 21-35 centimeters for all climatic regions. The pipes for the plumping and the central stream heating were built into the walls. That's why the problem is how to renovate the five-storey buildings of the first industrial era.

As of the date of the appraisal incurable physical deterioration was an essential feature. The outdated technology used in construction of the first industrial housing era made the buildings

unsuitable for the renovation. Structures suffered incurable physical deterioration but it was not economical to repair or replace structures, frames and panels, foundation, balconies, etc.

#### 4. The demolition steps

The cheaply built five-storey 1950's apartment blocks were never meant to take it into the XXI century.

The authorities set to demolition steps and developed the renovation program in regard to dilapidated housing stock.

In Moscow the prefabricated buildings of the first industrial era made the total area of 36 million square meters including 20 million square meters of dilapidated housing stock.

It was the reason for the great renovation program developed by the Moscow authorities. The authorities stipulated that the buildings could only be demolished and replaced after its residents had been moved into new housing.

The N 735 Government Decree of the City of Moscow dated 6 September 1994 and the Demolition program developed by the Capital construction department were stated as the start documents for the first renovation period.

The procedure of the renovation was firstly formulated in the N 876 Government Decree of the City of Moscow published on 24 October 1995. The next one was The N 884 Government Decree of the City of Moscow dated 8 October 1996 where the plans for the renovation of the first industrial era buildings till 2000 were presented. The N 292 Government Decree of the City of Moscow dated 22 April 1997 provided information about procedures of the renovation of the dilapidated housing too.

The program proposed in 1990's is partially completed.

The fragment of the housing stock of the first industrial era to be demolished is represented in Table 2.

**Table 2.** Housing stock of the first industrial era to be demolished (fragment).

Yrblt.	Number of storeys	Series of standard designs	Total area in Moscow (sq. m.)
1956-1960	5	1605AM	40556
1956-1960	5	II-32	13918
1956-1960	5	II-32	11366
1956-1960	5	1-MG-300	10725
1956-1960	5	K-7	126016
1961-1965	4	K-7	157336
1961-1965	5	II-32	1252325
1961-1965	5	II-32	74506
1961-1965	5	1605AM	874492
1961-1965	5	1-MG-300	91593
1961-1965	5	K-7	2639998
1966-1970	5	I-32	44263
1966-1970	5	1605AM	219887
1966-1970	5	1-MG-300	246772
1966-1970	5	K-7	688130
1971-1975	5	1-MG-300	6966
1971-1975	5	K-7	8755
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#### 5. The housing renovation program

The further commission of the five-storey buildings is not safe.

The program of the demolition of the last five-storey buildings is scheduled for completion in 2017-2018. Thereby the works will be wrapping up in Western Administrative District (Filyovsky Park District), Eastern Administrative District (Bogorodskoye District), Southern Administrative District (Biryolyovo-Zapadnoye District), South-East Administrative District (Kuzminki District).

A key moment is to replace ageing housing - the renovation of the dilapidated housing. The next issue is the resettlement because of the demolition. The authorities try to resettle people within the area they now live in, offering good options to satisfy residents.

In general, the further program will include next steps:

- to demolish the last 8000 five-storey buildings of the first industrial era;
- to torn down more than 10% of the Moscow housing stock - 25 million square meters;
- to resettle 1,6 million people;
- to create a new comfortable urban environment.

The key points of the program are as follows:

- cancellation of the major repair because of its inefficiency;
- the quarterly demolition of the non-comfortable housing stock;
- the relocation of the residents to the new apartments infill community;
- the demolition based only on the decision of the residents;
- an introduction of amendments to the Urban Development Code and to the Housing Code of the Russian Federation.

To perform all procedures in accordance with the Codes it's required to work on Construction project drawings and specifications.

Based on the prior experience it's required to study the measures given below:

- reasons of the demolition procedure, the determination of the construction steps, the location of the hazard zones and stock areas for the demolished items, protection and safe guards, environmental protection measures;
- step-by-step cutting off the networks: electrical power outage, gas pipe-line, water-supply and others. Therewith to set the temporary power supply free of the current scheme;
- prior to the demolition to breaking-off the engineering equipment, services (sanitary-engineering system, electrical supply, telecom, radio, TV) and the removing of the surface trim.

The demolition is carried out in accordance with the developed Work Execution Design. An additional requirements for it consider the execution of work on the residential area such as the matching of the safety systems (safe guards) for the walkways, the work of the machines in confined spaces, the non-stop operation of the installation and power, etc.

## 6. Moscow authorities efforts

In April 2017 the Government Commission on legislative activities endorsed the initiative of the deputies of the demolition of five-story building in Moscow. The authenticity of the document is confirmed by the source in the Cabinet of Ministers.

The Government indicated key points: how to move residents from their flats; how to correlate the property rights of Muscovites on the premises of the demolished houses and others.

The first reading of the document is assigned in the Moscow Duma on the 21st of April 2017. In the Federation Council it was proposed to extend the law on the demolition of the five-storey buildings all over Russia so that the project of the renovation would be more effective.

## Conclusion

The great part of the housing stock is prefabricate concrete structures of the first industrial era on the stage close to the ultimate limit state - the dilapidated housing. It's not efficient to repair such structures.

Moscow's prefabricated houses were built according to the standards of the 1950's series, with the requirements of that time - to design own flats for all workers. Modern structures provide a wide variety of possibilities for the construction of quality housing: lower thermal conductivity, noise conductivity, quality finishing, etc.

The demolition of the first series of five-storey buildings required incredible efforts.

The renovation program development requires huge financial resources, significant organizational and administrative costs based on the Russian and foreign experience.

## References

- [1] Afanasiev A.A., Matveev E.P. 2008 *Reconstruction of residential buildings*. Part I. Technology restoration of operational reliability of residential buildings. Moscow.
- [2] Bashlai K.I., Gendin V.Ya., Evdokimov N.I., Zhadanovsky B.V. and others. 1980 *The builder's builder*. Concrete and reinforced concrete works. Moscow.
- [3] Bulgakov S.N. 2001 *Reconstruction of residential houses of the first mass series and low-rise residential development*. Moscow.
- [4] Grabovyi PG [and others] 2006 *Reconstruction and renovation of the existing building of the city*. Moscow.
- [5] Guryev V.V. [and others] 2008 *Reconstruction and rehabilitation of residential buildings of the first and second periods of industrial housing construction, taking into account the experience of Berlin*, Industrial and civil construction p. 12.
- [6] Ershov M.N. 2005 The system method of reconstruction of buildings in operation mode: diss. Cand. tech. MSUCE.
- [7] Zhadanovsky BV 2009 *Organizational and technological preparation of reconstruction of civil and industrial buildings and structures* Industrial and civil construction p. 10.
- [8] SP 48.13330.2011 *Organization of construction*. Updated version of SNiP 12-01-(2004)
- [9] SP 70.13330 2011 *Bearing and enclosing structures*.
- [10] Technology of building processes Ed. N.N. Danilova, O.M. Terentyev. Moscow, (2000)
- [11] Federal Law of 23.11.2009, 2009 No. 261-FZ "On Energy Saving and on Improving Energy Efficiency and on Amending Certain Legislative Acts of the Russian Federation".
- [12] Zhadanovsky B.V., Beschastyi A.V. and others 2017 *Mechanical processing of diamond tools by nonmetallic materials and reinforced concrete in construction* Moscow.
- [13] Gu, X. 2016 *Basic Principles of Concrete Structures* X. Gu, X. Jin, Y. Zhou
- [14] Kurdowski, W. 2014 *Cement and Concrete Chemistry* W. Kurdowski.
- [15] Fardis, M. N. (Ed) 2012 *Innovative Materials and Techniques in Concrete Construction* M. N. Fardis, (Ed).
- [16] Xiao, J. 2018 *Recycled Aggregate Concrete Structures* J. Xiao.
- [17] Setareh, M. 2017 *Concrete Structures* M. Setareh, R. Darvas.
- [18] Oleynik P. P., Brodsky V. I. 2017 About document concerning the improvement in organizational level of construction production. *Industrial and Civil Engineering* vol. 3.
- [19] Oleynik P. P., Kuzmina T.K. 2017 Choice of Rational Decisions of Reconstruction of the Textile Industry Enterprises. *News of higher educational institutions. technology of textile industry* vol. 3.
- [20] Sinenko S.A., Zhadanovsky B.V., Slavina A.Yu. 2018 Methods of aging freshly laid concrete during the erection of monolithic structures in winter BST *Bulletin of Construction Equipment* vol. 4.