

# Maintenance and Repair of Engineering Systems of an Apartment Building



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**Abstract:** Improving the well-being of citizens implies a further solution to the housing problem, both through new construction and, to a large extent, through the reconstruction, modernization and overhaul of existing residential buildings, i.e., the reconstruction and renovation of the housing stock of old buildings. The article reveals the technologies in a qualitative and effective inspection of buildings, in improving the organization of technical inspection of buildings of the housing stock to perform work on major repairs, modernization and reconstruction. The purpose of the article is to organize a technical survey of housing stock buildings to perform works on engineering systems, modernization and reconstruction. The analysis of activity on maintenance and repair of engineering systems of an apartment building is carried out. The ways of solving the problems associated with the repair of engineering systems of an apartment building are considered.

**Keywords:** Maintenance, Buildings, Apartment Building, Engineering Systems, Repair Work.

## I. INTRODUCTION

The preservation of the housing stock from premature disposal necessitates a technical survey. Technical inspection of buildings and structures is an independent direction of engineering activity, covering a wide range of issues related to ensuring the operational reliability of buildings, carrying out repair and restoration works, as well as with the development of project documentation for major repairs, modernization, reconstruction of buildings or strengthening of individual structures [1].

The volume of surveys is increasing every year, which is a consequence of some factors: physical wear and functional obsolescence of buildings, expiration of normative terms of operation of buildings,

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changes in the functional purpose of premises, reconstruction, increase in real estate prices [2]. It is especially important to conduct surveys after various kinds of man-made and natural impacts (fires, earthquakes, floods, hurricanes) and during the reconstruction of old buildings, which is often associated with changes in existing loads, structural, planning and engineering solutions, the need to take into account modern design standards [3]. The relevance of the chosen topic is a qualitative and effective survey of buildings, in improving the organization of technical inspection of buildings of the housing stock to perform work on major repairs, modernization and reconstruction [4].

## II. LITERATURE REVIEW

All of the above determines the relevance of improving the organization of technical inspection of buildings of the housing stock to perform work on major repairs, modernization and reconstruction [5]. The organization of technical inspection of residential buildings is an insufficiently studied area of research [6]. Questions on scientific approaches to the development of the research topic are reflected in the works of scientists such as B. C. Abrashitov, A. I. Bedov A. G. Wandoan, T. V. Cluster, A. N. Dobromyslov, A. A. Emelyanov, V. M. Kalinin V. G. Kozachek, O. V. Luzhin E. P. Matveev V. Machacek, A. C. Miroshnichenko, A. C. Frost, N. In. Pryadko V. V. Remnev, B. I. Rimshin, I. A. Sazykin, N. G. Smolensk, A. N. Tetior, G. P. Thin, etc.

## III. METHODOLOGY

In our study, we analyzed the activities of maintenance and repair of engineering systems of an apartment building. For the analysis of repair works of apartment houses, we used data of condition of apartment houses of Nizhny Novgorod.

The purpose of the analysis of the technical condition of apartment buildings is the statistical indicators of the work carried out on the state of engineering systems of the house.

The main aspects of house maintenance include the following procedures: regular inspections of the condition of the house, which allow us to identify the need of particular repair actions; current home repairs, eliminating minor problems with the housing (collapse of the plaster in the stairwell, breaking pipes in the basement, etc.); the overhaul associated with the removal of fairly large defects of the structure (collapse of walls, improvement of water supply, rectification of defects in the wiring, etc.);

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seasonal maintenance of the house (care beds in an area, painting of the facades, knocking down icicles and cleaning roofs from snow, etc.); various additional services related to the maintenance of the house clean and tidy (washing Windows, cleaning the walls of entrances, cleaning, etc.).

In total, more than 50% of the Nizhny Novgorod housing stock accounts for "Khrushchev" and "Brezhnevki", only 31% refers to the modern houses and improved layout.



Thus, the service life of individual elements of the object may be less than the regulatory period provided for the entire building, 2-3 times.

For trouble-free and comfortable operation during the entire service life, it is necessary to replace systems or elements.

In the course of technical operation of buildings and constructions works on repeated adjustment and restoration of the worn-out engineering equipment are made.

The elements of the structure should not be used until complete wear and tear. In the course of functional use of the object, works aimed at compensating for normative wear and tear are performed.

Failure to perform planned work, significant in volume, may lead to premature failure of systems.

During the technical operation of buildings and structures, work is carried out to maintain parts and elements of the object in good condition, compliance with operating modes and device parameters.

### IV. ANALYSIS AND DISCUSSION

The object of the study of the technical condition of apartment buildings in this study is engineering networks [7].

Any industrial or residential building cannot be fully used, if it is not installed in engineering networks.

Equipment of buildings and structures is thought out at the design stage, the cost of them can now reach up to 40% of the total construction budget [8].

Such high cost of all components of networks is explained by their technical perfection, because now it is possible to organize almost intuitive control of all communications in the room [9].

Engineering networks and equipment are a set of elements that make work and life in buildings the most comfortable. Without such components, it is impossible to call the construction complete and suitable for operation [10].

Network engineering provides: Supply of buildings with thermal energy; Water supply and sanitation; Ventilation and

air conditioning; Outdoor lighting; Gas supply; Alarm and communication; Supply of electric energy [11].

Engineering networks, equipment of buildings of various types have their own characteristics.

All human activity depends on the proper functioning of engineering networks-from the comfort of living in a private house to the work of large industrial enterprises [12]. Therefore, their design, installation and maintenance require high professional qualifications, experience, as well as knowledge of safety and established rules and regulations. Engineering networks are a complex set of all life support systems that interact with each other [13]. The functioning of the entire facility depends on how professionally and qualitatively the installation of engineering networks is performed [14].

Maintenance can be carried out on periodically - carried out according to the schedule of scheduled maintenance. Continuous maintenance involves monitoring the working condition of engineering systems regularly. Seasonal maintenance is performed to prepare or transfer systems for the winter heating or summer season. The choice of the type of maintenance depends only on the building or structure, its engineering infrastructure, architectural and construction solutions. [15]

Control over the technical condition is carried out by inspections using modern means of technical diagnostics [16].

The works performed during inspections of the main engineering systems of the building include the following works: troubleshoot minor malfunctions in the systems of water supply and sanitation (change of gaskets in faucets, sealing sleeves, removing blockages, adjustment of flushing cisterns, fixing of sanitary appliances, cleaning of siphons, mirror lapping valves in faucets, gasket seals, change the float bowl, replace rubber gaskets with a bell and a ball valve, the installation stops - orifice plate cleaning tank lime deposits, etc.), strengthening of loose devices in places of their accession to the pipeline, strengthening pipelines [17]; elimination of minor faults in heating systems and hot water (adjust three-way valves, gasket seals, minor repair of thermal insulation, etc., replacement of steel radiators with leaks, disassembly, inspection and cleaning of sumps of collectors of air valves, compensators regulating valves, valves; and the descaling valves, etc., strengthening of loose devices in places of their accession to the pipeline, strengthening pipelines); elimination of minor malfunctions of electrical devices (cleaning and change of burned bulbs in public areas, change or repair of receptacles and switches, minor repairs of wiring, etc.). [18]

General inspections, which specify the scope of work to be included in the maintenance plan, are carried out twice a year. Partial inspections shall eliminate faults that can be eliminated within the time allotted for inspection.

Partial inspections of water supply and sanitation systems are carried out 3-6 times a month, Central heating systems 3-6 times a month during the heating period. Examinations open wiring and fixtures in the service areas are held 3 times per month, inspections concealed wiring to 6 times a month.

The results of inspections should be reflected in the documents on an accounting of the technical condition of the equipment (magazines, special cards, etc.).

These documents should contain: assessment of the technical condition of engineering equipment, identified faults, as well as information about the repairs performed during inspections.

To ensure the smooth operation of the heating system, maintenance technicians need to study the heating system of the building, both according to drawings and by examining it in kind. The personnel servicing the heating system is obliged to timely identify and as soon as possible eliminate malfunctions of the system that disable it or lead to fuel overruns, as well as systematically maintain a normal temperature in the premises.

Hot and cold water supply and Sewerage systems must be in a state that ensures their smooth operation. Pipes and devices should not be water leaks.

Engineering and technical personnel in charge of the operation of buildings must: in the shortest possible time to eliminate the system malfunctions revealed at inspections or noted in statements of residents, tenants or tenants of premises; to make an annual inventory of faults of water supply and Sewerage, which could not be eliminated in the order of current repair (change of a significant number of sanitary devices, change of pipes of domestic Sewerage, etc.); provide at least 1 time a year preventive cleaning of the yard sewer network; carry out at least 2 times a year preventive cleaning of the house sewer network (through audits); to monitor continuous availability for inspection of the wells of a domestic network; cover wells all-year-round should be cleaned from ground, dust and snow; mark the location of wells with special plates attached to the walls of the building, indicating the distance to the well.

The main requirement for the maintenance and operation of the ventilation system is to ensure regulatory air exchange in all rooms.

The main task facing the engineering service is the effective use of the construction site with a minimum of costs. The functionality of all systems should be at a high level. The right approach will ensure the optimization of material costs for the maintenance of buildings. Depending on the time of year, the technical operation of residential buildings has its characteristics.

The following types of work are typical for the spring and summer period: strengthening of drains, funnels and knees; repair watering system, sunken pavings; preservation of the Central heating system etc.

Autumn-winter period assumes: conservation irrigation systems; repair and cleaning of ventilation channels; insulation of balconies, pipes, attic ceilings, door and window openings, etc.

When operating residential buildings, two problems may arise. The first is an unprofessionally created instruction manual or its absence.

The second – is in the absence of responsible persons who will be responsible for the correct operation. [25]

## V. CONCLUSION

Maintenance of engineering systems is a kind of Foundation in the efficient and continuous operation of any building. Obviously, it is much easier not to let an "accident" happen than to fix the problem when it has already taken place.

Works aimed at preventing failure in the technical equipment of the building depend on the documents, which prescribe all the indicators of the equipment directly by the manufacturer.

Effective operation of the equipment is impossible without timely maintenance and repair in certain volumes and quality.

Long-term maintenance of equipment operability and reduction of the amount of costs for its maintenance and losses of the main production associated with downtime of equipment due to malfunction, require rational organization of operation and mandatory performance of a complex of works on its maintenance.

Maintenance and repair of technological (mechanical) equipment is carried out based on a Unified system of preventive maintenance and rational operation of technological equipment of machine-building enterprises, which includes: definition of repair works by types and their description; planning of preventive operations (adjustment, tightening of bolted connections, etc.) and control of their implementation; setting the duration of maintenance cycles, overhaul periods; the determination of categories of rheumatologist for all types of equipment; organization of service for repair works; application of modern methods of repair of the equipment simplifying technology and methods of restoration of the worn-out details; organization of procurement of finished spare parts, introduction of advanced manufacturing processes of spare parts, their storage and accounting; maintenance lubricating the economy; organization of material supply of repair service; organization of quality control of repair and maintenance of equipment.

The analysis of activity on maintenance and repair of engineering networks of the apartment house by the organizations is characterized by that in the process of the organization of servicing and repair works there are certain problems which need to be solved at the level of the state legislation:

The fight against debtors. According to the new legislation, the mechanism of struggle against debtors – individuals is tightened. So, in the presence of debt, the state housing Inspectorate sends a letter to the regional operator, and that – to the management

company. If within 60 days the latter fails to convince the defaulter to repay the debt, it has the right to initiate General meetings of tenants, which will decide on measures to repay the debt until the court and eviction.

The postponement of overhaul. Basically, this process is associated with the desire of civil servants to raise more money in the appropriate Fund for the convenience of corruption schemes. Therefore, if, according to the updated Legislative framework,

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the reasons for postponing the terms do not justify such an action, it is necessary to contact the appropriate authorities.

The poor quality repair. The most common problem of major repairs in homes-poor quality and damage to personal property of apartment owners: housing Bay, smudges, puddles on the roof, not a complete replacement of gas or other pipes and similar complaints.

At the moment, the overhaul includes work on the replacement (restoration) of the construction structure, utilities or their elements, and everything else is the current repair. Therefore, repair and insulation of facades, roofs, basements and communications are required to carry out regional operators (contractors chosen by them), and repair the entrance and similar work – management companies.

In such a situation, it is necessary to clarify what kind of work is planned and control their quality.

Failure to meet repair deadlines. Another problem with the overhaul of the ICD is the delay in its implementation. The reasons for this are most often: lack of material resource, which occurs in the process of repair. That is, with the minimum installments for capital repairs (per square meter) established by the regional authorities, the real amount of work significantly exceeds the amount collected.

Shortage of qualified specialists. In the absence of qualified personnel directly in the Fund, there should be questions to the regional operator or its controlling body, taking into account the average salary of such specialists (about 60 thousand rubles).

In any of the above cases, the lack of specialists is only an excuse.

Insufficient funds: why little money. Quite often, the lack or poor quality of overhaul is explained by a shortage of funds. But according to statistics, in early 2017. the planned collection rate (average) across regions is 80% and in some regions of Russia up to 85%. Thus, owners of the privatized housing pay contributions in full, and the indicator underestimate debts of municipalities. But these funds in many areas are mastered only by 50%. Therefore, such a reason lies in another, and may need to check for violations of the law.

Violation of laws and malfeasance. As can be seen, problems and difficulties arise at all levels of the ICD overhaul program. Some of them are related to the imperfection of the legislative framework, which did not take into account all the nuances. But most of the claims are based on violations of citizens' rights to live in safe and favourable conditions, which arise from the abuse of weakness, illegal embezzlement of finances and failure to meet deadlines.

Thus, studies of the organization of maintenance of apartment houses according to the utilities enhance the welfare of citizens of the Russian Federation suggests further addressing the housing problems both due to new construction and to a considerable extent by the reconstruction, modernization and capital repair of existing residential buildings, i.e. reconstruction and housing renovation of old buildings.

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