

To the question of planning the volume of investments for capital repair of the common property in the apartment buildings in the Irkutsk region

Ekaterina Dedukhina^{1,*}, and *Irina Torgashina*²

¹Irkutsk National Research Technical University, 664074, Lermontova str., 83, Irkutsk, Russia

²Baikal State University, 664003, Lenina str., 11, Irkutsk, Russia

Abstract. The regional program of capital repair of the common property in multi-apartment buildings located on the territory of the Irkutsk region is analyzed in this paper. The drawbacks of the program are described. Particular attention has been paid to the identification of dependence of the residential buildings characteristics and the cost of capital repairs. Proposals have been made to improve the mechanism for financing capital repair of the common property in the apartment buildings.

1 Introduction

The quality of life of the population of our country directly depends on housing conditions. In this regard, the problem of safety of living premises interests everyone.

Over time, residential buildings, as a result of external factors, lose their strength characteristics of reliability and require reproduction.

In recent decades, in our country new construction has been the main form of reproduction of housing stock. After 1992, the financing of construction of new housing and capital repair of the housing stock has significantly decreased. Insufficient investment in capital repair and reconstruction led to a constant accumulation of the fund of residential buildings that needed repair work [1]. At the same time, the results of the research show that the existing approach to reproduction of the housing stock does not allow effectively solving the issue of insufficient provision of comfortable housing for the population [2].

To plan the costs and justify the amount of funding for the work on capital repair of the housing stock in Irkutsk, it is necessary to identify the preliminary cost of the repair work.

The accuracy of determining the cost of repair work on the early stages of investment is an important task of economic science. Minimization of calculation errors in the enlarged assessment of the cost of repair and construction work will allow more reliable planning of

* Corresponding author: ded_es@mail.ru

funds for capital repair of multi-apartment buildings (hereinafter - MAB) and reduce investment risks [3].

After the amendments were introduced into the Housing Code of the Russian Federation in 2013, according to which the financing of capital repair of the common property in MAB became the responsibility of the owners of the living quarters of this house, the problem of effective use of funds for capital repairs of the common property in MAB concerns most citizens of our country. To solve the problem of accumulating funds and organizing capital repair of MAB, Capital Repair Funds were established in the constituent entities of the Russian Federation, including in the Irkutsk region. The main functions of these Funds are the accumulation of funding for capital repairs, which are formed in the form of contributions paid by the owners of premises in MAB and budgetary funds, as well as ensuring the organization of repair of the common property in MAB using innovative mechanisms [4].

2 Materials and Methods

In 2014, the Regional program of capital repair of the common property of MAB of the Irkutsk region for the period from 2014 to 2043 (hereinafter - the Program) was approved. The objectives of the Program are to plan and organize capital repair of the common property of MAB [5].

A register of MAB of the Irkutsk region, which requires major repairs, was compiled in the framework of the Program. All the houses included in the Program are planned to be repaired in six stages, the duration of each stage is five years [6].

One of the shortcomings of the Program is a lack of mechanisms for determining the estimated cost at the stage of the investment planning. Nowadays, the cost is determined by the element-wise calculation, which is very labor intensive, and, respectively, entails an increase in the cost of work on the organization of capital repair. Along with this, the Program does not specify how much investment is planned to be spent at each stage. Thus, it is not possible to assess the effectiveness of the implementation of the Program. To do this, it is necessary to determine the cost of capital repair of each MAB at the planning stage.

So far, there are no regulatory documents containing cost indicators for planning investments for the repair work in the residential buildings. In accordance with [7], the marginal cost of works on capital repair of the common property in MAB located on the territory of the Irkutsk region was established, which can be paid for by the regional operator at the expense of the Capital Repair Fund. The marginal cost was established, based on the minimum amount of the contribution for capital repair, paid by the owners of premises in MAB, the methodology for determining which also does not take into account the cost of repairing a particular MAB.

The size of the contribution takes into account the type and the number of stores of the residential building, availability of engineering systems, elevator equipment and a garbage chute. When determining the amount of the contribution, the age of the house, its wear and tear, the number of capital repairs carried out earlier, including those made at the expense of the owners of premises in MAB, as well as a list of necessary works for the capital repairs are not taken into account [8].

The safety of MAB operation depends on the quality of planning of repair and restoration works, and is determined not only by the technical state of the constructive elements of MAB, but also by the economic efficiency of the reproductive activities [9]. The efficiency of reproduction of MAB is largely influenced by the accuracy of determining the size of capital investments for repair work.

To analyze the cost of repair, and the impact of various characteristics of the house on this cost, a sample of 31 houses in Irkutsk, where the capital repairs were carried out, has been considered.

For each house, the operating time before repair, the size of the house, its total and living spaces, the physical wear and tear, the time of exploitation, the estimated cost of capital repair, including the costs of the repaired elements of the building, have been taken into account.

To establish the closeness of the connection between the cost of repair work and the characteristics of the object, correlation and regression analysis has been applied.

In the process of analysis, the closeness of connection between the cost of capital repair and various characteristics of the facilities has been identified, and their dependence in the form of mathematical function presented.

3 Results

First, let us define the closeness of connection between the cost of capital repair and the total area of MAB. As a rule, the highest costs for repairs have buildings with a large total area. This trend continues in the sample presented. The correlation coefficient of these two values is 0.82 that indicates a fairly close connection.

Correlation between the total area of MAB and the cost of its capital repair can be seen in Figure 1.

The value of the indicator R2 referring to the force factor is 0.72, with a trend line represented as a power law. Such a value of the indicator of force evidences the high force of the connection.

In addition to the total area, the cost of the capital repair depends on the volume of the building. Figure 2 shows the correlation between these indicators. The correlation coefficient of these values is 0.85, and this is higher than the correlation coefficient of the total area of the building and the cost of repair.

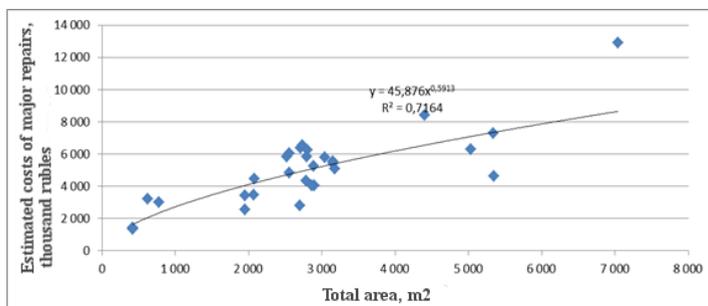


Fig. 1. Dependence of the estimated cost of capital repair on the total area of MAB.

The value of the constraint force indicator R2 is 0.74, with a trend line represented as a power law. Such a value of the indicator of force indicates the high strength of the connection.

Next, let us check how close is the connection between the cost of the repair work and the time of operation of the building before capital repair. In order to exclude the influence of the size of the building, let us consider the connection between the unit cost of the capital repair, calculated per one square meter of the total area. The correlation coefficient is 0.58.

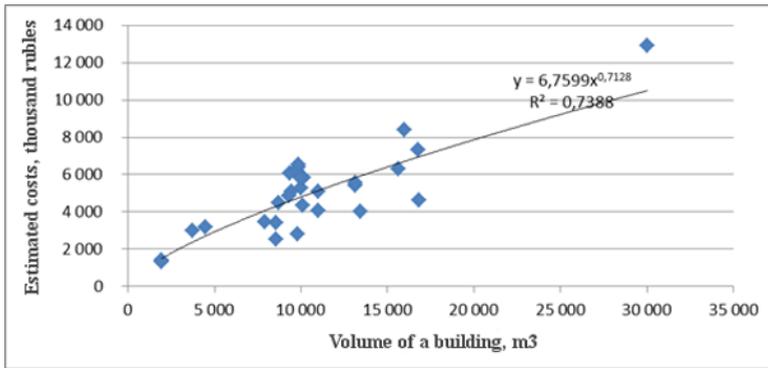


Fig. 2. Dependence of the estimated cost of capital repair on the volume of MAB.

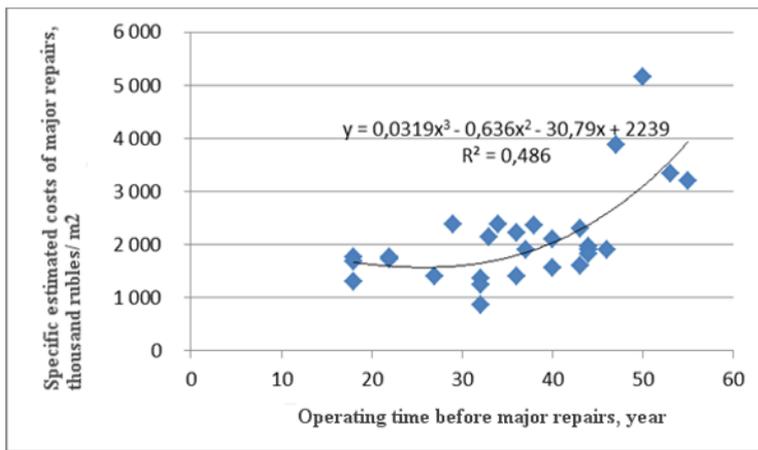


Fig. 3. Dependence of the estimated cost of capital repair on the term of exploitation of MAB.

The magnitude of the force factor R^2 is 0.49, with the polynomial trend line. Such a value of the correlation ratio indicates noticeable correlation.

The value of the force factor R^2 between the unit cost of capital repair (ruble / m2) and the deterioration of the building is 0.36 with the polynomial trend line, shown in Figure 4.

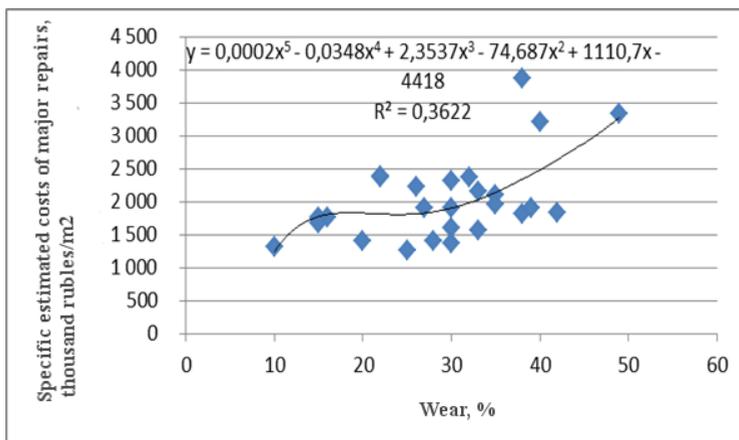


Fig. 4. Dependence of the estimated cost of capital repair on the deterioration of MAB.

Such a value of the correlation ratio evidences the moderate force of the connection. In fact, the amount of wear is one of the most important components that affect the cost of the repair work. A low indicator of the correlation ratio has been obtained, because the wear of the building at the time of repair was determined by the calculation method, depending on the age of the building, and not by the instrumental survey method.

The correlation between the term of exploitation of the building at the time of repair and the amount of its wear, shown in Figure 5, confirms our assumption. The correlation coefficient of these values is 0.92, and the tightness ratio is 0.88 that indicates high tightness of these parameters.

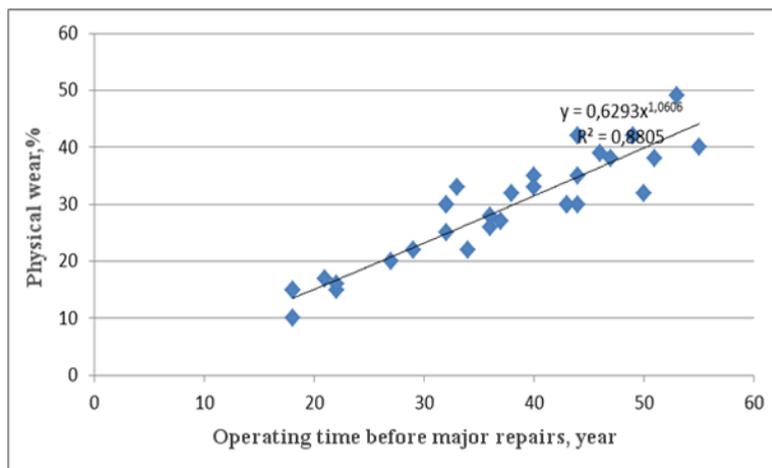


Fig. 5. Dependence of the physical wear of MAB on the term of its exploitation.

The data obtained are tabulated, where the tightness ratio (above the line) and the correlation coefficient (below the line) of these values are given at the intersection of the lines of these two indicators:

Table 2. A summary table of the results of analysis of the tightness ratio between the parameters of MAB and the estimated cost of capital repair.

	Total square, m ²	Volume of a building, m ³	Term of exploitation of a building before capital repair, years	Physical wear, %
Estimated cost of capital repair	0.71	0.74		
	0.82	0.85		
Unit cost of capital repair, ruble / m ²			0.49	0.36
			0.58	0.53
Term of exploitation of a building before capital repair, years				0.88
				0.92

4 Discussion

Based on the results of the analysis, it can be concluded that when planning the volume of investments for capital repairs of the common property of apartment buildings, it is possible to determine the cost per m² of the total area or per m³ of the building's volume. At the same time, much attention should be paid to determining the actual, and not the estimated, value of the building wear, and also the exploitation term of the facility prior to capital repair.

Determining the estimated cost using the element-wise calculation method requires a large amount of initial data on local conditions of work, constructive decisions, and methods of work, mechanisms and other information that can be obtained from a detailed draft of capital repair. All these make it impossible to apply this method at the stage of investment planning. To simplify the estimated costs calculations at the planning stage, it is necessary to apply the aggregated estimated cost methods of calculations.

In foreign practice of pricing, the enlarged indicators of the cost of structural elements and types of work per unit of physical volume of buildings and structures are used [10]. In our country, as a rule, the enlarged indicators of the cost of construction and compilations of element-wise calculation are utilized. There are no any enlarged indicators of the cost of repair work in our regulatory framework for pricing. At the same time, it seems to be most appropriate to use such standards at the investment planning stage [11].

It should be noted that the effectiveness of capital repair depends on the quality of development of design and estimate documentation, and, accordingly, the determination of the cost of work [12].

5 Conclusion

Despite its active introduction, the innovative capital repair system has some shortcomings and requires significant changes. When paying contributions for capital repairs, both owners of new buildings, owners of buildings in which capital repairs have been carried out at the expense of the owners of premises, as well as owners of premises in the buildings where the normative inter-repair term of operation has been repeatedly exceeded are in the same situation.

Respectively, such buildings have a number of defects and, as a consequence, the cost of repair is much higher than the buildings, whose age at the time of repair will be 25-30 years. To address this issue, a review of the level of contributions should be made, depending on the technical condition of the building and the time of its operation after their last capital repair, if any. At the same time, some authors also propose considering availability of the size of the contribution for capital repairs for owners of premises in MAB [13].

Along with this, in order to determine the cost of repair when planning the volume of investments for capital repairs, it is necessary to develop a unified methodology for determining the cost of capital repair of the common property of MAB.

It is also necessary to expand the sources of financing for capital repairs. In the global practice, there are the following models for financing capital repair of MAB:

- Accumulated funds of owners of premises in MAB;
- Bank loans for capital repair under the accumulation of funds of owners of housing on a special account;
- Budgetary financing for the repair aimed at improving the energy efficiency of the building [14, 15, 16, 17].

References

1. Fund for Assistance to Housing and Utilities Reform, *Capital repairs in apartment buildings: questions and answers. Comments and explanations of experts of the state corporation* (CJSC Bibliotechka RG, Moscow, 2013)
2. G. V. Khomkalov, I. G. Torgashina, K. V. Demyanov, *Baikal Research Journal*, **7(2)** (2016)
3. I. V. Yamshchikova, R. V. Sayfutdinova, *Proceedings of the Irkutsk State Technical University*, **3(98)**, 307-312 (2015)
4. ConsultantPlus, *Housing Code of the Russian Federation: Federal Law of the Russian Federation No. 188-FZ of December 29, 2004* (<http://www.consultant.ru/popular/housing/>, 2018)
5. Government of the Irkutsk region, *Regional program of capital repairs of common property in apartment buildings on the territory of the Irkutsk region for 2014-2043* (Irkutsk, 2014)
6. E. S. Dedyukhina, T. V. Dobysheva, E. A. Neudachin, *Izvestiya Vuzov. Investments. Building. Real Estate*, **2(7)**, 13-19 (2014)
7. Government of the Irkutsk region, *Resolution of the Government of the Irkutsk Region No. 497-pp dated July 31, 2017* (Irkutsk, 2017)
8. Government of the Irkutsk region, *On the establishment of a minimum contribution for capital repairs of common property in apartment buildings located on the territory of the Irkutsk region for 2018: Decree of the Government of the Irkutsk region dated 25.12.2017 N 871-pp* (Irkutsk, 2017)
9. O. N. Popova, T. L. Simankina, *Engineering and Construction Journal*, **7(42)**, 40-50 (2013)
10. Technical Services Division, *2017 cost schedule* (http://sfdbi.org/sites/default/files/Cost%20Schedule_0.pdf, SanFrancisco, 2017)
11. R. V. Sayfutdinova, *Modern Fundamental and Applied Researchers*, **1(20)**, 167-173 (2016)
12. T. V. Dobysheva, *Izvestiya Vuzov. Investments. Building. Real Estate*, **1(12)**, 33-38 (2015)
13. E. P. Druzhnikova, A. K. Samkharadze, *Privolzhsky Scientific Bulletin*, **7(47)**, 72-81 (2015)
14. S. A. Kozhevnikov, *Problems of Territory Development*, **4(84)**, 61-76 (2016)
15. A. A. Martens, *Municipality: Economics and Management*, **2(11)**, 66-73 (2015)
16. M. Y. Veselovsky, M. A. Izmailova, A. V. Bogoviz, S. V. Lobova, Y. V. Ragulina, *Quality - Access to Success*, **19(163)**, 30-36 (2018)
17. A. V. Bogoviz, S. V. Lobova, Y. V. Ragulina, A. N. Alekseev, *International Journal of Energy Economics and Policy*, **7(5)**, 93-101 (2017)