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Technical and regulatory aspects of establishing signs of emergency of apartment buildings within the framework of forensic construction and technical expertise

In the practice of experts working in the framework of judicial construction and technical expertise, questions often arise related to the identification of signs of technical and regulatory nature of the accident rate of apartment buildings. This is due to the fact that the number of such houses, according to Rosstat, is steadily increasing. As the analysis of expert opinions carried out in various state forensic expert institutions has shown, there is currently no single approach to this kind of research. In this regard, this article is of particular interest, since issues related to emergency housing are relevant. In research conducted by experts on these issues, there is often a semantic unification of the concepts of “dilapidated building condition” and emergency technical condition. The purpose of this work is to develop a universal research algorithm for judicial construction and technical examinations aimed at resolving issues about the accident rate of residential multi-apartment buildings, which, among other things, will eliminate contradictions between the conclusions of interdepartmental commissions and the actual technical condition of buildings. The article provides specific examples of damages and accidents (collapses) of apartment buildings, their causes. The regulatory, legal and technical aspects of the problem are considered. It is noted that all the described accidents are not related to man-made or emergency situations (earthquakes, explosions, fires, terrorist attacks), but are the result of weakening of critically important load-bearing structures.
Keywords: forensic construction and technical expertise, emergency housing stock, technical and regulatory signs of emergency, dilapidated condition of the building, emergency technical condition of the building

INTRODUCTION

According to Rosstat [1], despite the current state programme for the resettlement of the population in the country, the emergency housing stock in the Russian Federation increased in real terms from 15,188 thousand m² to 22,059 thousand m² in 2015–2021 alone, which is an increase of 45.2 %. By 2030, an increase is projected compared to 2020 by 1.5 times [2]. In some regions, there is a situation where housing is not recognized as emergency “due to the fact that this fact entails an increase in resettlement obligations, and there is not enough funding for these tasks”.

According to data presented on open Internet resources¹, at the beginning of 2024, more than 70 thousand buildings with over 1 million people living in them were declared emergency. It is noted that the recognition of an apartment building (AB) as an emergency and subject to demolition or reconstruction belongs to the exclusive competence of interdepartmental commissions². However, due to various circumstances, it is not uncommon for the last AB to be unreasonably not recognized as emergency and subject to demolition or reconstruction, but rather the wording “major repairs are required” is indicated. Within the framework of this article, the existing problem is considered in detail. At the same time, the number of complaints about these issues of substandard housing is steadily increasing. In total, the Forensic Expert Centre (FEC)

of the Investigative Committee of the Russian Federation (IC RF) for housing of inadequate quality, dilapidated houses carried out 185 forensic construction and technical examinations in 2022, 339 in 2023, and 609 in 2024, which amounted to 53.7 % of the total number of construction and technical expertise and research carried out in the FEC of the IC of Russia.

As the analysis of expert opinions carried out in various state forensic expert institutions has shown, there is currently no single approach to this kind of research. Experts often try to link the concepts of “dilapidated condition of a building”, based on indicators of physical wear and tear, established in accordance with the standards of VSN 53-86(r) [3] or methods [4, 5], with the concept of “emergency technical condition”. In particular, appendix 6 of the document [6] notes that “dilapidated condition of a building” is a condition in which the structure of the building and the building as a whole are worn out: for stone houses — over 70 %, wooden houses with walls made of local materials, as well as attics — over 65 %. At the same time, the main load-bearing structures retain strength sufficient to ensure the stability of the building, however, the building ceases to meet the specified operational requirements. As noted in the article [8], although dilapidated housing is characterized by a fairly high degree of wear and tear, there is no formal danger of collapse, unlike emergency housing. Even if the deterioration of the structure is more than 70 %, this is not a guarantee that the dilapidated housing will be resettled [8].

The article [9] presents an approach for determining the category of technical condition of

¹ URL: <https://tass.ru/ntdvizhimost/20626935> (date of request 29.08.2024).
² Paragraph 47 of the Decree of the Government of the Russian Federation dated 28.01.2006 No. 47 [7].



Fig. 1. General view of an apartment building in Kuibyshev Street in Perm before and after the collapse

buildings by physical wear, however, due to the introduction in 2019 of uniform criteria for assessing the emergency and limited-functioning technical condition of residential buildings, this approach cannot be used in the production of forensic construction and technical examinations, which require the resolution of questions about AB accident rate.

The main purpose of this work is to develop a universal research algorithm for forensic construction and technical examinations aimed at resolving issues about the accident rate of residential buildings, which, among other things, will eliminate contradictions between the findings of interdepartmental commissions and the actual technical condition of buildings. For this purpose, a number of accidents that have occurred in long-term residential buildings over the past 10 years have been considered, as well as relevant technical and regulatory aspects of legislation regulating the recognition of residential buildings as emergency and subject to demolition or reconstruction. When conducting the study, it is proposed to rely solely on the technical signs of the emergency condition of structures made of various structural materials [10–12], with instrumental control of the parameters of defects and damages according to the criteria specified in tables 5.2–5.26 of the Code of Practice[13].

DAMAGE, ACCIDENTS OF AB AND THEIR CAUSES

On 11.07.2015, the corner part of a 5-storey residential building on Kuibyshev Street in Perm collapsed (Fig. 1). The house was built in 1957. It was established that before the collapse, the reconstruction and redevelopment of the basement premises was carried out. During the reconstruction, instead of the loading hatch of the store, an entrance group to the basement was made, for which the sill section of the window opening was dismantled and a recess for the installation of an external staircase was filled in, as well as a new opening in the inner load-bearing wall, which was not provided for by the project.

After the reconstruction, force damage was observed in the newly formed basement pillar in the form of cracks separating the integrity of the masonry section, chipping of bricks in peripheral sections of the pillar, and a network of cracks under the lintel support crossing more than four rows of masonry. These damages occurred as a result of the redistribution of loads from the overlying structures after making changes to the vertical supporting structures of the basement part of the building (Fig. 2). Vertical cracks



Fig. 2. View of the pillar of the non-designed opening in the basement, which was the source for activating the process of destruction of the building (the state of the pillar, recorded before the collapse of the corner of the building)

formed on the exterior walls, which subsequently separated the collapsed fragment, as a result of cyclic freezing of the soil base in a deepened hole under the exterior staircase.

On 29.08.2017, the middle section collapsed within one span of a 4-storey residential building in the city of Orel along the Dubrovinsky Embankment (Fig. 3, a). The house was built in 1955 with brick walls and wooden floors, located in close proximity to the Oka River.

Shortly before the collapse, damage was recorded in the piers of the first floor: vertical cracks along the entire height of the piers with an opening width of more than 1 cm, layering of the masonry into thin flexible columns and bulging of the outer wythe (Fig. 3, b). This state of brickwork corresponds to the 3–4 stage of destruction, which is the final stage of masonry destruction, when through cracks do not stabilize, but continue to develop and increase without increasing the load [14].



a



b

Fig. 3. General view of an apartment building along the Dubrovinsky Embankment in the city of Orel after the collapse: a — emergency condition of the first-floor walls; b — recorded before the collapse

The reasons for this weakening of the masonry were the regular soaking of the structures of foundations, walls and pillars by groundwater and floodwaters, leaks from engineering communications, inadequate horizontal waterproofing of walls, uneven degradation of the strength and deformation properties of the masonry solution within the seam. Concomitant unfavorable factors, due to which additional uneven deformations appeared — precipitation of foundations, were the construction work during the construction of the Oka River embankment in 2015 using heavy machinery, and possible vibrational decompression of the foundation soils.

On 12.08.2022, the end part of a 5-storey building in XX Partysyezda Street in Omsk collapsed (Fig. 4). In 2024, a secondary collapse occurred in a resettled but not demolished building, as a result of which the floors from 1st to 5th collapsed adjacent to the previously destroyed site. 1st floor and a full-height longitudinal exterior wall.

The house was built in 1966 with brick walls and prefabricated reinforced concrete floors. The cause of the collapse was the loss of the bearing capacity of the brickwork (made of clay bricks) of the basement of the building at the intersection of the end and longitudinal exterior walls. The collapse was preceded by systematic

leaks from engineering communications in the basement. The brickwork at the basement and ground floor levels, where the wet rooms are located, was systematically saturated with capillary moisture, and on the street side it was subjected to repeated freezing/thawing. Subsequently, this caused a significant decrease in the bearing capacity of the masonry — buckling deformations of the outer wythe appeared according to the 3–4 stage of destruction scheme [14] and further avalanche progression of damage deep into the section under load.

On 16.11.2023, the third and fourth entrances of a five-story apartment building in the Leninsky district at 1a Vokzalnaya Square in Astrakhan collapsed (Fig. 5). The house was built in 1962 with brick walls and prefabricated reinforced concrete floors (3 walls). The foundation is ribbon; the building is basement-free. The supporting structure of the ceiling was wooden, with beams supported on brick pillars on the ground. Partially, the floors at the indicated mark were made of concrete on the ground (under the bathrooms). To maintain communications and maintain them in proper condition in such a building, it was necessary to open the floors and ceiling structures in the apartments on the first floor. The actual



Fig. 4. General view of an apartment building in XX Partsezda St. in Omsk before and after the collapse (the arrow shows the progressive destruction of the corner section of the outer wall a few seconds before the collapse of the end part of the building)

implementation of horizontal waterproofing and its current condition did not allow for the capillary suction of moisture into the outer wall structure from the saturated soil in contact with the wall and led to weathering of the masonry (degradation of strength and deformation characteristics).

Immediately before the collapse, on the section of the outer wall that subsequently collapsed, the presence of oblique cracks crossing the sections of brickwork under the window openings from the first to the fifth floor was recorded in the level of residential floors. The deformations of the brickwork, uneven in length, which were accompanied by a skew in the geometry of the window openings, the window cover burst fullness, a characteristic crack was heard. As a result, the cause of the collapse, as well as in the previous case, was the weakening of the strength and deformation characteristics of the masonry at the basement and ground floor levels due to environmental influences as a result of systematic leaks from engineering communications. Moreover, the physical wear calculated according to the method [3] on the date preceding the collapse was 51 %.

All the accidents mentioned above are not related to emergencies, such as gas-air mixture explosions and terrorist attacks, but they have a general picture of the mechanism of destruction. The accidents discussed in the article are related to the weakening

(man-made and/or environmental — corrosion) of critically important load-bearing structures during operation, both during reconstruction and redevelopment, and as a result of accelerated physical wear due to improper condition of engineering communications, waterproofing, and building structure elements.

REGULATORY AND LEGAL ASPECTS

The following issues can be resolved without going beyond the competence of an expert in the conduct of forensic examinations. The first group of issues is related to the study of the technical condition of AB (building as a whole), including when the decision of the interdepartmental commission needs to be challenged in court³:

- did the interdepartmental commission⁴ have any technical grounds for deciding that there were no grounds for

³ If there are relevant documents, for example, technical reports made by specialized organizations authorized by the SRO in the field of engineering research for construction, the study can be conducted on the basis of these documents as of the date of the engineering survey.

⁴ The study is conducted using regulatory legal acts in force on the date of issuance of the interdepartmental commission's Opinion (if there is a technical opinion from a specialized organization on the relevant date).



Fig. 5. General view of a destroyed apartment building in the Leninsky district 1a Vokzalnaya Square in the city of Astrakhan

recognizing AB as an accident and subject to demolition or reconstruction?

- are there signs of an emergency condition of AB at the time of the examination?

Are there grounds for recognizing the residential premises of AB as uninhabitable, and the buildings as a whole as emergency and subject to demolition?

The second group of issues is related to the study of the technical condition of individual⁵ load-bearing structures of AB, necessary for making a decision on the expediency of conducting a technical inspection of AB as part of a preliminary investigation:

Are there signs of an emergency condition of individual load-bearing structures of AB?

The grounds for the recognition by the interdepartmental commission of AB as unsafe and subject to demolition or reconstruction in accordance with Part 3 of art. 55.26-1 of the Urban Planning Code of the Russian Federation [15] are established by the provisions of Section IV of the Regulation (approved by Decree of the Government of the Russian Federation dated 28.01.2006 No. 47) [7]. The procedure for assessing the conformity of a building (or residential building) with an emergency one, which is subject to reconstruction, repair, demolition, as well as the list of documents necessary for making such a decision, is established in paragraph 44 [7].

Based on the results of the work, the interdepartmental commission must make one of the decisions specified in paragraph 47 [7] on assessing the compliance of premises and apartment buildings with the established requirements.

It should be noted that in the practice of conducting forensic examinations, conclusions of interdepartmental commissions are quite common, which indicate that a decision has been made to recognize AB as subject to capital repairs, however, such a solution is missing in paragraph 47 of the Provision approved by Government Decree No. 47 [7].

Thus, the wording in the Conclusion of the interdepartmental commission should clearly correspond to one of those listed in paragraph 47 [7], which should be reflected in the expert's conclusion within the framework of the study.

The main document for the interdepartmental commission in assessing the suitability (unsuitability) of residential premises for

living, and the recognition of AB as emergency and subject to demolition, is the conclusion of a specialized organization⁶ on the condition of load-bearing and enclosing structures (technical opinion). If the applicant is a state supervision (control) body, it submits its opinion to the commission, and after its consideration, the commission invites the owner of the premises to submit the documents specified in paragraph 45 [7]. Based on the above, the specified documents for the examination are provided by the investigator, among others, in the materials of the criminal case.

In the absence of a technical opinion from a specialized organization, an interdepartmental commission, and other documents in the materials provided for the study, the expert can only conduct an investigation to identify signs of malfunction of individual load-bearing structures of AB without going beyond the competence.

If the case file contains a technical opinion from a specialized organization, which establishes the emergency technical condition of the building, and there is a decision by local governments and state authorities that the building is recognized as emergency and subject to demolition, but the building is not actually inhabited, then there is a need to appoint forensic construction and technical examinations in relation to such housing for the above-mentioned there are no questions. At the same time, ABs that are not recognized as emergency, but are located in a building with other buildings recognized as emergency in the territory subject to complex development, may be subject to demolition or reconstruction in accordance with paragraph 2, Part 2, art. 65 of the Urban Planning Code of the Russian Federation [15], if the physical wear of the main structural elements exceeds the value defined by the subject of the Russian Federation⁷. Such issues are not considered in the framework of forensic examinations, as they fall within the competence of local self-government bodies.

Summing up the above, in order to resolve the issues of the first group, the investigative body must provide a technical report from

⁶ In the case that, in accordance with the third paragraph of paragraph 44 [7], the provision of such a conclusion is necessary for making a decision on recognizing residential premises as meeting (not meeting) the requirements established in the Regulation [7].

⁷ In accordance with the regulatory legal act of the subject of the Russian Federation, the regional capital repair programme may not include apartment buildings, physical wear of the main structural elements (roof, walls, foundation) which exceed 70 %, and (or) apartment buildings in which the total cost of services and (or) major repairs of structural elements and internal engineering systems that are part of the common property in apartment buildings, per square meter of the total area of residential premises exceeds the cost of, defined by the regulatory legal act of the subject of the Russian Federation (paragraph 1, part 2, art. 168 of the Housing Code of the Russian Federation).

⁵ Single structure: A load-bearing building structure (part of the structure), which is a repeating element in the totality of all load-bearing building structures of this type (clause 3.1.4 [13]).

Technical aspects of classifying a structure as an emergency category

CP 454.1325800.2019 [13]	Regulations [7]
More than 5 % of the load-bearing building structures of at least one type of the total number of load-bearing building structures of this type have been identified ⁸ , but not less than three corresponding to the emergency category of technical condition (clause 5.1.5 of the Code of Practice [13])	Paragraph 34 of the regulation [7] describes the procedure for establishing an emergency technical condition of AB, which is determined in accordance with GOST [16], justified by appropriate verification calculations of the bearing capacity of structures and (or) the foundations. For houses with no more than two floors, it is possible to determine the emergency technical condition in accordance with the Code of Practice [13], while more than 50 % of the structures of foundations, load-bearing walls and ceilings are classified as an emergency technical condition
Two types and more load-bearing building structures have been identified (with the exception of the types of structures specified in 4.4–4.6 [13]) with the number of emergency load-bearing building structures exceeding 3 % of the total number of structures in each, but not less than three in total (clause 5.1.7 of the Code of Practice [13])	If the specified volume of emergency structures is not detected during the examination in accordance with the Code of Practice [13], but one of the listed facts is found (see exceptions), then the examination must be carried out in accordance with GOST [16]
Exceptions	
If a residential building has load-bearing building structures for which the Code of Practice [13] does not provide criteria for emergency and limited-functioning technical conditions and in which significant damage was detected during inspection, their assessment is carried out in accordance with GOST 31937 (clause 5.1.4 of the Code of Practice [13])	• localization of defects in a separate part of an apartment building, including in one entrance, on one floor; • a single significant defect in a separate load-bearing building structure of an apartment building, which may lead to a threat of collapse of the apartment building
If a sufficient number of emergency load-bearing building structures have not been identified to recognize a residential building as an emergency as a whole, but there is a single significant defect in a separate load-bearing building structure that may lead to a threat of collapse of the residential building, the assessment of the technical category of the residential building is carried out in accordance with GOST 31937 (clause 5.1.6 of the Code of Practice [13])	Presence of an apartment building that has been arbitrarily rebuilt and (or) redeveloped

a specialized organization for examination, as well as organize an inspection of the scene with the participation of an expert and interested persons (representatives of the local administration, the management company and the owner).

TECHNICAL ASPECTS

If there is no conclusion of a specialized organization in the case file, the following approach is used. Currently, a residential building is classified as an emergency technical condition category if (see the Table).

The exceptions provided for by the current regulatory documents make it possible to identify the emergency category of technical condition, and are well combined with the indicators of identification of accidental damage in Table 5.2–5.26 of the Code of Practice [13], observed before AB accidents in the above review, and not with indicators of physical wear, which in the examples of emergency buildings is not exceeded 60 %. In low-rise residential buildings, where wooden floors are most common (wooden flooring on wooden beams, sheeting and plaster on shingles from below) and most often have the greatest damage (hidden defects), the following inspection scheme is proposed. The inspection is carried out in accordance with clause 5.2.14 of the Code of Practice [13], but if necessary (due to the lack of access through technological openings), autopsies⁹ are performed in the places specified in clause 5.3.4.6 of GOST [16], in the presence of residents and with their consent. In accordance with paragraph 5.2.4, According to the rules [13], at least 10 % (but not less than three) of the load-bearing building structures of each type are subject to inspection

⁸ The specified number does not include emergency wooden covering structures, emergency stairway structures and outbuildings (which do not affect the main building), if there are possibilities to strengthen or replace emergency elements without evicting residents (paragraphs 4.4-4.6 [8]).
⁹ In order to carry out autopsies of load-bearing structures, the expert submits a reasoned petition to the investigator.

and measurements of controlled parameters. Damages are recorded in such a way that it is possible to compare with the accident rates in tables 5.2–5.26 of the Code of Practice [13].
If the case file contains an opinion of a specialized organization (technical opinion), which does not establish an emergency technical condition of AB, or there is no technical opinion at all, the inspection of AB is carried out according to the methodology specified in section 5.2 of the Code of Practice [13]. During such an inspection, it is also necessary to ensure that there are no emergency load-bearing structures. When conducting forensic construction and technical examinations on the issues of AB accidents, the damage recorded in the inspection report is examined. It is also compared with the data of a specialized organization and an analysis of the verification calculation, if it is provided.

CONCLUSION

1. A brief overview analysis of the existing approaches for determining the technical condition of AB is given.
2. AB accidents that have occurred over the past 10 years and the causes that caused them are considered, which well illustrate the criteria for the emergency technical condition of a residential building provided for by current regulatory documents.
3. An algorithm (approach) has been developed for the production of forensic structural and technical examinations, in which it is required to resolve questions about the signs of AB accidents.

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Технические и нормативно-правовые аспекты установления признаков аварийности многоквартирных жилых домов в рамках судебных строительно-технических экспертиз

В практике экспертов, работающих в рамках судебных строительно-технических экспертиз, часто возникают вопросы, связанные с выявлением признаков технического и нормативно-правового характера аварийности многоквартирных жилых домов. Это связано с тем, что число таких домов, по данным Росстата, неуклонно возрастает. Как показал анализ заключений экспертов, выполненных в различных государственных судебно-экспертных учреждениях, единого подхода к подобного рода исследованиям в настоящее время не существует. В этом отношении настоящая статья представляет определенный интерес, поскольку вопросы, связанные с аварийным жилым фондом, являются актуальными. При исследованиях, проводимых экспертами по данным вопросам, часто происходит смысловое объединение понятий «ветхое состояние здания» и «аварийное техническое состояние». Целью данной работы является разработка универсального алгоритма исследований для судебных строительно-технических экспертиз, направленного на разрешение вопросов об аварийности жилых многоквартирных домов, который, в том числе, позволит устранять противоречия между выводами межведомственных комиссий и фактическим техническим состоянием зданий. В статье приводятся конкретные примеры повреждений и аварий (обрушений) многоквартирных домов, их причины. Рассмотрены нормативно-правовые и технические аспекты проблемы. Отмечается, что все описанные аварии не связаны с техногенными или чрезвычайными ситуациями (землетрясения, взрывы, пожары, теракты), а являются результатом ослабления критически важных несущих конструкций.

Ключевые слова: судебная строительно-техническая экспертиза, аварийный жилой фонд, технические и нормативно-правовые признаки аварийности, ветхое состояние здания, аварийное техническое состояние здания

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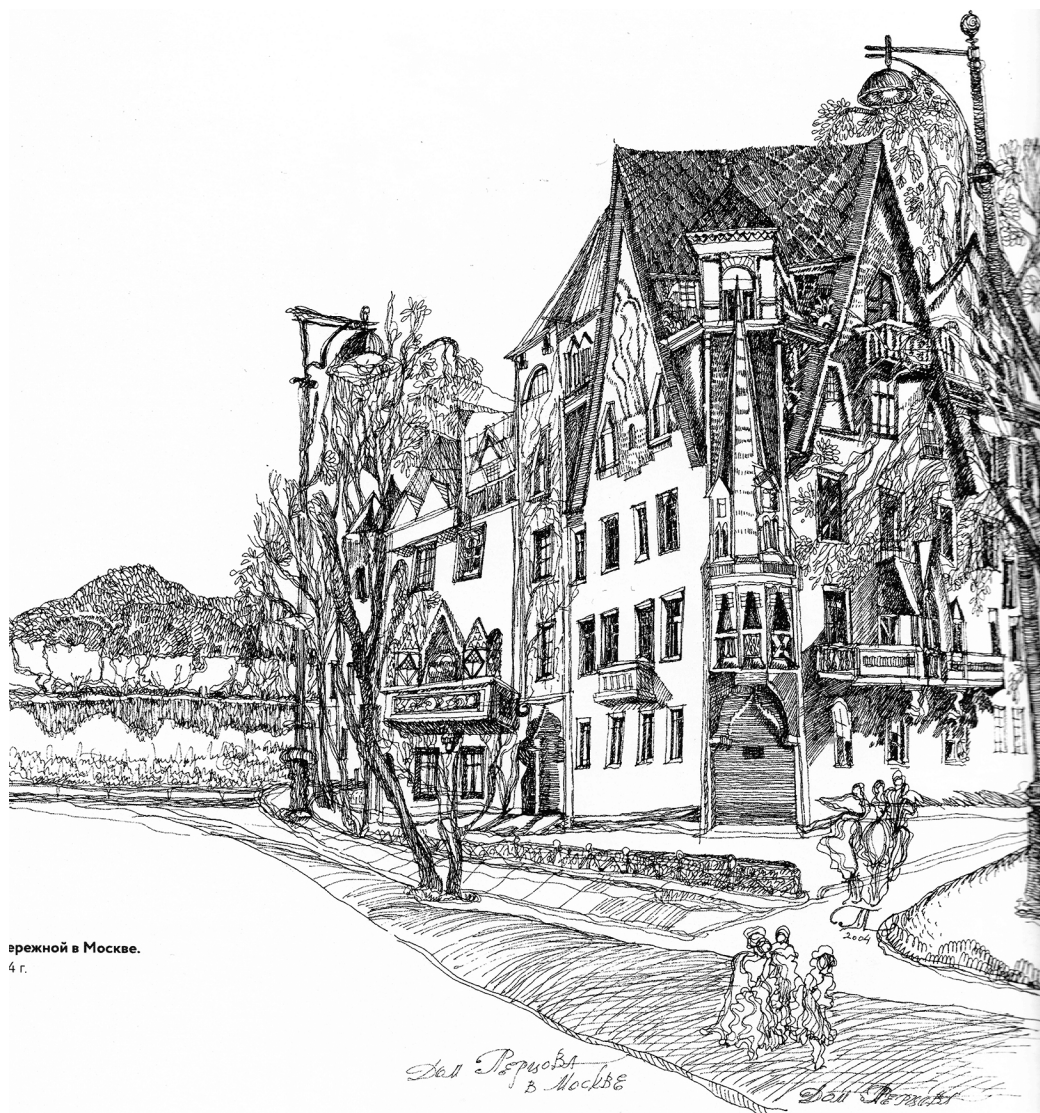
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