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Scheduling capital repairs of municipal real estate facilities in the context of drafting integrated land development programmes

The real technical condition of a building or structure can be assessed only on the basis of its instrumental examination. Capital repair plans and schedules are mainly drawn up without any instrumental control of load-bearing structures, foundation maintenance and hydrogeological surveys of ground foundations, whose influence on the operation of foundations in urban areas has increased dramatically. Densely built-up urban areas trigger the deformation and destruction of existing and, to a greater extent, old buildings. Therefore, it is advisable to monitor the condition of structures with an interval of no more than 3–5 years, rather than 10 years (according to effective regulations). Planning repairs on the basis of the condition of structures, rather than using a traditional method of determining the percentage of wear, ensures more accurate engineering solutions when scheduling repairs, by spending money on strengthening structures rather than painting deformed walls. This approach allows cutting unproductive financial and time costs. Saving financial resources by preventing the failure of structures eliminates the need for their restoration. Such a solution is most appropriate and effective in the context of the implementation of modern approaches to Integrated Land Development Programmes (“Programmes”).

Keywords: capital repairs, technical condition, structures, instrumental inspection, soil hydrogeology, financial savings, real estate management, state structures of technical control, integrated land development

INTRODUCTION

The problems of scheduling capital repairs start from selecting the facilities in need of repair, the starting date and duration of repairs and reconstructions, the intended purpose and their funding. These issues always arouse debates and trigger conflicts of interests at all levels of real estate management. However it is the deficit of cash that creates severe endless problems. By “problems” we can and should understand the fact that significant funds granted by the state, together with the additional financing from Capital Repair Funds, and the result that we obtain can in no way be called an “effective investment” in this most important industry that shapes up our living environment. Freshly painted facades of renovated buildings cannot hide the problems that determine the true “technical condition of real estate facilities”, that management companies and their contractors are willingly or unwillingly trying to hide by performing “camouflage repairs” [1].

Historically, the responsibility for the technical condition of real estate is assumed its owner. However, this means that there is no necessary control of the technical condition of all types of the housing stock and social facilities in residential urban quarters built up 50–80 years ago. At the same time, the problem of dilapidated housing has not been solved for many years [2].

The system of visual inspections of buildings and structures of urban real estate is based on the data presented as a percentage of building structures in need of repairs and elements featuring deformations, cracking or destruction, which means “physical wear” of structures and the entire building. Such a formal approach to complex engineering problems, which in certain combinations of

conditions, loadings, deformations and age-related weakening of load-bearing structures, “inevitably” turns into a state of active and progressive destruction of the building as a whole, is unacceptable today. It is difficult for any professional to track such changes in structures, which are often invisible, and it is not possible for non-specialists of management companies and real estate management services of official owners. The prevailing opinion is that an instrumental survey of the technical condition of real estate is absolutely necessary if there are legal requirements. Spending money on the time consuming and expensive process of instrumental examination is considered impractical today, if there are no visible reasons and concerns [3].

PROBLEM STATEMENT

If the building examination is necessary in case when a construction facility is prepared for major repairs or reconstruction, a change in ownership or the functional purpose, the inter-repair cycle of 40–50 years will be complied with. An approach to the monitoring of the physical and technical condition of structures has been developing since the 70s. It assumes two visual examinations of facilities during the year of operation. When dangerous factors of damage emerge, instrumental checks of deformations, strength or other parameters are recommended, although this requirement is also rarely met [4].

It is obvious that:

- effective regulations (SNIps, SP — Construction regulations, SN — Construction norms) neither oblige, nor encourage the owner (this has been in effect only since 2000) to reduce the time between the examinations of construction facilities [5];

- the assessment of the physical condition of building structures, measured in the “percent of wear”, does not correspond to the assessment of its real condition, since it takes into account their age and fails to take into account the real conditions of their operation;
- currently, there is an insufficient number of professionally trained specialists equipped with modern equipment and measurement methods in the field of the technical control of the condition of the urban housing [6];
- over the past 20 years, the conditions of the real estate operation have changed significantly due to the impact of the atmosphere and other growing man-induced impacts.

Over the past decade, the totality of the factors, influencing the real estate management sector, has been supplemented by the effect of groundwater on buildings and structures. As a result, properties of soil bases change. This happens under the influence of hydrogeological conditions changing in urban areas at a different pace. Such changes are triggered by the intensive development of urban areas via densification and implementation of such design solutions as underground or high-rise elements of buildings. A pressure drop in layers of soil radically affect water flows in aquifers and, thereby, dramatically change the bearing properties of soils under existing facilities. Vibro-shock vibrations of soils and buildings, triggered by construction works and transport vehicles, for example, impact piling technologies, prohibited in urban areas, multiply this effect. The situation is aggravated by frequent (hidden) emergency breakthroughs of aquifers.

St. Petersburg and Moscow construction communities have drafted and updated TSN (Local Estimated Cost Standards) 50-302-96 (1997) and TSN (Local Estimated Cost Standards) 50-302-2004 (2004), namely, their section “Construction (design) of foundations of civil buildings and structures”. As well as SP 50-101-2004, designated for buildings erected near existing (or adjacent) facilities. These norms provide for the mutual influence of such objects, that intensify the loading of soil, foundations and frameworks of buildings, so that it exceeds initially designed load values. Such zones of dangerous influence have radii up to 30–50 m.

In other words, the practice of construction under the conditions of dense urban development shows that the problem of interaction in the course of the implementation of complex design and engineering solutions (at the stages of “survey – design – construction”) is particularly relevant today.

These standards explain the fundamentals of such engineering interaction. An accurate statement of the stress-strain state of any facility can only be obtained by making instrumental examination of the contact area of the facilities under construction. Destructive processes in soil foundations are constant and continuous, but their substantial intensification and diversification are proportionate to the increase in the pace of urban construction. At the same time, recommendations and instructions concerning the mandatory technical control in the area of contact load is of serious concern, since it is not carried out at any stage of the land development process. This control is performed neither at the survey stage, nor at design and construction stages. Rather, surveys are only conducted at the stage of the building operation, as in the aftermath of 40–50 years the need for capital repairs forces the owner to analyze the technical condition of a facility [7].

MAIN PART

Let's consider what economic result this practice of technical control over the condition of buildings may generate at the present stage of development of the construction industry and the sector of housing and utilities.

In the central cities of Russia, major buildings were built in the 1960–1980s, the most productive (industrial) construction term of the Soviet period. Their age exceeds 45–50 years; therefore, they require major repairs and technical maintenance. These buildings are located mainly in the central zones of urban areas, where developers are now seeking to build new facilities. The decision on the expediency of the repair, reconstruction or demolition of a particular building can only be made based on the results of a very thorough instrumental examination, taking into account the data on new hydrogeological surveys. Extensive technical surveys need to be conducted in large residential areas, where the growing bearing capacity of soils exceeds the design values. At such a stage, before deformations start growing and before the structural failure process is triggered, only a special examination and instrumental measurements can register the initial phase of the stress amplification and prevent the destruction process. Modern engineering technologies enable engineers to quickly, efficiently and inexpensively stop the process of building failure [8, 9].

This determines the economic benefit of advanced stress control before the onset of deformations and the failure of building structures, thereby preserving structural integrity. It is this fact that ensures the long-term structural strength of a building and the absence of significant costs for a long period of its operation. The integrity of foundations and the building frame contributes to the preservation of heat-hydro-insulation, elements of engineering networks, roofing structures and finishing coatings [10]. It drastically reduces the estimated costs of current and major repairs, but, most importantly, eliminates huge costs of restoring collapsed structures. The cost of such an approach to the problem of real estate maintenance becomes the cost of an instrument kit needed for examination and control. These non-recurring costs range from 3.5 to 6 million rubles, and the cost of performing control measurements is from 30 to 80 rubles per square meter of the total area [11].

The productivity of the examination of buildings using a modern set of equipment can average 4–8 facilities a month and up to 100 facilities a year. Surveys of urban residential houses, if conducted once in two years, can provide city administrations with accurate information necessary for planning major repairs, given that the number of facilities requiring repair and restoration measures, exact types and amounts of required work, their estimated cost and timing of are available. The surveys of buildings operated by management companies can be funded from the capital repair fund.

The main condition of effectiveness is that the activities of companies in control of the technical condition of buildings are based on their state ownership. The costs of their maintenance and operation are easily covered by the reduced costs of repairs, reduced inefficient costs of minor repairs of buildings that have hidden and undetected structural defects [12]. Accurate engineering calculations make it possible to identify bearing capacity resources of building structures and timely strengthen them to prevent further destruction. If the load-bearing capacity of building frames is maintained, conditions are created for increasing the inter-repair cycles, funds are made available for more necessary types of work at other facilities [13].

► This management system is most effective is applied to intensive reconstruction and construction within the framework of Integrated Local Development Programs.

Figure presents statistical data on the types of work performed within the framework of the capital repair of residential buildings. With a total annual cost of 890 million rubles, the absolute priority in terms of financing is given to the repair of the structures that are in the pre-emergency condition. These are roofing, facade and repair of heat supply systems. The repair of the foundation structures was included into the cost of repair of the basement walls, amounting to 0.2 % of the total cost. Specialists are aware that the lack of funding needed to repair the foundations, wall frames and ceilings indicates the lack of due attention to them and, as a consequence, the failure to perform their examination. This fact is confirmed by the rapid failure of new finishing layers and the need for repeated annual repairs. This fact is also confirmed by the cost of instrumental surveys specified in the top row of the table, which amounts to \$1.53 million rubles, or 0.2 % of the total cost amount. This amount corresponds to the cost of surveys of three to five construction facilities out of 200, initially selected for examination.

In other words, the planning of major repairs is not preceded by instrumental surveys of construction facilities [14]. This means that the engineering solutions made in respect of the facilities selected for repairs, their real technical condition, the need for the reinforcement of load-bearing structures, are made without analyzing reliable information. This certainly provokes inappropriate financing, reduces its effectiveness, and makes it largely useless. The main problem triggered by this approach is that the number of building failures is not reduced by such repairs, and the number of houses with substantial defects is constantly increasing. That means that

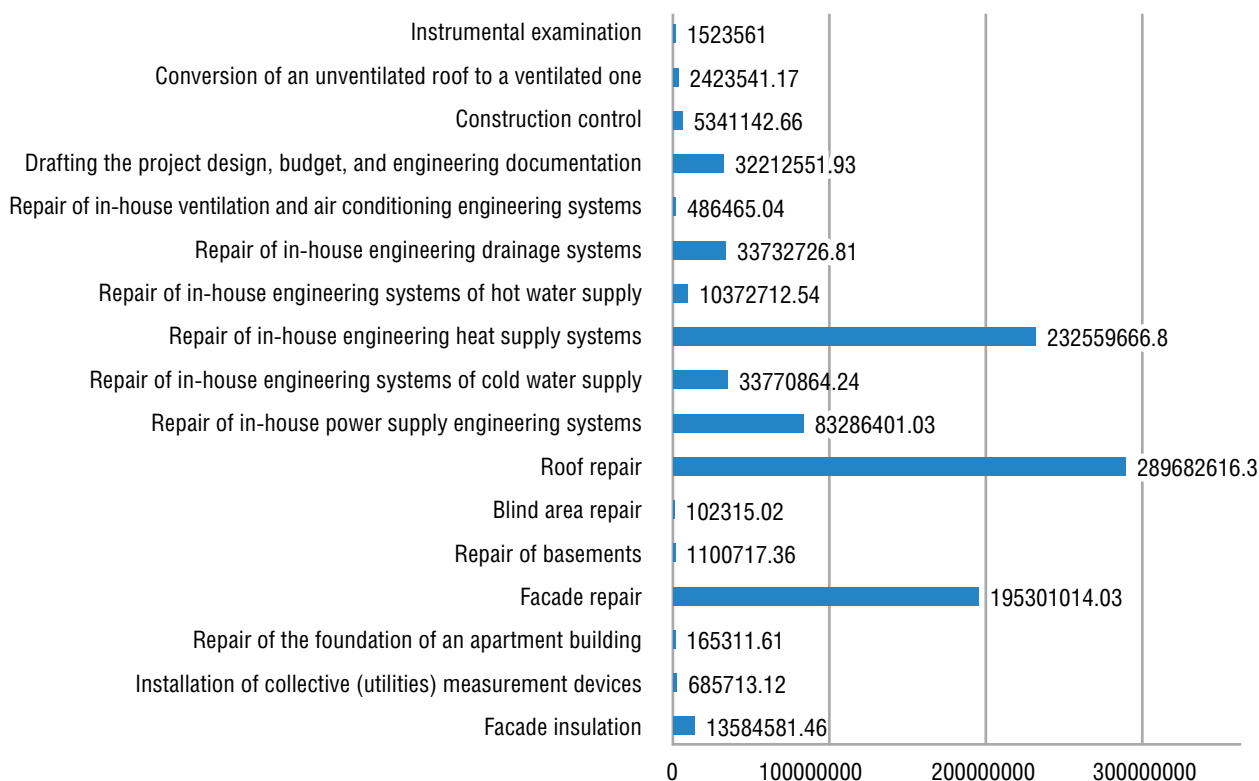
funds are being spent, but the condition of the housing stock becomes worse even faster [15].

The purpose of the Programme is reorganization, renewal and modernization of residential urban areas to make them safer and more comfortable. Towards this end, the main component is the reorganization of areas, redevelopment of blocks and, most importantly, decision making on the preservation, repair or reconstruction of existing residential and public buildings. It is possible to develop engineering solutions on the demolition of objects, the use of which is no longer feasible or simply dangerous due to their technical condition [16]. The construction of new buildings is impossible without the preparation of new sites and the demolition of old buildings. These problems are extremely difficult to resolve without preliminary in-depth instrumental surveys of a large number of buildings and structures.

CONCLUSIONS

Given the experience accumulated in the construction and operation of real estate facilities, particularly, residential buildings, one should realize that the success and economic efficiency of building management, to a significant extent, depends on the accuracy and completeness of information about the technical condition of each construction facility. Such information can only be obtained on the basis of the results of instrumental control performed using modern instruments and equipment operated by qualified specialists. The cost of such a survey is disproportionately smaller than the annual cost of inefficient repairs. The development of capital repair plans based on the data about the condition of facilities allows preventing any pre-emergency situations and performing timely

Capital repair costs by the type of work (in rubles)



Costs broken down by the types of repair and construction works within the framework of the capital repair of the housing stock of Voronezh in 2019–2020 according to Rosstat

structural reinforcements, and adequately distributing the amount of funding among the facilities.

The implementation of the Programme requires the engineering information to be prepared at the stage of development of master plans in the process of designing the urban infrastructure.

REFERENCES

- Grabovy K.P., Levanov S.V. *Characteristic approaches to the implementation of construction and technical research in relation to construction, reconstruction, modernization, technical reequipment and overhaul in modern conditions. Real estate: economics, management. 2019; 2:84-91. URL: <https://elibrary.ru/item.asp?id=4118721> (rus.).*
- Grabovy K.P., Narezhnaya T.K. *Modern organizational forms of residential real estate and conditions of their use. Real estate: economics, management. 2017; 1:71-75. URL: <https://www.elibrary.ru/item.asp?id=29993258> (rus.).*
- Strazhnikov A.M. *Quality monitoring of the technical condition of the housing stock. Moscow, Stroyizdat Publ., 2002; 338. (rus.).*
- Akristinii V.A., Butyrin A.Yu., Stativa E.B., Vekk M., Grabovy P.G., Kapustkina A.V. *etc. Surveying: organization, expertise, management: textbook in three parts. Part II. Examination of the investment project. Risk Management. 2nd ed., rev. and exp. Moscow, 2021; 442. (rus.).*
- Grabovy P.G., Lukmanova I.G., Chernyshev L.N., Trukhina N.I., Ivanova N.V., Filimonov S.L. *Planning and controlling in the housing sector: textbook for universities. Voronezh, 2009; 505. (rus.).*
- Trukhina N.I. *Scientific aspects of real estate management in the housing sector: monograph. Voronezh, 2006; 359. (rus.).*
- Trukhina N.I., Pogrebennaya E.A. *Organizational and economic mechanism of planning and control in the management of residential real estate: monograph. Rostov-on-Don, 2010; 165. (rus.).*
- Grabovy P.G., Manukhina L.A., Budanov I.V. *Features of project financing of investment and construction projects of housing real estate: problems, risks, forecast. Real estate: economics, management. 2019; 4:6-12. URL: <https://www.elibrary.ru/item.asp?id=29993258> (rus.).*
- Kirillova A.N., Yakubov H.G. *Reproductive renovation of real estate: minimization of impact on the surrounding urban environment. Real estate: economics, management. 2018; 1:52-55. (rus.).*
- Trukhin Yu.G., Trukhina N.I., Vyazov G.B. *Improvement of an integrated security system designated for the construction and operation of large scale construction facilities. Real estate: economics, management. 2020; 4:6-12. URL: <https://www.elibrary.ru/item.asp?id=44803571> (rus.).*
- Trukhina N.I., Pogrebennaya E.A. *Planning and control in the management of housing organizations. Labor and social relations. 2010; 21(3):57-61. (rus.).*
- Trukhina N.I., Chernyshikhina I.I. *Risk-based management of an investment project that contemplates reproduction of real estate. Vestnik MGSU [Proceedings of Moscow State University of Civil Engineering]. 2012; 9:227-233. DOI: 10.22227/1997-0935.2012.9.227-233 (rus.).*
- Trukhina N.I., Barinov V.N. *Strategic planning of the activities of housing sector organizations in modern conditions. FES: Financial. Economy. 2012; 2:42-46. (rus.).*
- Okolelova E., Shibaeva M., Trukhina N. *Model of investment appraisal of high-rise construction with account of cost of land resources. E3S Web of Conferences. 2018; 33:03014. DOI: 10.1051/e3sconf/20183303014*
- Grabovy P.G., Trukhin Yu.G., Trukhina N.I. *Monitoring the stress state of frame structures of buildings and structures under the influence of operational load on construction sites. Real Estate: Economics, Management. 2019; 2:46-52. URL: <https://www.elibrary.ru/item.asp?id=41187212> (rus.).*
- Trukhina N.I., Trukhin Yu.G., Kalabukhov G.A. *Monitoring of engineering status of buildings as the factor of effective management in real estate development strategy. Real estate: economics, management. 2015; 4:60-64. URL: <https://www.elibrary.ru/item.asp?id=25668456> (rus.).*

Планирование капитальных ремонтов муниципальных объектов недвижимости при формировании программ комплексного развития территорий

Реальное техническое состояние здания или сооружения можно оценить только на основании выполненного инструментального обследования объекта. Планы выполнения капитальных ремонтов составляются в основном без инструментального контроля несущих конструкций, без обследования фундаментов и гидрогеологических изысканий грунтовых оснований, влияние которых на работу фундаментов в городских зонах строительства резко увеличилось. Плотная городская застройка способствует началу процессов деформаций и разрушения существующих и, в большей степени, возрастных зданий. Поэтому контролировать состояние конструкций целесообразно с интервалом не более 5–8 лет, а не 10 лет (по нормам). Планирование ремонтов по данным о состоянии конструкций, а не по «износу», обеспечивает принятие более точных инженерных решений при проектировании ремонтных работ, сосредоточив расходы на усилении конструкций, а не на сезонной окраске деформированных стен. Такой подход позволяет значительно сократить непроизводительные финансовые и временные затраты. Экономия финансовых средств за счет предотвращения разрушения конструкций, исключая необходимость их восстановления. Наиболее целесообразно и эффективно такое решение в условиях реализации современных подходов при выполнении Программ Комплексного развития территорий (КРТ).

Ключевые слова: капитальный ремонт, техническое состояние, конструкции, инструментальное обследование, гидрогеология грунтов, экономия финансов, управление недвижимостью, государственные структуры технического контроля, комплексное развитие территорий

СПИСОК ИСТОЧНИКОВ

- Грабовый К.П., Леванов С.В. *Характерные подходы по осуществлению строительного-технического исследования в отношении объектов строительства, реконструкции, модернизации, технического перевооружения и капитального ремонта в современных условиях // Недвижимость: экономика, управление. 2019. № 2. С. 84–91. URL: <https://elibrary.ru/item.asp?id=41187219>*
- Грабовый К.П., Нарежная Т.К. *Современные организационные формы жилищной недвижимости и условия их использования // Недвижимость: экономика, управление. 2017. № 1. С. 71–75. URL: <https://www.elibrary.ru/item.asp?id=29993258>*
- Стражников А.М. *Мониторинг качества технического состояния жилого фонда. М.: Стройиздат, 2002. 338 с.*
- Акрстиний В.А., Бутырин А.Ю., Статива Е.Б., Векк М., Грабовый П.Г., Доан З.Х. и др. *Сервейинг: организация, экспертиза, управление: учебник в 3-х ч. Ч. II. Экспертиза инвестиционного проекта. Управление рисками. 2-е изд., перераб. и доп. М., 2021. 442 с.*
- Грабовый П.Г., Лукманова И.Г., Чернышев Л.Н., Трухина Н.И., Иванова Н.В., Филимонов С.Л. *Планирование и контроллинг в жилищной сфере: учебник для вузов. Воронеж, 2009. 505 с.*
- Трухина Н.И. *Научные аспекты управления объектами недвижимости в жилищной сфере: монография. Воронеж, 2006. 359 с.*
- Трухина Н.И., Погребенная Е.А. *Организационно-экономический механизм планирования и контроля в управлении жилищной недвижимостью: монография. Ростов н/Д, 2010. 165 с.*
- Грабовый П.Г., Манухина Л.А., Буданов И.В. *Особенности проектного финансирования инвестиционно-строительных проектов жилищной недвижимости: проблемы, риски, прогноз // Недвижимость: экономика, управление. 2019. № 4. С. 6–12. URL: <https://www.elibrary.ru/item.asp?id=29993258>*

9. Кириллова А.Н., Якубов Х.Г. Воспроизводственное обновление объектов недвижимости: минимизация воздействия на окружающую городскую среду // *Недвижимость: экономика, управление*. 2018. № 1. С. 52–55. URL: <https://elibrary.ru/item.asp?id=34993183>

10. Трухин Ю.Г., Трухина Н.И., Вязов Г.Б. Совершенствование единой системы безопасности строительства и эксплуатации объектов массовой застройки // *Недвижимость: экономика, управление*. 2020. № 4. С. 6–12. URL: <https://www.elibrary.ru/item.asp?id=44803571>

11. Трухина Н.И., Погребенная Е.А. Планирование и контроль в управлении организаций жилищной сферы // *Труд и социальные отношения*. 2010. Т. 21. № 3. С. 57–61.

12. Трухина Н.И., Чернышихина И.И. Управление инвестиционным проектом воспроизводства недвижимости с учетом рисков // *Вестник МГСУ*. 2012. № 9. С. 227–233. DOI: 10.22227/1997-0935.2012.9.227-233

13. Трухина Н.И., Баринов В.Н. Стратегическое планирование деятельности организаций жилищной сферы в современных условиях // *ФЗС: Финансы. Экономика*. 2012. № 2. С. 42–46.

14. Okolelova E., Shibaeva M., Trukhina N. Model of investment appraisal of high-rise construction with account of cost of land resources // *E3S Web of Conferences*. 2018. Vol. 33. P. 03014. DOI: 10.1051/e3sconf/20183303014

15. Грабовый П.Г., Трухин Ю.Г., Трухина Н.И. Мониторинг напряженного состояния каркасных конструкций зданий и сооружений под воздействием эксплуатационной нагрузки на строительных объектах // *Недвижимость: экономика, управление*. 2019. № 2. С. 46–52. URL: <https://www.elibrary.ru/item.asp?id=41187212>

16. Трухина Н.И., Трухин Ю.Г., Калабухов Г.А. Мониторинг технического состояния зданий — фактор эффективного управления в стратегии девелопмента недвижимости // *Недвижимость: экономика, управление*. 2015. № 4. С. 60–64. URL: <https://www.elibrary.ru/item.asp?id=25668456>

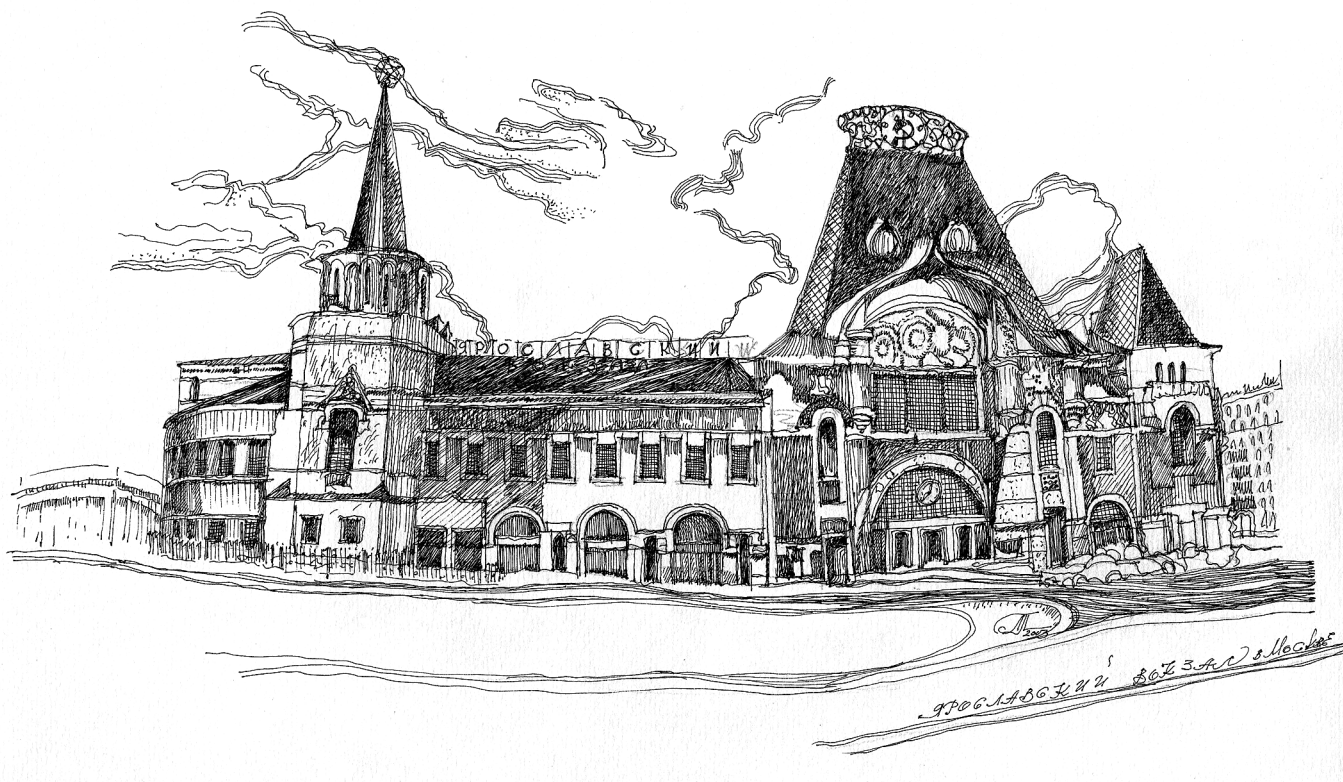
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