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THE ORGANIZATION OF PRODUCTION RECONSTRUCTION OF BUILDINGS THE HISTORICAL BUILDING OF CITIES: «CSTC T-PPR»

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INTRODUCTION

The historic center of Odessa has undergone significant social, economic and urban changes over its more than 220 years of existence, but has retained a unique planning structure with world-renowned architectural ensembles and cultural heritage sites of local and national importance. The planning structure within the historic center has not changed in the twentieth century and is of high value as a whole.

On the territory of the city of Odessa there are 1354 monuments and objects of cultural heritage (including 42 monuments of national importance), of which 1012 objects are located in the Central historical area of Odessa, (including 977 buildings -monuments of architecture and urban planning, history of national and local significance).

Many of the buildings of the historic center are unique monuments of urban planning and architecture of national and local importance, many of which are a kind of business card of the city. Preservation of valuable authentic historical buildings, especially in the heart of the historic center of Odessa, where a large number of monuments and cultural heritage sites of a wide stylistic range, plays an important role in increasing investment and tourist attractiveness of Odessa and has a great impact on further development.

One of the most pressing problems today is the lack of an integrated approach to the restoration, reconstruction or overhaul of buildings and facilities in the historic area of the city.

Further measures to preserve historic buildings, continue repair and restoration work and overhaul facades, roofs of buildings, most of which are monuments, can normalize the problem of deterioration with each passing year, the technical condition of many historical, including famous objects of historical heritage of Odessa. A comprehensive approach to solving the problem is combined with one goal – bringing the central part of the city for a comfortable stay, improving the aesthetic visual perception of the beauty of our city, attracting more tourists.

Relevance of the issue. In Odessa, the reconstruction of the historic buildings of the city are engaged in various construction contractors (constantly changing), which perform work at a low scientific and technical level, without a common vision of the specific problem of reconstruction of the historic buildings of the city.

Statement of the problem in general. Various complexes act as one of the promising forms of integration in the urban structure. In the process of forming plans for social and economic development of large cities is increasingly a situation where to increase the efficiency of financial, material and labor resources requires not only concentration of efforts, but also new progressive forms of construction – corporate, scientific, technical, energy efficient.

Highlighting previously unresolved parts of the overall problem. In urban planning there is a tendency to integration, both in the field of material production and in the field of management. Extended reproduction requires a further increase in the division of labor, concentration and specialization of construction production, intensification of the exchange of results of production and economic activities.

The aim of the study. To propose an innovative organizational structure that uses in practice the accumulated scientific and technical potential for the reconstruction of historic buildings in Odessa on energy efficiency standards with foreign experience and explore the procedure for measuring the quality of management, as modeling: M-CW; M-CUR; M-CDF.

Subject of research. Calendar planning and management of «CSTC T-PPR» and formation of flows by methods: M-CW; M-CUR; M-CDF.

Object of research. Corporate scientific and technical complex of urban energy reconstruction «CSTC T-PPR».

1. Corporate scientific and technical complex of town-planning energy reconstruction «CSTC T-PPR»: general provisions

Trends in the economy of modern information society are such that the driving force of innovative development of society is science[1]. Competitive potential is very important for high-tech, science-intensive, technically complex goods and services, because an enterprise that cannot create competitive goods and services in the future may go bankrupt. Today it may have a competitive product on the market, but it is the fruit of past

[1] Буй Д., Білощицький А, Гогунський В. Scopus та інші наукометричні бази: прості питання та нечіткі відповіді. *Вища школа*. 2014. № 4. Київ: Знання. С. 27–40.

achievements[2]. The concept of «urban heritage» covers both individual houses and large neighborhoods, areas of historic centers and the city as a whole. «The city is an integral of human activity, materialized in architecture...». Such a multifaceted definition of a complex urban organism was given by the architect A.K. Byrov[3]. The new city is an instant phenomenon. Once established, it becomes a historical category in the process of its development and is the object of consideration.

The value of historical architectural and urban heritage is determined by the following provisions[4]:

– architectural and urban achievements of past epochs are one of the most important components of historical and cultural heritage;

– monuments of history and culture, historical architectural and spatial environment enriches the appearance of modern cities;

– the presence of formed ensembles evokes a desire for harmony with the surrounding context.

In accordance with the changing socio-economic conditions of life in the urban body, old tissues naturally die and new ones are born, so urban renewal takes place consistently, by replacing obsolete material resources and gradually transforming the planning structure as a whole or its individual elements. *The purpose of reconstruction and restoration of architectural and urban heritage is to preserve the compositional and aesthetic features of the historic urban environment. Urban reconstruction* is a purposeful activity to change the previously formed structure, which is due to the needs of development and improvement. The concept of urban reconstruction has two meanings. On the one hand, it reflects the process of development of settlements, the improvement of their spatial organization, which has a long time. On the other hand, it is a material result, the state of construction at the moment. Only by understanding these aspects of reconstruction in their relationship, you can properly approach the assessment of tasks and establish methods of urban reconstruction. Reconstruction is a continuous process that takes place in each city differently depending on previous growth and current requirements. This defines the importance of the city as a historical phenomenon in which

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[2] Чернов С. К., Кошкин К. В. Концептуальные основы развития наукоемких предприятий в конкурентной среде. *Восточно-Европейский журнал передовых технологий*. 2010. № 1/2(43). Харьков : Тех. центр. С. 20–22.

[3] Пруцын О.И, Рымашевский Б., Борусевич В. Архитектурно-историческая среда: научное изд. М. : Стройиздат, 1990. 408 с.

[4] Пруцын О.И, Рымашевский Б., Борусевич В. Архитектурно-историческая среда: научное изд. М. : Стройиздат, 1990. 408 с.

different epochs are intertwined. And in the modern urban organism its components are constantly changing[5].

The theoretical basis of the study on organizational and economic principles, innovation potential, a systematic approach to management and energy conservation of construction companies were the works of such scientists, in particular S.A. Ushac'kij and A.V. Serdjuk[6], O.O. Pshyk-Kovalska[7], O.M. Gucaljuk[8], V.M. Kirnos, V.F. Zalunin and T.V. Tkach[9], V.O. Kozlovs'kij and I.V. Prichepa[10], N.I. Verkhohliadova, D.L. Levchynskyi and O.Ye. Rossikhina[11], A.V. Strokovich[12], O.I. Kirnos,

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[5] Пруцын О.И, Рымашевский Б., Борусевич В. Архитектурно-историческая среда: научное изд. М: Стройиздат, 1990. 408 с.

Россохін С. О. Оновлення міст і модернізація житлового фонду України: проблеми і перспективи. *Строительство, материаловедение, машиностроение*. 2009. Вып. 50. Днепропетровск: ПГАСА. С. 455–461.

Кравчуновська Т. С. До питання комплексної реконструкції кварталів. *Строительство, материаловедение, машиностроение*. 2009. Вып. 50. Днепропетровск: ПГАСА. С. 271–276.

Gabriel I., Ladener H. Vom Altbau zum Niedrigenergie und Passivhaus. Dresden: Staufen bei Freiburg, 2010. 480 p.

Верхоглядова Н. И., Левчинский Д. Л. Комплексное развитие и планирование реконструкции жилой застройки. *Строительство, материаловедение, машиностроение*. 2009. Вып. 50. Днепр: ПГАСА. С. 90–94.

[6] Ушацький С. А., Сердюк А. В. Організаційно-економічні основи формування та розвитку ринку доступного житла: монографія. Вінниця: ВНТУ, 2011. 176 с.

[7] Пшик-Ковальська О. О. Концептуальні засади правового забезпечення та державної підтримки розвитку будівельних підприємств у напрямку здійснення будівництва соціального житла. *Соціально-економічний та технічний розвиток підприємств: проблеми, рішення, оцінка ефективності* / ред. Савчук. Л. М. Дніпропетровськ: Пороги, 2016. С. 43–51.

[8] Гуцалюк О. М. Організація управління інноваційним розвитком інтегрованих об'єднань підприємств. *Управління інноваційною, інвестиційною та економічною діяльністю інтегрованих об'єднань та підприємств* / ред. Савчук. Л. М. Дніпропетровськ: Пороги, 2016. С. 273–281.

[9] Кирнос В. М., Залунин В. Ф., Ткач Т. В. Организационно-экономическое регулирование при планировании результативности деятельности предприятий строительного комплекса. *Строительство, материаловедение, машиностроение*. 2009. Вып. 50. Днепр: ПГАСА. С. 243–249.

[10] Козловський В. О., Причепа І. В. Управління інноваційним потенціалом промислових підприємств: монограф. Вінниця: ВНТУ, 2013. 184 с.

[11] Верхоглядова Н. І., Левчинський Д. Л., Россіхіна О. Є. Системний підхід до управління конкурентоспроможністю будівельного підприємства. *Строительство, материаловедение, машиностроение*. 2009. Вып. 50. Днепр.: ПГАСА. С. 95–98.

[12] Строкович Г. В. Концепція стратегічного управління якістю функціонування підприємства. *Соціально-економічний та технічний розвиток підприємств: проблеми, рішення, оцінка ефективності*/ред. Савчук. Л. М. Дніпро.: Пороги, 2016. С.110–120.

O.Ju. Shheglova and D.S. Nikitin[13], L.O. Voloshchuk[14], V.V. Dzhedzhula[15].

Labor resources, influencing the objects of labor by means of labor, create construction products, using effective forms of organization of construction production – specialization, cooperation, concentration, combination.

Specialization reflects the level of social division of labor and includes four main forms or directions of development – sectoral, object (subject), technological and detailed.

Cooperation is a form of interaction between the participants in the construction of buildings and structures. Both external and internal cooperation has been developed in construction. In the first direction, production links are established between general contractors and subcontractors, construction companies and construction companies.

Concentration characterizes the increase in capacity of construction companies and industrial enterprises. As a result, the necessary conditions are created for the introduction of new technology, efficient allocation of resources over time and on construction sites. Thus, the development of concentration allows:

– at the stage of preparation of construction production to determine the required capacity of construction organizations (enterprises) through the amount of necessary labor resources and means of labor, as well as to create in advance the normal production and sanitary conditions of workers;

– at the stage of construction to ensure not only the efficient allocation in time of labor resources and means of labor, but also their interaction throughout the construction period, as well as widely use for construction mobile inventory complexes, permanent buildings and structures.

Combination – a special organizational form of association of construction organization and industrial enterprise. With this form of organization in one enterprise is concentrated closed technological cycle of construction production – from the manufacture of parts and transportation to the site to the construction and commissioning of the object

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[13] Кірнос О. І., Щеглова О. Ю., Нікітін Д. С., Ткач Т. В. Організаційно-економічний механізм забезпечення ефективного використання ресурсів будівельного підприємства при реконструкції житла. *Строительство, материаловедение, машиностроение*. 2009. Вып.50. Днепр:ПГАСА. С. 249–254.

[14] Волощук Л.О. Інноваційний розвиток та економічна безпека промислових підприємств: проблеми комплексного управління.: монографія Одеса, 2015. 396 с.

[15]. Джеджула В.В. Енергозбереження промислових підприємств: методологія формування, механізм управління : монографія. Вінниця: ВНТУ, 2014. 346 с.

The leading sign of the expediency of the application of coordination principles of management is the common economic goals and objectives, which requires production cooperation.

From the standpoint of management methodology, the Corporate Scientific and Technical Complex of Urban Energy Reconstruction (CSTC T-PPR) (developed by Posternak Iryna and Posternak Serhii) is an economic object of a new class, called integration. suggesting:

– high level of coincidence of interests of the main production organizations that are members of CSTC T-PPR while maintaining industry affiliation and its appropriate inclusion in the industry systems of planning, financing, logistics and management;

– the relationship of economic activity, which determines their dependence in achieving both their own and industry goals that form this complex;

– territorially conditioned socio-economic unity, which is impossible without the implementation of a coordinated economic policy, free from conjunctural and departmental restrictions.

The same general features indicate that the organization of the management of CSTC T-PPR can not only adapt the existing economic mechanism, it is necessary to find new forms and methods. In fact, the main problem today is to ensure coordination in the activities of government agencies related to different levels and levels of the construction industry. It is often suggested that they be combined under one roof. But such structures are too cumbersome, difficult to manage, and not always implemented in practice, especially in construction. It is necessary to organize the participants of CSTC T-PPR in such a way that they, achieving their own goals, would achieve common results – say, with partners in the construction of certain construction sites or with associates who, although not directly involved in the work, but provide them. There is such a mechanism – it is *coordination*. The integrity of the CSTC T-PPR is provided not so much by the spatial organization as by the end result – the product of the reconstruction production created by the builders. Now that the emphasis is on economic levers, the lessons of contempt for coordinating management in relation to primary economic centers need to be taken into account.

At the legislative level in Odessa in recent years have acted and operate: Programs to support investment activities in the city of Odessa for

2016...2021[16], the adoption of which is due to the need to create conditions for intensifying investment activities aimed at improving the business environment business and economic activity, improvement of the general macroeconomic indicators, as a consequence of maintenance of constant social and economic development of the city of Odessa; and Comprehensive Programs for construction and development of social and engineering infrastructure of the city of Odessa for 2017...2023[17], aimed at solving such major problems of the urban sphere of the city of Odessa, as the development of housing, as well as the restoration of the technical condition of social facilities and engineering and transport infrastructure.

In order to successfully develop the CSTC T-PPR, it is necessary to take into account changes in the system of urban management and radical changes in the economy. This is especially true of the problem of accelerating the technical recovery of construction materials.

Reconstruction of historic buildings is of great socio-economic importance. Its main tasks are not only to extend the life of buildings, but also to eliminate physical and moral wear and tear, improve living conditions, equip residential buildings with modern engineering equipment, improve performance and architectural expressiveness. In Odessa, in the context of international integration into the standards of energy efficient buildings, the City Comprehensive Energy Efficiency Program in Odessa for 2017...2021[18].

Analysis of the urban environment of the historic city center in its current state shows a high degree of preservation of historic living

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[16] Програма підтримки інвестиційної діяльності на території міста Одеси на 2016-2018 рр.: рішення Одеської міської ради № 438-VII від 16.03.2016 р. *Офіційний сайт міста Одеса*. URL: http://omr.gov.ua/ru/acts/council/81386/ (дата звернення: 10.02.2022).

Міська цільова програма підтримки інвестиційної діяльності на території міста Одеси на 2019-2021 роки: рішення Одеської міської ради № 4206-VII від 30.01.2019 р. *Офіційний сайт міста Одеса*. URL: https://omr.gov.ua/ru/acts/council/114620/ (дата звернення: 10.02.2022).

[17] Комплексна Програма будівництва і розвитку соціальної та інженерної інфраструктури міста Одеси на 2017-2019 роки: рішення Одеської міської ради № 1338-VII від 07.12.2016р. *Офіційний сайт міста Одеса*. URL: https://omr.gov.ua/ru/acts/council/91100/ (дата звернення: 10.02.2022).

Комплексна програма будівництва і розвитку соціальної та інженерної інфраструктури міста Одеси на 2020-2023 роки: рішення Одеської міської ради № 5644-VII від 06.02.2020 р. *Офіційний сайт міста Одеса*. URL: https://omr.gov.ua/ru/acts/council/178168/ (дата звернення: 10.02.2022).

[18] Міська комплексна програма енергоефективності у м. Одесі на 2017-2021 роки: рішення Одеської міської ради № 2449-VII від 04.10.2017 р. *Офіційний сайт міста Одеса*. URL: https://omr.gov.ua/ru/acts/council/100018/ (дата звернення: 10.02.2022).

environment, good preservation of urban dominants, architectural accents, public buildings. However, the long-term operation of municipal infrastructure and the lack of an integrated approach to its maintenance over the past decades have led to unsatisfactory condition of buildings, facilities and elements located in the central part of the city, which in turn led to loss of integrity of perception cities. The cultural heritage of the city of Odessa is an integral part of the cultural heritage of Ukraine and the world. Prerequisite for solving problems of preservation and protection of cultural heritage, as well as the development of the historic area of the city is the implementation of local programs in recent years: Programs for preservation and development of the historic center of Odessa for 2013...2021[19].

Builders and architects face a difficult task, because the reconstruction and adaptation of such facilities to the new functions must be carried out taking into account all requirements and standards for architectural heritage protection and be comprehensive, taking into account the prospects of the city, quarter and facility. When carrying out reconstruction, it is extremely important to preserve the aesthetic and architectural qualities of historic buildings, especially their facades. Therefore, much attention should be paid to the reconstruction of fencing structures.

For all enclosing structures of the building as a whole, first of all, it is necessary to develop a concept of thermal insulation and make a comprehensive list of measures. It will help to make the decision on calculation of parameters of thermal insulation, the choice of the sizes and carrying out separate actions for thermal insulation. There are different thermal insulation options for each structural element, and our task is to choose the most practical one. When making a decision, the assessment is based on the following criteria:

[19] Міська цільова програма включення центральної історичної частини забудови Одеси до основного списку Всесвітньої спадщини ЮНЕСКО на 2013-2015 роки: рішення Одеської міської ради № 3313-VI від 16.04.2013 р. *Офіційний сайт міста Одеса*. URL: http://omr.gov.ua/acts/council/49938/ (дата звернення: 10.02.2022).

Міська цільова програма «Номінування історичного надбання Одеси до Списку всесвітньої спадщини ЮНЕСКО» на 2016-2018 роки: рішення Одеської міської ради № 776-VII від 30.06.2016р. *Офіційний сайт міста Одеса*. URL: https://omr.gov.ua/ru/acts/council/85829/ (дата звернення: 10.02.2022).

Міська комплексна програма збереження та розвитку історичного центру міста Одеси на 2019-2021 роки: рішення Одеської міської ради № 4199-VII від 30.01.2019 р. *Офіційний сайт міста Одеса*. URL: http://omr.gov.ua/acts/council/49938/ (дата звернення: 10.02.2022).

– energy efficiency and significance within the whole set of reconstruction measures;

– practical feasibility of the existing building and the risks of side effects;

– improvement of thermal characteristics, increase of comfort and improvement of appearance of the building;

– cost and evaluation of the total quality improvement.

Thermal insulation concept for the enclosing structures of the building is important no less than a list of wishes or exceptions when choosing a thermal insulation material. This is important because when using environmentally friendly materials, maximum values can be achieved only at higher design costs, more attention to detail and the overall higher cost of all work.

Before planning energy reconstruction, it is necessary to determine the amount of energy consumption to be sought. In its original form, it is recommended to dwell on an intermediate version somewhere between an improved building and a «passive house». Exact values will be determined in further planning. In principle, you can choose both the maximum insulation thickness and the minimum. The fact is that in parallel with thermal insulation measures, other measures are planned to reduce energy consumption, including hot water supply, household appliances and equipment and other needs. The fundamental question that needs to be answered is: what are the costs of implementing a measure, and what energy savings will it achieve?

Not all buildings of historic buildings can achieve optimal insulation, keeping within adequate costs. For example, restrictions may be imposed by existing design or, say, legislation on the protection of architectural heritage. These limitations can be offset by the use of an improved heating system, which will significantly reduce primary energy consumption. It is very important at the earliest stages of planning to consider all available energy-saving technologies and compare them with their cost, resulting in savings and reduction of CO_2 emissions. This often requires a non-standard and even creative approach.

Development and implementation of new and improvement of existing technologies in capital construction is determined by the need to reduce material and labor costs for their implementation, as well as the need to reduce the investment cycle of construction of buildings and structures.

The housing stock of the city of Odessa is quite diverse. This diversity is due to changes over time in such characteristics and parameters as purpose, architectural and planning decision, configuration in the plan, the

availability of utilities, number of floors, location of the building on the site and more. All these features have undergone significant changes over time due to the development of capacities and capabilities of the construction base, functional requirements, construction traditions and trends.

The economic criterion for the preservation and modernization of the existing building is to compare the construction of old buildings with new ones that have similar urban, technical and architectural-planning characteristics (location, degree of improvement, capital, number of store's, etc.). Therefore, for the economic evaluation of each old building, it is necessary to take into account the general regime of reconstruction in the area, ie the density and reliability of the building, its functional and historical and cultural value. Schreiber K. A. provides a block diagram for determining the manufacturability of options for repair or replacement of floors in the reconstruction of residential buildings[20]. It is also possible to raise the question of the feasibility of reconstruction of the site in determining the physical and moral wear and tear with the previously established urban value, it is proposed to apply it not only to individual structures but to the building as a whole.

In addition, as an economic criterion in determining the general regime of reconstruction, the efficiency of land use is taken into account. An indicator of economic feasibility is the comparison of the cost of $1m^2$ of living (useful) space for residential buildings, or the cost of $1m^2$ of working space – for public buildings, new and renovated.

The value of the historical environment and territory in the central part of Odessa imposes a number of restrictions on the location, size, configuration, architectural design of the house, technology of works, which leads to 1.5 to 2 times more expensive new construction and, accordingly, increases economic expediency of preservation and modernization of old houses.

But in many countries, reconstruction work is considered inexpedient if the cost of carrying it out exceeds 70...80% of the cost of a new building, and this does not apply to buildings that are historical or architectural monuments. Standards of marginal costs (% of the cost of $1m^2$ of total construction area in the same region of a similar building) are: for reconstruction – 80%; for major repairs with modernization (with improved planning without changing the number and size of premises, for example, with the installation of missing types of engineering equipment, including

[20] Шрейбер К.А. Вариантное проектирование при реконструкции жилых зданий. Москва : Стройиздат, 1990. 287с.

external networks, except for main and landscaping) – 55%; for major repairs without modernization – 35%. These standards of marginal cost set the upper limit of the value at the amount of physical wear F_{phw} <40%, at F_{phw}> 40% is entered K=1.25.

The final technical and economic analysis is based on estimate documentation and comparison with analogous projects of reconstruction and new construction. In practice, calculations to assess the feasibility of reconstruction are performed very rarely, their implementation is rational for facilities that require high costs. If there are several options for reconstruction, then the economic analysis will help to choose a rational option.

Therefore, *it is proposed to create in the city of Odessa «Corporate scientific and technical complex of urban energy reconstruction «CSTC T-PPR» as an innovative organizational structure that uses in practice the accumulated scientific and technical potential for reconstruction of historic buildings in Odessa on energy efficiency standards with foreign experience. The criterion for the preservation and modernization of the existing building is to compare the construction of old buildings with new ones that have similar urban, technical and architectural and planning characteristics. As an economic criterion in determining the general regime of reconstruction, the efficiency of land use is taken into account. The final technical and economic analysis is based on estimate documentation and comparison with analogous reconstruction projects.*

2. Estimation of quality of processes of management of a course of performance of works of a complex of town-planning power reconstruction

Economic assessment of the progress of work is the basis for the assessment of construction management. Management expertise is defined as the study of the quality of the management process and the issuance of a reasoned opinion on it, which is used to further influence both the object of management and (or) the subject of management. *The main purpose of management expertise* is an assessment of the quality of the management system as a whole, the whole set of elements, namely: the subject and object of management, associated with the circulating information flows between them. *The pragmatic purpose of managerial expertise* is to improve the efficiency and quality of real estate management at all stages of their life cycle. The conclusion on the quality of the management process should either confirm the trust in the subject of management (accredit it), or

express distrust in it (not accredit). So, *subject of managerial examination* there is an analysis of quality management.

The defining argument of any process in general and management, in particular, is time. It follows that the study of any process means the dynamic recording of its essential characteristics over time. The set of dynamic characteristics of the control object is conditionally defined as *management trajectory*.

Planning trajectory of management is based on the actual determination of the initial state of the object of management and the projected forecast of its state in the future. In the general case, under the influence of unaccounted for environmental influences, there will be a discrepancy between the planning status of the control object and its actual characteristics, or, in other words, *divergence*. The magnitude of the discrepancy between the actual situation and the planned is, on the one hand, the basis for the conclusion on the quality of management, and on the other hand – the basis for making the appropriate management decision. A systematic approach is important for managerial expertise, which focuses on a comprehensive assessment of all the essential characteristics of the object of management.

The tasks facing management expertise follow from the analysis of general management functions. Regulatory influences due to such common functions as planning, organization and regulation are transmitted directly from the subject to the object of management. Feedback (control function) transmits information about the status of the control object.

The description of the real development of the construction project is an informationally complex process, because it depends on a large number of characteristics that affect it. Therefore, *at the planning stage, a modeling methodology is used*, which predicts a change in not all, but only part of the characteristics of the process. Any model cannot be completely identical to the original, especially since in this situation the original may occur only in the future. Moreover, the considered control models are homomorphic, because the unambiguousness of their reflection in contrast to isomorphic models acts only in one direction. It follows that the model of the management process can more or less unambiguously determine the future properties of the original, but regression (return or projection) properties of the original on the initial characteristics may have multiple interpretations. However, despite the fundamental convergence of models of management processes, they (although often qualitative) allow you to systematically describe the objects of management and on this basis to plan management decisions.

Thus, *through the modeling methodology, the subject of management performs general management functions*. Thus, the main tasks of management expertise are the tasks of model analysis:

– construction planning as a management process;

– organization of its resource provision;

– control over the implementation of the process;

– regulation as a process of direct impact on the object of management.

As a rule, modeling of management processes allows their certain variety. However, in practical terms, one of the possible models is used for a specific situation, which must meet the following most important requirements:

– maximizing the adequacy (compliance) of the original;

– adaptation (adaptation) to changing conditions, ie its reliability over time;

– efficiency both in achieving the goal and in the costs associated with its use.

Any general process of real estate management of a historic building consists of managing individual interdependent processes: organizational, labor, information and others. A common way to display them dynamically is a *calendar plan*, for the formation of which computer project management programs are used. To implement the control function, data sets on the actual execution of works are intended. On the basis of control of an actual condition of performance of works are formed *regulatory influences*, contained in the corresponding reformulation of the calendar plan (the law of unity of analysis and synthesis). Thus, *in addition to the fact that the calendar reflects the dynamics of the work, it is itself a structure that is being rebuilt dynamically*. This allows with a certain frequency (day, decade, month), ie cyclically, to repeat the general functions of management in a comprehensive management process. *The sequence of actions within each control cycle is as follows*:

a) at time t, taking into account the initial conditions, the current calendar plan is formed;

b) to create a basis for comparison with subsequent possible changes in the current plan, its initial state is recorded as a reference;

c) at the time $t+\Delta t$ the account of actually executed works is carried out, ie the function of control on in advance defined points of the project (a method of control on milestones) is realized;

d) comparison of the reference state of the performed works with their forecasted state gives a basis for the decision on adjustment of the calendar plan for the future period;

e) then the control cycle is repeated in the range $t+\Delta t \ldots t+2\Delta t$ until the end of the entire control process.

The complete completion of the management process is characterized in the calendar plan by fixing the actual execution of all works, both in terms of execution and cost. Naturally, the initial calendar plan and its actual implementation will be different, and the assessment of this difference by one criterion or another will be an assessment of management as a whole.

We substantiate the criterion for assessing the quality of management, consider the situation shown in Figure 2.1.

According to the original plan, the work should be performed at time T_p and at a cost of *Cp*. In fact, this work was performed at time T_f and at a cost of C_f. The corresponding deviations from the plan are defined as $\Delta T = T_f - T_p$ and $\Delta C = C_f - Cp$. Obviously, the performance of each job for the management process as a whole has a certain value, or, in other words, consumer value. Assume that in the first approximation, the consumer value is determined by its payment or simply the cost.

In order to bring different values to one point in time, a discounting method is used, for which the most common option is pre-project discounting. Thus, the considered evaluation scheme assumes that the assessment of management quality should be determined by the calculation of net discounted investments, which indirectly determine the current consumer value of the project, and the higher it is, the more effective the management process.

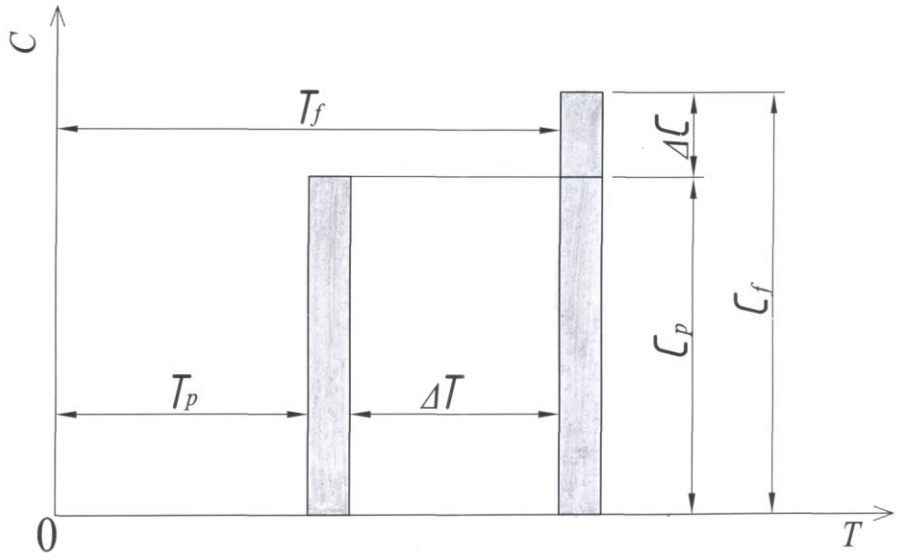

Fig. 2.1. The main characteristics of the work: p – plan; f – fact*

**Compiled to substantiate the criterion for assessing the quality of management.*

Planned net discounted NPI_p investments are as follows:

$$NPI_{p,i} = \sum_i C_{p,i} \left(1+E\right)^{-T_p}, \tag{2.1}$$

where i – is the ordinal index of the work performed;

E – discount rate, which previously assessed the economic efficiency of the project.

The actual net discounted NPI_f investments are:

$$NPI_{f,i} = \sum_i C_{p,i} \left(1+E\right)^{-T_p-\Delta T} - \sum_i \Delta C \left(1+E\right)^{-T_p-\Delta T} \tag{2.2}$$

When performing certain works, their cost may exceed the planned cost. It is obvious that this circumstance reduces the corresponding consumer value, and therefore the second member of this calculation formula is included with a negative sign. If the actual cost of wages was lower than planned, it means that there is additional cash flow, which increases the current consumer value.

The relative efficiency of *IQM* management is generally determined by the ratio of actual to planned net discounted investments:

$$IQM = \frac{NPI_f}{NPI_p} \tag{2.3}$$

The value of the management index fluctuates around one, and its increase indicates greater management efficiency.

Consider the modeling of the function of calendar planning and management, which includes the calculation of the quality index of management on the example of a conditional calendar schedule, presented in Figure 2.2 entitled «Reconstruction of the quarter of historic buildings in Odessa».

Despite the fact that the calendar plan is a dynamically developing system, its two events are defined as invariants of this system – it is the general beginning of the basic plan and its general end. Usually in calendar planning the general beginning of the basic plan is set by directive, and the general end of the basic plan is determined by summing up the general beginning and normative-directive duration of reconstruction. As a rule, the actual beginning of the reconstruction coincides with the planned beginning, and the actual end of the reconstruction depends on the actual execution of all its works and in the general case shows deviations from the goal. Therefore, optimal management should be designed to minimize this deviation. In project management systems, it is accepted that works that have no duration and are only the result of an event are called milestones. Accordingly, in Figure 2.2 the basic beginning and end of construction, which are reflected by the corresponding milestones, are marked by triangles.

Between the beginning and the end of the reconstruction it is planned to perform the following works (table 2.1).

Table 2.1

List and duration of types of work to the calendar plan*

№	List of works	Duration, days
1	The general beginning of the basic plan	01.08.2023
2	Obtaining permits and drawing up a design task	60
3	Development of design and technological documentation (DTD)	90
4	General organizational and technological training	30
5	Preparation for the reconstruction of facilities	30
6	Reconstruction (construction and installation works)	235
7	Commissioning of reconstructed facilities	5
8	The general end of the basic plan	30.10.2024

** Compiled for modeling management decisions «CSTC T-PPR».*

According to the presented example, all these works are performed sequentially. When displaying the linear calendar graph «Reconstruction of the quarter of historical buildings of Odessa» (Figure 2.2) the following graphical means of presenting works on a time scale are used: to display the work on the basic (reference) calendar plan uses the lower shaded rectangle; the upper unshaded rectangle is used to display the current status of work; black extinguishing of a part of the current state of work is used for display of the executed parts of works.

Consider the actual state of reconstruction on the control date – November 15, 2023. From the reference calendar plan it follows that on this date must be fully completed 1st work (obtaining permits and design tasks) and 50% must be completed 2nd work (DTD development). In fact, on this date, completed 100% of the 1st work (obtaining permits and drawing up a design assignment) and only 40% of the work on the development of design and technological documentation for the reconstruction of the historic quarter of Odessa. Given that 50% of the time spent on 40% of the workload, it is expected that the planned duration of 90 days will increase to 113 days. This will lead to a corresponding shift in all deadlines for subsequent work and delay the overall completion of construction by 23 days. Thus, the implementation of the control function allows not only to record the actual state of performance of any work, but also to form a forecast for its further implementation.

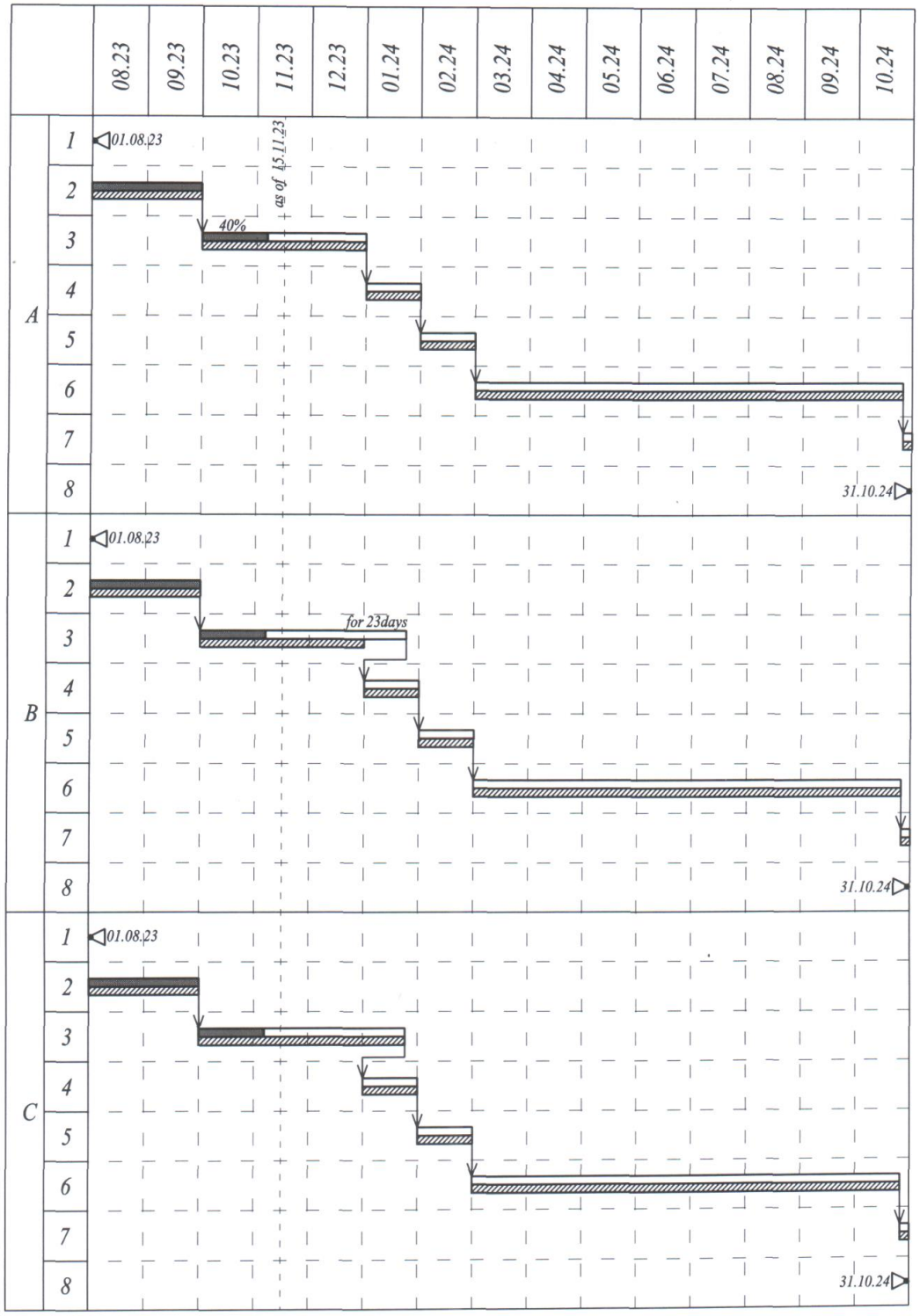

Fig. 2.2. Line calendar schedule «Reconstruction of the quarter historical buildings of Odessa»: A – basic; B – taking into account regulatory management; C – new baseline after the 1st iteration*

**Compiled on the basis of modeling management decisions «CSTC T-PPR».*

Naturally, the delay in the completion of all subsequent works will delay the overall completion of the reconstruction, it should be considered as a negative phenomenon. Therefore, the decision-maker must create such a regulatory impact on the system that would minimize the negative consequences associated with late implementation of design work. Here is one of the possible solutions, which is as follows: increase the development of design and technological documentation to 113 days; introduced in connection with the next work (general organizational and technological training) with a negative time lag of -23 days, which will allow the parallel performance of both works for 23 days; list the calendar plan and get the work schedule shown in Figure 2.2, B.

To implement the proposed regulatory impact, it is necessary to apply the administrative method of management, the essence of which is that the start date of the general organizational and technological training remains the same. The introduced corrective effect allowed to reorganize the achievement of the main goal, and is characterized by the fact that the new calendar plan differs from the original plan (Figure 2.2, C).

Consider how to assess this difference in the previously introduced economic categories. Determine the discount rate. The discount rate on capital invested in future utility is determined by the value of E=30%. The adjusted calendar plan differs from the initial plan in that the final payment for the work performed on the development of design and technological documentation will be made in the 6th month (on the 24th day), and in the weekend – at the end of the 5th month.

If the amount of payment is UAH 200000, its delay will reduce the discounted investment by UAH 1007. Calculated by formulas (2.1)…(2.3) management quality *index IQM* = 0,99.

After completing the adjustment of the current plan, it can be presented as a new base plan (Figure 2.2, C), determine the next date for which the inspection is scheduled, and repeat the whole procedure as described above.

It should be noted that *the described procedure for measuring control quality allows you to dynamically calculate the control quality index from iteration to iteration. Moreover, according to this index, you can determine the degree of responsibility of the performers of specific works.*

The presented model of management quality assessment is adequate because it is based on the modern concept of evaluating the effectiveness of investment projects. This model mainly has the property of adaptability. However, to adjust it to a more complete evaluative effect, it is necessary to take into account the dependence of the discount rate on time. Finally, the model is effective because it allows you to dynamically assess the results of management activities and on this dynamics to form a very detailed forecast of the management process.

3. Formation of flows of the complex of town-planning energy reconstruction

According to the researcher O.S. Semid'janova in his article[21] «the main criteria for reducing the duration of work and as a consequence – reducing labor intensity, is the introduction into the workflow of modern equipment and materials with improved characteristics».

Development and implementation of new and improvement of existing technologies in capital construction is determined by the need to reduce material and labor costs for their implementation, the annual amount of which is estimated at millions of hryvnia direct costs and millions of man-days of labor costs, and the need to reduce investment cycle.

The use of mechanized methods of production of internal finishing works increases the efficiency of construction mixtures, as it allows to organize the performance of works by the flow method and reduce the duration of complex processes of production works. Widespread introduction into the practice of construction of dry construction mixtures has opened up the possibility of mechanization of plaster production with the use of both foreign and domestic equipment.

Due to the use of mechanized technologies in the production of plaster work, the number of specialized teams and the duration of work is halved. This is achieved, firstly, by reducing labor costs at the stage of procurement and transport work, due to a combination of processes of preparation and delivery of the mixture to the workplace, and secondly, by sharply increasing productivity at the stage of major works related to replacement of technological operations of spraying, soil and cover in a single process of applying plaster. Depending on the chosen scheme of mechanization of production of plaster works, productivity of work essentially raises in comparison with a manual way of performance of works.

The method of calendar planning for the organization of construction production is used in the work.

Calendar plan – this is a project document that dynamically (in time) reflects the timing and cost of work. The calendar plan can be presented in various forms (descriptive, matrix, calendar, graphic and others), of which the most obvious is the graphic form. The latter is widely used in the form of a linear calendar graph (Gantt chart) and network schedule (graph).

In terms of content, the calendar system systematically combines technology, organization and economics of construction production.

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[21] 27. Семидьянова О.С. Ожидаемый экономико-технологический эффект от внедрения инновационных технологий в процесс производства внутренних отделочных работ. *Строительство, материаловедение, машиностроение*. 2009. Вып. 50. Днепропетровск: ПГАСА, 2009. С. 503–507.

Calendar plans are the basis for both the organization of construction production and project management. Calendar plans are developed as part of the following projects: business plan of the investment construction project; construction organization project; investment justification project; offers for its submission for contract bidding; project of execution of works; project of annual organization of works of construction organization; technological maps and more.

The calendar plan is also the basis for the formation of the construction financing schedule and the cash flow schedule (*Cash Flow*) related to the assessment of the economic efficiency of the project.

The initial stage of calendar planning associated with the choice of model of organization of work, which best meets the needs of production, specific economic and technical conditions. Depending on the available conditions is determined *organizational and technological scheme,* which is the basis for developing a calendar plan model.

The organizational and technological scheme mainly determines the topological formulation of the problem of calendar planning, as well as the essential conditions, criteria and constraints. Methods and ways of organizing work are determined by the specific conditions of construction, the nature of the connection of works in their technological sequence, in time and space.

Creating an organizational and technological scheme of construction of the object is a complex creative process that requires highly qualified specialists in the field of construction planning.

There are common elements in calendar plans. Consider the main ones:

A) Division of construction space into private fronts of works.

Construction space, which includes either a single object or a group of objects, can be divided into separate private fronts of works depending on the nature of design decisions and the ability to consistently perform work on dedicated private fronts. *Separation of private fronts of works from the general construction space is a necessary condition for the organization of the construction flow, the main feature of which should be considered a combination of different types of work on different parts of the object or complex of objects.* It should be noted that *private front* – is the generalized name of the selected part of the construction space.

B) Division of construction into private workflows.

The division of construction space into private fronts shows where the work is being done. In contrast, the division of construction into private streams determines what work must be done. Cycles of work can be distinguished as the top level of the hierarchy, which reflects the specialization of labor in construction. In turn, work cycles include certain types of work. According to the hierarchy of types of work are construction processes, their result is the release of intermediate or final construction

products. Construction processes can be simple and complex, include simple processes. Then simple processes are divided into work operations, the invariant of which is a fixed composition of performers, tools and implements. Production of work operations is carried out by means of their decomposition into separate working methods.

Thus, there is a clear hierarchy in the organization of labor in construction: *work cycle → type of work → complex process → simple process → work operation → work technique.*

To describe the conditions of the types of work are used *technological maps,* to describe the processes – *maps of labor processes.* In some cases, these descriptions are supplemented *technological norms*, which determine all the essential conditions and methods of control of works and operations necessary for their quality and effective performance.

There may be connections or dependencies between any two works that are part of a certain set of works, more precisely between any two events that determine the facts of the beginning and end of two works of the complex. *Connections* – this is what unites the individual elements in the system, establishes relationships, interdependencies, conditionality and, finally, the commonality of elements in the system. Usually, two main types of connections are taken into account in construction.

Resource connection – it is the relationship between two adjacent works of the same type (performed on adjacent private fronts), which shows that the beginning of further work can be done after the end of previous work. Resource connections can change over time (stretching of resource connections). Thus, they reflect the degree of continuity of work on adjacent private fronts and, ultimately, the degree of continuity of resource use within each private stream.

Front connection – it is a link between two related works of different kinds that are performed on the same private front. The frontal connection shows the dependence of the beginning of the next type of work on the end of the previous type of work within one private front. Frontal ligaments can change over time (stretching of frontal ligaments). Thus, frontal connections reflect the degree of continuity of development of private fronts.

Any set of works can be performed by different methods with different start and end dates, with different nature of resource use and development of private fronts and, accordingly, different in size technical and economic indicators. Basically, the methods of calculating the organization of work are determined taking into account the limitations imposed on the links between the works.

The current method of organization of works is formed by means of spatial division of the general front of works on private fronts of works and parallel performance on them of various types of private streams of works.

Flow methods of work organization can be calculated in different ways, so they are called methods of calculating work organization. Consider three of them that are most used in construction:

A) Method of critical way (M-CW);

B) Method of continuous use of resources (M-CUR);

C) Method of continuous development fronts works (M-CDF).

A) Method of critical way (M-CW).

Before describing the algorithm for calculating the formation of flows by the critical path method, consider the flow organization of works, represented by a matrix of durations and two schedules of interior finishing works, in the reconstruction of historic buildings in Odessa according to energy efficiency standards calculated by the critical path method (Table 3.1).

On four construction sites (buildings of historical buildings of Odessa), defined as private fronts of works, four types of works in rigid technological sequence (A→B→C→D) on each object are carried out: plaster works (index A), priming works (index B), spackling works (index B) and painting works (index D). The order of development of private fronts of works is also fixed by the following sequence: 1→2→3→4.

Each type of work is performed by a permanent staff of performers, who move to the next object only after the completion of work on the previous object. If this set of works was performed by a sequential method, its minimum duration would be equal to the sum of the durations of all included in this set of works:

$$T = 7 + 9 + 6 + 8 + 2 + 3 + 2 + 3 + 13 + 17 + 11 + 15 + 5 + 8 + 4 + 6 = 119 \text{ days}.$$

For the flow organization of work in the performance of any work on any object should meet two prerequisites:

a) the end of this type of resource work on the previous object (*resource readiness of performers*);

b) completion of the previous type of work on this object (*technological readiness of the private front of work*).

In the center of each element of table 3.1 the values of durations of works in days are shown. When forming work schedules, the main task is to calculate the time of work or, in other words, the start and end of work.

Table 3.1

Matrix of duration and two schedules of internal finishing works, at reconstruction of buildings of historical building of Odessa according to the energy efficiency standards calculated by a method of a critical way*

Index and the name of works	Private front of work				Total duration of work
	I	II	III	IV	
A. Plaster works	0 7 **7** 0 7	7 16 9 10 19	16 22 6 31 37	22 30 8 39 47	30=30–0 30=7+9+6+8 47=47–0
B. Priming works	7 9 **2** 7 9	16 19 3 19 22	22 24 2 37 39	30 33 3 47 50	26=33–7 10=2+3+2+3 43=50–7
C. Underpaint putty works	9 22 **13** 9 22	22 39 **17** 22 39	39 50 **11** 39 50	50 65 **15** 50 65	56=65–9 56=13+17+11+15 56=65–9
D. Works on colouring	22 27 5 48 53	39 47 8 53 61	50 54 4 61 65	65 71 **6** 65 71	49=71–22 23=5+8+4+6 23=71–48
Total durations of fronts of works	27=27–0 27 53=53–0	40=47–7 37 51=61–10	38=54–16 23 34=65–31	49=71–22 32 32=71–39	Stretching of communications: resource – 42/50 frontal – 35/51

**Compiled on the basis of statistical modeling*

The algorithm of calculation of a building stream on a method of a critical way includes following stages:

I. Calculation of early terms performance events.

II. Calculation of late terms performance events.

III. Calculation of reserves of time and definition of the critical works defining corresponding critical ways.

I. Calculation of early terms performance events includes consecutive performance of following settlement operations:

I.1. The zero moment of time is accepted to the early beginning of the first by the form and first work first by the form on front (AI).

I.2. The early termination of work is defined by the sum of the early beginning and its duration.

I.3. The early beginning of the subsequent work in case of its dependence on set of previous works is defined by the maximum termination of these (previous) works.

The calculated terms of manufacture works are put down in the top elements of a matrix (at the left – the early beginnings, on the right – the early terminations).

II. Calculation of late terms performance events includes consecutive performance of following settlement operations:

II.1. The early termination of the given work is accepted to later termination of last by the form and last work on front (DIV).

II.2. Later the work beginning is defined by a difference of its late termination and its duration.

II.3. Later the termination of previous work in case of its influence on set of the subsequent works is defined by the minimum beginning from these (subsequent) works.

The calculated terms of manufacture of works are put down in the bottom elements of a matrix (at the left – the late beginnings, on the right – the late terminations).

III. Calculation of reserves of time and definition of the critical works defining corresponding critical ways, includes consecutive performance of following settlement operations.

III.1. Full reserves of time of events (the beginnings and the terminations of works) by means of subtraction from late term of corresponding early term pay off.

III.2. Critical works on the basis of zero value of a full reserve of an operating time are defined.

III.3. Critical ways (can be more than one) are defined, each of which connects critical works in the consecutive chain connecting initial and final events. The sum of works of any critical way is equal to the general duration of performance of all works for the given schedule.

III.4. The method of a critical way also establishes a free reserve of time for any work which is defined as the greatest possible delay of the early termination of the given work, not leading to increase in the early beginnings of all subsequent works.

For the flow calculated by the critical path method and presented in Table 3.1, the last column of the table shows the total durations of the types of work that are components in relation to simple work performed on individual private fronts. The calculated durations show that the increase in duration in relation to the sum of durations of simple works occurs due to stretching (breaks) of resource connections. The last row of Table 3.1 shows similar data for the private fronts of the same name, for which the increase in duration relative to the sum of the durations of simple work is due to stretching (breaks) of the front connections. The last (lower right)

element shows the total stretches of resource and frontal connections in the early stages of events (in the numerator) and in the late stages of events (in the denominator).

The considered method of calculation of a construction stream has positive property of receiving a minimum of the general duration of all complex of performed works. Thus, the most fast-paced work schedule is calculated by the critical path method. However, as a rule, there are breaks, both in the development of individual private fronts of work, and in the use of resources.

B) Method of continuous use of resources (M-CUR).

Before describing the algorithm for calculating the formation of flows by the method of continuous use of resources, consider the flow organization of works, represented by a matrix of durations and schedules of internal finishing works in the reconstruction of historic buildings in Odessa according to energy efficiency standards calculated by continuous use of resources (Table 3.2).

The flow calculated by M-CUR is formed in the same technological sequence of types of work and in the same order of development of work fronts.

For M-CUR, as a limitation, the introduction of continuous performance of each type of work (zero stretching of resource links) is introduced, and as a target function – the maximum possible convergence of related types of work (private flows).

In the center of each element of table 3.2 are the values of the duration of work in days. When forming work schedules, the main task is to calculate the timing of work or the timing of the beginning and end of work.

For the main calculation formulas, a value called the deployment period is introduced, which determines the difference between the beginning of the next work on the private front I and the beginning of the previous work on the same front – T^{w}_{i+1}. It is clear that the first technological work is not preceded by any other work and, therefore, its beginning is considered zero. Thus, having determined the beginning of the first work and the corresponding period of deployment of the second work, you can calculate the beginning of its production on the private front I and so on (by induction) to determine the beginning of the last type of work.

Calculating the beginning of the last work, taking into account the restrictions on the continuity of work, we can determine the total duration of the whole set of works by formula (3.1):

$$T = \sum_{i=1}^{m-1} T_{i+1}^{w} + \sum_{j=1}^{n} t_{m,j}\ , \qquad (3.1)$$

where T^{w}_{i+1} – the period of expansion the subsequent work; m – the general number of kinds works (a current serial index, i); n – the general number of fronts works (a current serial index, j); $t_{m,j}$ – duration of last kind work on j-м front.

Table 3.2

Matrix of duration and schedules of interior finishes works on the reconstruction of buildings of historical buildings of Odessa according to energy efficiency standards calculated by the method continuous use of resources*

Index and the name of works	Private front of work												Total duration of work
	I			II			III			IV			
A. Plaster works	0		7	7		16	16		22	22		30	
		7			9			6			8		30=7+9+6+8
B. Priming works	23		25	25		28	28		30	30		33	$T_B^w = 23$
		2			3			2			3		10=2+3+2+3
C. Underpaint putty works	25		38	38		55	55		66	66		81	$T_C^w = 2$
		13			17			11			15		56=13+17+ +11+15
D. Works on colouring	64		69	69		77	77		81	81		87	$T_D^w = 39$
		5			8			4			6		23=5+8+4+6
Total durations of fronts of works	69=69–0			70=77–7			65=81–16			65=87–22			Stretching frontal ligaments – 150
	27=7+2+13+5			37=9+3+17+8			23=6+2+11+4			32=8+3+15+6			
	42=69–27			33=70–37			42=65–23			33=65–32			

**Compiled on the basis of statistical modeling*

For definition of values the periods of expansion subsequent works we will take advantage of a condition (3.2) at which prior to the beginning of any simple work previous work by the form on the same private front should be executed:

$$T_{i+1}^{w} = \max_{j=1,n} \sum_{k=1}^{j} \left(t_{i,k} - t_{i+1,k-1} \right), \qquad (3.2)$$

where $t_{i+1,0}$ – operation time on zero front is equal to zero.

Let's take advantage the previous formula (3.2) and we will define the periods expansion works B, C and D, shown by following formulas (3.3).

As can be seen from table 3.2, the resulting schedule differs significantly from previous schedules presented in table 3.1.

The considered method of calculation of a construction stream – a method of continuous use of resources (in a matrix form) possesses positive property of effective use of cost of labor and machine resources, at their considerable (determining duration of works) cost. However, there are breaks in the development of individual private fronts.

$$
\begin{aligned}
T_B^w &= \max\begin{Bmatrix} 7-0=7 \\ 7+9-0-2=14 \\ 7+9+6-0-2-3=17 \\ 7+9+6+8-0-2-3-2=23 \end{Bmatrix} = 23; \\
T_C^w &= \max\begin{Bmatrix} 2-0=2 \\ 2+3-0-13=-8 \\ 2+3+2-0-13-17=-23 \\ 2+3+2+3-0-13-17-11=-31 \end{Bmatrix} = 2; \\
T_D^w &= \max\begin{Bmatrix} 13-0=13 \\ 13+17-0-5=25 \\ 13+17+11-0-5-8=28 \\ 13+17+11+15-0-5-8-4=39 \end{Bmatrix} = 39.
\end{aligned}
\qquad (3.3)
$$

C) Method of continuous development fronts works (M-CDF).

The flow, calculated by the method of M-CDF, is formed in the same technological sequence of types of work and the sequence of development of the fronts of work, as previous flows.

For this flow, as a limitation, the introduction of continuous development of each private work front (zero stretching of frontal connections) is introduced, and as a target function – the maximum possible convergence of adjacent work fronts. The matrix of duration and schedule of work flow, calculated by the method of continuous development of work fronts, is presented in table 3.3.

The logic of deriving the basic calculation formulas for this method corresponds to the logic of deriving formulas for the calculation of M-CDF (3.1)...(3.3), the difference is that here the restrictions prohibit the negativity of resource relationships.

Table 3.3

Matrix of duration and schedules of interior finishes works on the reconstruction of buildings of historical buildings of Odessa according to energy efficiency standards calculated by the method continuous development work fronts*

Index and the name of works	Private front of work				Total duration of work
	I	II	III	IV	
A. Plaster works	0 7 7	10 19 9	31 37 6	39 47 8	47=47–0 30=7+9+6+8 17=47–30
B. Priming works	7 9 2	19 22 3	37 39 2	47 50 3	43=50–7 10=2+3+2+3 33=43–10
C. Underpaint putty works	9 22 13	22 39 17	39 50 11	50 65 15	56=65–9 56=13+17+ +11+15 0=56–56
D. Works on colouring	22 27 5	39 47 8	50 54 4	65 71 6	49=71–22 23=5+8+4+6 26=49–23
Total durations of fronts of works	27=27–0 27=7+2+13+5	37=47–10 37=9+3+17+8 T_{II}^{p} = 10	23=54–31 23=6+2+11+4 T_{III}^{p} = 21	32=71–39 32=8+3+15+6 T_{IV}^{p} = 8	Stretching ties: resource 76=17+33+ +0+26

**Compiled on the basis of statistical modeling*

Thus, taking into account the restrictions on the continuity of the development of the fronts of work, we can determine the total duration of the whole complex of works by formula (3.4):

$$T = \sum_{j=1}^{n-1} T_{j,j+1}^{p} + \sum_{i=1}^{m} t_{n,i}\,, \tag{3.4}$$

where $T^{p}_{j,\ j+1}$ – the period expansion the subsequent front of work concerning previous; m – the general number kinds of works (a current serial index, i); n – the general number fronts of works (a current serial index, j); $t_{n,\,i}$ – duration i works on last private front.

To determine the values of the periods of deployment of further fronts of work, we use the condition (3.5), under which before any simple work must be performed previous work on the front of the same type:

$$T_{j,j+1}^{p} = \max_{i=1,m} \sum_{k=1}^{i} \left(t_{j,k} - t_{j+1,k-1} \right), \tag{3.5}$$

where $t_{j+1,0}$ – the operation time a zero kind equal to zero.

As an example of the use of the previous formula (3.5) we define the periods of deployment of works II, III and IV, shown by the following formulas (3.6):

$$T_{II}^{p} = \max\begin{Bmatrix} 7-0=7 \\ 7+2-0-9=0 \\ 7+2+13-0-9-3=10 \\ 7+2+13+5-0-9-3-17=-2 \end{Bmatrix} = 10;$$

$$T_{III}^{p} = \max\begin{Bmatrix} 9-0=9 \\ 9+3-0-6=6 \\ 9+3+17-0-6-2=21 \\ 9+3+17+8-0-6-2-11=18 \end{Bmatrix} = 21; \qquad (3.6)$$

$$T_{IV}^{p} = \max\begin{Bmatrix} 6-0=6 \\ 6+2-0-8=0 \\ 6+2+11-0-8-3=8 \\ 6+2+11+4-0-8-3-15=-3 \end{Bmatrix} = 8.$$

As can be seen from table 3.3, the resulting schedule differs significantly from previous schedules presented in tables 3.1 and 3.2.

The effectiveness of using different flow methods of calculating the organization of work depends on the specific economic situation. If, for example, the cost of labor and machine resources, which determine the duration of work, is large enough, it is necessary to plan construction by the method of continuous use of resources.

If each object needs to be put into operation in the shortest possible time, it is necessary to calculate the organization of work by the method of continuous development of the fronts of work. If it is necessary to hand over the whole complex of objects as soon as possible in order to approximate the profitable period of operation of the project, then the method of critical path must be used for optimal organization of work.

CONCLUSIONS

It is proposed to create in the city of Odessa «Corporate scientific and technical complex of urban energy reconstruction «CSTC T-PPR» as an innovative organizational structure that uses in practice the accumulated scientific and technical potential for reconstruction of historic buildings in Odessa according to energy efficiency standards with foreign experience. The criterion for the preservation and modernization of the existing

building is to compare the construction of old buildings with new ones that have similar urban, technical and architectural-planning characteristics. As an economic criterion in determining the general regime of reconstruction, the efficiency of land use is taken into account. The final technical and economic analysis is based on estimate documentation and comparison with analogous reconstruction projects.

The described procedure for measuring control quality allows you to dynamically calculate the control quality index from iteration to iteration. Moreover, according to this index, you can determine the degree of responsibility of the performers of specific works. The presented model of management quality assessment is adequate because it is based on the modern concept of evaluating the effectiveness of investment projects. This model mainly has the property of adaptability. However, to adjust it to a more complete evaluative effect, it is necessary to take into account the dependence of the discount rate on time. Finally, the model is effective because it allows you to dynamically assess the results of management activities and on this dynamics to form a very detailed forecast of the management process.

Separation of private fronts of works from the general construction space is a necessary condition for the organization of the construction flow, the main feature of which should be considered a combination of different types of work on different parts of the object or complex of objects. Any set of works can be performed by different methods with different start and end dates, with different nature of resource use and development of private fronts and, accordingly, different in size technical and economic indicators. Basically, the methods of calculating the organization of work are determined taking into account the limitations imposed on the links between the works. The current method of organization of works is formed by means of spatial division of the general front of works on private fronts of works and parallel performance on them of various types of private streams of works.

The formation of flows (in matrix form) by the critical path method (M-CW) as a flow method of calculating the calendar plan of internal finishing works of the Corporate Scientific and Technical Complex of Urban Energy Reconstruction «CSTC T-PPR». The considered method of construction flow calculation has the positive property of obtaining a minimum of the total duration of the whole complex of performed works (the most fast-acting work schedule is calculated by the critical path method) in order to approximate the revenue period of the project operation. However, as a rule,

there are breaks, both in the development of individual private fronts of work, and in the use of resources.

The formation of flows (in matrix form) by the method of continuous use of resources (M-CUR) as a flow method of calculating the schedule of internal finishing works of the Corporate Scientific and Technical Complex of Urban Energy Reconstruction «CSTC T-PPR». The considered method of calculation of a construction stream has positive property of effective use of cost of labor and machine resources, at their considerable (determining duration of works) cost. However, there are breaks in the development of individual private fronts.

The formation of flows (in matrix form) by the method of continuous development of work fronts (M-CDF) as a flow method of calculating the calendar plan of internal finishing works of the Corporate Scientific and Technical Complex of Urban Energy Reconstruction «CSTC T-PPR». The considered method of calculation of a construction stream can be effectively applied in case of need of commissioning of construction objects in extremely short terms.

SUMMARY

In Odessa, the reconstruction of the historic buildings of the city are engaged in various construction contractors (constantly changing), which perform work at a low scientific and technical level, without a common vision of the specific problem of reconstruction of the historic buildings of the city. It is proposed to create in the city of Odessa «Corporate scientific and technical complex of urban energy reconstruction» CSTC T-PPR «as an innovative organizational structure that uses in practice the accumulated scientific and technical potential for reconstruction of historic buildings in Odessa according to energy efficiency standards with foreign experience. The described procedure for measuring control quality allows you to dynamically calculate the control quality index from iteration to iteration. Moreover, according to this index, you can determine the degree of responsibility of the performers of specific works. The formation of flows by the critical path method (M-CW), which has the positive property of obtaining a minimum of the total duration of the complex of works (critical path method calculates the fastest work schedule) in order to approximate the revenue period of the project. The formation of flows by the method of continuous use of resources (M-CUR), which has the positive property of efficient use of labor and machine resources, with their significant (determining the duration of work) cost. The formation of flows by the method of continuous development of work fronts (M-CDF), in particular,

it can be effectively used when it is necessary to put into operation of construction projects in a very short time.

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