Cost optimization for overhauling the apartment blocks in Irkutsk, Russia

I V Yamshchikova\textsuperscript{1} and I A Lisetskij\textsuperscript{1}
\textsuperscript{1}Department of real estate expertise and management, Irkutsk National Research Technical University, Lermontov Street 83, 664038 Irkutsk, Russia
E-mail: yamsirina@yandex.ru

Abstract. This paper analyzes the specifics and major shortcomings of the following documents: the Irkutsk Oblast Act No. 167-OZ of December 27, 2013 On the Arrangement of Common Property Overhauls in Irkutsk Oblast and the pertaining regulations, programs, and Short-Term Plans Under the Irkutsk Oblast Regional Apartment Block Overhaul Program (hereinafter, common property stands for common facilities used by the residents of a single apartment block, e.g. rooftops, utilities, etc.). It further analyzes the financial reports of the Irkutsk Oblast Apartment Block Overhaul Fund. The analysis demonstrates the costs of overhauling the apartment blocks in Irkutsk Oblast with breakdown by sources, the amount and source of funds coming from the region’s municipalities as shown in the general funding structure of the Plan, and the specific jobs arranged under the City of Irkutsk Short-Term Plan Under the Regional Apartment Block Overhaul Program in 2015-2016. To simplify the drafting of overhaul programs, the authors hereof present the estimates of roof overhaul costs per square meter with breakdown by overhaul-related jobs; the estimates assume the use of novel materials: MasterSeal*501 and MasterEmaco*S 48. Such analysis reveals the roof job-specific coefficients (multipliers) one needs to apply to find the actual overhaul costs for Series 135 panel buildings in Irkutsk. The authors propose an scenario-based approach to design when drafting time-adjusted short-term overhaul plans. Time adjustment helps optimize such plans and minimize the change of a building being classified as a dilapidated apartment block.

1. Introduction
Housing must be in good condition and meet some minimum requirements to be suitable for comfortable and safe residential use. So far, the Russian Federation’s attempt to compile apartment block (AB) data sheets have shed light on the situation. Based on such data sheets, they drafted a 30-year overhaul program. Irkutsk Oblast’s Ministry of Housing Policy and Energy issued its Order No. 73-mpr of September 1, 2014, which approved the Irkutsk Oblast Regional Common Property Overhaul Program for 2014-2043 [1]. The overhaul queue is adjusted every year for how long this or that building has been in use, how worn it is, and what its specifications are.

Pursuant to Article 178 of the Housing Code of the Russian Federation and the Irkutsk Oblast Act No. 167-OZ of December 27, 2013 On the Arrangement of Common Property Overhauls in Irkutsk Oblast , the region now has a regional operator, the Irkutsk Oblast Apartment Block Overhaul Fund.[2] The mentioned documents specify the following core functions of this company: (1) accumulation of fees collected from landlords or allocated from various budgets specifically for the purpose of overhaul; (2) arranging the overhaul of common property in apartment blocks in Irkutsk Oblast.
2. Materials and methods
Data for this research was collected from the reports on carrying out the *Irkutsk Oblast Regional Common Property Overhaul Program for 2014-2043*, as well as from the financial reports of the Irkutsk Oblast Apartment Block Overhaul Fund.

Methods included economic statistical analysis, systematic method, and systematization of theoretical and empirical data.

AB overhaul valuation and cost optimization were based on finding the costs of construction products relevant in the Russian Federation as of the timeframe of this research.

3. Results
Pursuant to the 2014 *Short-Term Plan Under the Irkutsk Oblast Regional Common Property Overhaul Program for 2014-2043*, the Plan shall be funded by the Irkutsk Oblast Apartment Block Overhaul Fund as well as from the regional budget, the municipalities’ budgets, and AB landlords’ funds collected and stored on the Overhaul Accounts of the Regional Operator. [2]

The Program sets forth the following breakdown of overhaul funding sources.

![Diagram of Apartment Block Overhaul Funding Breakdown](image)

**Figure 1.** Apartment Block Overhaul Funding Breakdown

Funding under the Plan totals 338,368,762 rubles that come from the following sources:

| Municipality of Irkutsk Oblast | total funds for AB overhauls, rubles |
|-------------------------------|-------------------------------------|
|                               | total                               |
|                               | including funds from                |
|                               | the Fund                            |
|                               | regional budget                     |
|                               | the local budgets                   |
|                               | landlords                           |
| City of Irkutsk              | 139,390,494                         |
|                               | 55,016,956                          |
|                               | 42,223,000                          |
|                               | 35,000,000                          |
|                               | 7,150,538                           |
| total for Irkutsk Oblast     | 338,368,762                         |
|                               | 133,554,956                         |
|                               | 102,500,000                         |
|                               | 84,957,000                          |
|                               | 17,356,806                          |

For this Plan, the compiled general data sheets of apartment blocks in Irkutsk Oblast. Data provided by the region’s municipalities revealed 1287 apartment blocks to be covered by the Program; these have a deterioration of >70% [3]. The short-term plan for 2015 covered 100 blocks commissioned in the 1950-1980s, of which only 8 had seen any overhaul. 34 of the scheduled-for-
overhaul buildings were in the Municipality of Irkutsk, none had ever been overhauled. The oldest one was 80 years old (commissioned in 1935), and the newest one was 35. When making the short-term plan for 2015, its authors adjusted the amount of investment, which resulted in the following figures.

Table 2. Short-Term Plan Under the Irkutsk Oblast Regional Apartment Block Overhaul Program for 2015-2016, rubles

| AB overhaul costs in 2015-2016, Irkutsk | total     | landlords’ fees | the local budgets | regional budget |
|----------------------------------------|-----------|-----------------|-------------------|-----------------|
|                                        | 266,632,812 | 266,632,812     | 0                 | 0               |

Breakdown by overhaul types.

Table 3. Short-Term Plan Under the Irkutsk Oblast Regional Apartment Block Overhaul Program for 2015-2016, thousand rubles (breakdown by jobs)

| indoor wiring     | indoor heat piping | indoor cold water supply systems | indoor hot water supply systems | indoor sewerage systems | roof | basements and scaffolding | facades | construction monitoring |
|-------------------|--------------------|----------------------------------|---------------------------------|-------------------------|------|--------------------------|---------|-------------------------|
| 45,991            | 78,851             | 9,919                            | 12,220                          | 8,694                   | 29,890 | 15,585                   | 61,810  | 3,669                   |

AB overhauls: breakdown by affected systems and structures

- indoor wiring: 17%
- indoor heat piping: 23%
- indoor cold water supply systems: 6%
- indoor hot water supply systems: 11%
- indoor sewerage systems: 5%
- roof: 4%
- basements and scaffolding: 2%
- facades: 30%
- construction monitoring: 3%
**Figure 2.** Short-Term Plan Under the Irkutsk Oblast Regional Apartment Block Overhaul Program for 2015-2016, thousand rubles (breakdown by jobs)

As shown in the diagram, it is the indoor engineering systems, roofs, and facades that cost the most to overhaul.

4. Discussion

Pursuant to the *Regulations on Common Property Overhauls in Irkutsk Oblast for 2014-2043* [1], drafting the designs and estimates is done by the following roadmap:

- Inspect the apartment block;
- Run the calculations;
- Draft the designs and estimates;
- Overhaul the apartment block.

Apparently, none of these steps implies scenario-based design, which could help reduce the costs of this or that job. When drafting the original plan under the Program for 2014-2015, scenario-based approach was not an option. The Program covered mainly nearly-dilapidated apartment blocks and sought mainly to preserve the existing housing. However, the today’s adjustments to further plans for until 2043 must be made with optimization in mind.

For instance, consider overhauling the roofs, which accounted for 11% of the total overhaul costs, or 29,890 thousand rubles in 2015-2016. When overhauling a roof, they can redesign it to make a non-ventilated roof into a ventilated one with air outlets in the rooftop; such overhauls can also be associated with the repair or replacement of roofing elements and drains.

The City of Irkutsk is facing challenges pertaining to the overhaul of flat reinforced-concrete rooftops of Series 135 panel buildings. The first stage of the ICD survey revealed the possibility of using different methods of roof repair, depending on the degree of wear and tear. For repairs, the authors hereof propose novel materials: MasterSeal*501 and MasterEmaco*S 488.

### Table 4. Overhauls of flat reinforced-concrete rooftops in Series 135 panel buildings in the City of Irkutsk

| No. | Repair job       | Scope of work                                                                 |
|-----|------------------|-------------------------------------------------------------------------------|
| Job 1 | Surface restoration | Prepare the slab surface (brush with metal brushes, remove the dust, moisturize) Apply MasterSeal*501 to the surface (in two applications) |
| Job 2 | Upper layer restoration | Dismantle the protective concrete layer Prepare the slab surface (brush with metal brushes, remove the dust, moisturize) Apply MasterSeal*501 to the surface (in two applications). Apply MasterEmaco*S 488. Apply MasterSeal*501 to the restored surface (in two applications). |
| Job 3 | Coating restoration | Dismantle the protective concrete layer Prepare the slab surface (brush with metal brushes, remove the dust, moisturize) Seal the opened seams with a high-grade solution. Mount the reinforcement grids. Arrange the timbering. Pour the concrete mix. Apply MasterSeal*501 to the surface (in two applications). Apply MasterEmaco*S 488. Apply MasterSeal*501 to the restored surface (in two applications). |
Job 4 | Roof slab replacement
---|---
Place safety strain poles and bindings. Dismantle the roof slab. Arrange the timbering. Mount the reinforcement grids. Pour a mixture of high-grade modified concrete. Dismantle the timbering. Prepare the slab surface (brush with metal brushes, remove the dust, moisturize) Apply MasterSeal*501 to the surface (in one application).

To find repair job-specific costs, the authors hereof compiled process maps to estimate the repair costs by sourcing.

Calculations returned job-specific costs per square meter applicably to overhauling the reinforced-concrete rooftops in Series 135 panel buildings in Irkutsk.

![Figure 3. Overhauls of flat reinforced-concrete rooftops in Series 135 panel buildings in the City of Irkutsk: job-specific cost per square meter](image)

The estimates demonstrate the job-specific multipliers that can help adjust the short-term AB overhaul plans in the context of repair jobs.
Figure 4. Repair job-specific coefficients (multipliers) one needs to apply to find the actual overhaul costs for Series 135 panel buildings in Irkutsk.

5. Conclusion
Analysis of the Regulations on Common Property Overhauls in Irkutsk Oblast and Short-Term Plans Under the Irkutsk Oblast Regional Apartment Block Overhaul Program for 2015-2016 showed that such plans were often drafted and approved with no due consideration of the choice of design solutions. Applying the scenario-based approach to repair planning can reduce the roof repairs (rooftop element replacements) by a factor of up to 18. However, such reduction will require adjustments for time to exclude nearly-dilapidated buildings.

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