DOI: https://doi.org/10.32347/2707-501x.2023.52(1).110-122

УДК 693. 546

Sergei A. Osipov,
Candidate of Technical Sciences, Docent
ORCID: 0000-0002-5851-3517,
Kiev National University of Construction and Architecture

METHODOLOGY FOR DESIGNING TECHNOLOGY FOR RESTORATION OF ARCHITECTURAL MONUMENTS. CURRENT STATE AND PROSPECTS FOR DEVELOPMENT

The article presents the results of the generalization of the past development of the methodology of designing technologies for the restoration of architectural monuments with an assessment of the current state and development prospects. For the first time, the author proposed the division of the past development of the methodology of designing the technology of restoration processes into four main periods, which collectively reflect the general history of the development of restoration as a construction business, compatible with the development of the main concepts and principles of restoration, namely: the first period - the development of the initial foundations of the methodology organizationally - technological design based on the generalization of original practical experience and theoretical principles of restoration of architectural monuments; the second period - the formation of modern foundations of the methodology of organizational and technological design of restoration technology, including its natural and scientific essence, topology and methods of decision-making, taking into account the accepted principles of restoration of architectural and historical monuments, decisions of the World Venice Congress of restorers; the third period - implementation and adjustment of the basics of information and analytical modeling of organizational and technological solutions regarding the design conditions of restoration of architectural and historical monuments; the fourth period - the formation of modern informational and numerical methods of organizational and technological design with the presentation of design results in the form of a multidimensional parametric image. It has been established that the selection of rational technological solutions for the implementation of restoration processes is carried out today, as well as the general technology of construction production - on the basis of the variability of the choice and multi-criteria technical and economic analysis. For the first time, the main reasons for the imperfection of the elements of the methodology of designing restoration technologies are established, which are due to its phenomenological immaturity and a significant amount of borrowings from the general technology of construction production regarding the main provisions of the theoretical foundations and logic of the theory.

Keywords: design methodology, technology, restoration process, restoration of architectural monuments

Introduction. One of the main conditions for radically increasing the efficiency of the process of restoration of architectural monuments is to improve the methodology of its design in conditions of fragmentation, heterogeneity and temporal discreteness of the front of restoration work, in complex and unique conditions of restoration and in the non-stationary nature of restoration processes, their multiplicity and heterogeneity.

Formulation of the problem. The current state of the methodology for designing technology for the restoration of architectural monuments can be assessed in the context of its past development and in connection with the development of the foundations of the theory of restoration of architectural monuments in general.

Main part. The development of the methodology for designing technology for the restoration of architectural monuments was carried out along the path of gradual, step-by-step improvement of its natural scientific essence, the structure of design operations and methods for selecting and justifying rational decisions.

The modern foundations of the methodology for designing technology for the restoration of architectural monuments developed in several periods, which can be distinguished (Fig. 1):

the first period – 1920–1940 – development of the initial foundations of the methodology of organizational and technological design based on a generalization of the initial practical experience and theoretical principles of restoration of architectural monuments;

second period – 1940–1960 – formation of modern foundations of the methodology of organizational and technological design of restoration technology, including its natural scientific essence, topology and decision-making methods, taking into account the accepted principles of restoration of architectural and historical monuments (decisions of the World Venice Congress of Restorers, 1956);

third period – 1960–2000 – introduction and adaptation of the fundamentals of information and analytical modelling of organizational and technological solutions in relation to the conditions of designing restoration of an architectural and historical monument (network planning, game theory, mathematical modelling using computer technology, etc.);

fourth period – 2000 – to the present – the formation of modern information-numerical methods of organizational and technological design with the presentation of design results in the form of a multidimensional parametric image.

Certain issues concerning the methodology of organizational and technological design for the restoration of architectural monuments were first raised in the works of V.R. Bernhard [1], P.P. Pokryshkin [2], I.E. Grabar [3], B.N. Zasypkin [4] and N.R. Levinson [5], N. Balanos [6].

In these works and the works of other authors, *initial ideas* about the methodology of organizational and technological design are formed, taking into account the general principles of restoration of architectural monuments, as well as construction and technological conditions and features of a specific restoration.

Thus, taking into account the almost massive nature of the restoration of architectural monuments in our country and abroad in the 20–30s of the twentieth century, it can be argued that in the period 1920–1940 the initial foundations of the methodology for the organizational and technological design of restoration processes were created.

The works that laid the foundations of the modern methodology for designing technology for the restoration of architectural monuments include the works of P.N. Maksimov [7, 8], B.F. Vologodsky [9, 10], A.S. Altukhov and V.I. Baldin [11].

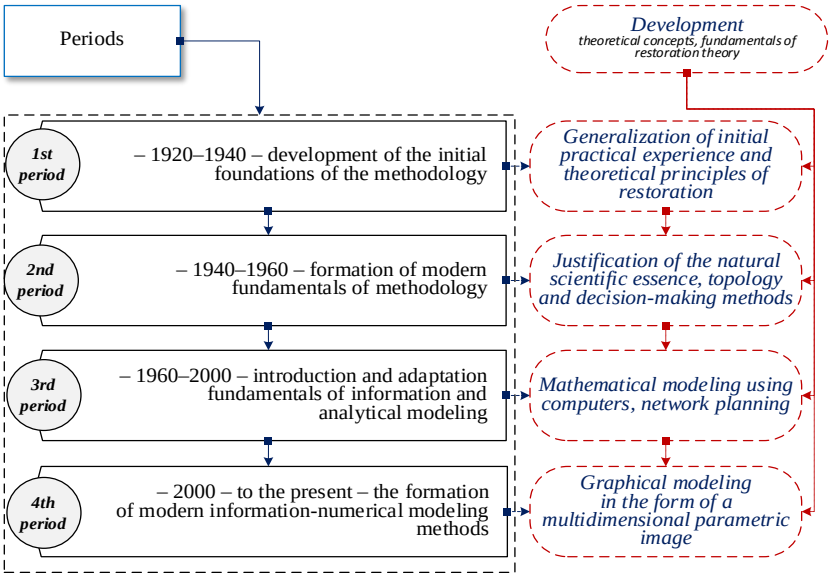

Fig. 1. Periods of development of the methodology of organizational and technological design of restoration of architectural monuments

In the indicated works, as well as in the works of foreign authors – P. Leon [12], C. Porogalli [13], A. Barbacci [14], – issues of justification of expedient solutions are considered, which are based on the known principles of physicality, technical and technological feasibility and technical and economic efficiency, as well as issues of the general topology of project operations, their structure, content and sequence of execution, in particular, the authors provide justification for the structure and content of research work and special regime observations, including archival, bibliographic and archaeological research, architectural archaeological measurements, graphic and photogrammetric recordings, sounding of finishing coatings and structures, material and chemical analysis of materials and soils, etc.

Further development (1960–2000) of the methodology of organizational and technological design for the restoration of architectural monuments occurred under the significant influence of achievements in the general methodology of construction design, which is based on the principles of flow, typification and unification of organizational and technological solutions, industrialization of construction and scientific organization of labor. During this period, the development of organizational and technological design methodology was significantly influenced by the works of such scientists as: S.S. Ataev [15], A.A. Afanasyev [16], Yu.I. Belyakov [17-18], M.S. Budnikov [19], N.I. Budunova [20], A.A. Gusakov [21-22], A.A. Zhukov [23], B. V. Prykin [24], A.V. Rezunik [25], V.I. Rybalsky [27], E.V. Fedosova [27], R.I. Fokov [28], V.K. Chernenko [29], W. Hartman, B. Mothes [30], R. Müller [31], H. Schmitz, J. Böhning, E. Krings [32], A. Steinle, V. Stuttgart [33], etc.

A significant influence on the development of modern foundations for information and analytical modeling of organizational and technological solutions for the restoration

of architectural and historical monuments was exerted by works devoted to the problems of reconstruction of buildings and their complexes; these are the works of Yu.I. Belyakov, E.G. Romanushko, S.A. Zaporozhchenko [34], E.Ya. Bubes [35], D.F. Goncharenko [36], G.S. Nizhnikovsky [37], V.K. Sokolov [38], Y. Thierry, S. Zaleski [39], S.A. Ushatsky, V.G. Lubenets, V.M. Maidanov [40], P.P. Fedorenko [41], N.P. Shepeleva, M.S. Shumilov [42], V.G. Yavorsky [43].

The formation of modern foundations of information and analytical modeling of organizational and technological solutions for the restoration of architectural monuments was also influenced by the works of B.G. Bessonov [44], A.F. Gaevoy, V.D. Zhvan, N.I. Kotlyar [45], E.M. Handel [46], I.E. Grabar [47], Cantaciusino, Shcherban, Brandt, Susan [48], A.P. Snezhko [49], etc.

Modern foundations of optimization and selection of technological solutions are finally formed in the works of A.A. Gusakov, A.V. Ginzburg, S.A. Veremeenko [50], S.G. Golovnev [51], V.A. Reusov, V.I. Torkatyuk, V.V. Pushkarenko [52], R.B. Tyan, N.M. Chernyshuk [53], V.K. Chernenko, V.F. Barannikov [54], as well as in the works of other authors, the main provisions of which formed the basis for the methodology for designing technology for performing restoration processes.

The selection of rational technological solutions for carrying out restoration processes is carried out, as in the general technology of construction production – on the principles of choice variability and multi-criteria technical and economic analysis.

The choice of options is based on the search for the optimal technological solution from a set of possible options that have technical and technological validity in relation to the given conditions for the restoration process, as well as existing restrictions, which are usually taken as various conditions regulated by the project regarding the preservation of the authenticity of the elements of an architectural monument during its process. restoration, strengthening or conservation.

The multi-criteria nature of the technical and economic analysis is ensured by the use of a system of technical and economic indicators widely tested in construction - labor intensity, cost and material intensity of the products of the restoration process.

Thus, the process of multi-criteria selection of rational technological solutions for carrying out restoration processes, as in the general technology of construction production, comes down to a compromise solution – with some reductions in the main criterion, they achieve an increase in others within given intervals-restrictions.

As a rule, the main criterion is the cost (c_i) of a unit of production of the restoration process, and the limitations are the duration (t_i), labor intensity (q_i), productivity (p_i) and material intensity (w_i) of the process, the value of which must be within acceptable limits – design values.

Thus, we have a well-known condition for choosing a rational solution in the form of a goal function ($\Phi_ц$) of the form [54-55]:

$$\Phi_ц(c_i) \to min \tag{1}$$

with restrictions:

$$\begin{cases} t_i \le t_н, \\ q_i \in \{q_i^{min}, [q]\} \\ p_i \in \{p_i^{min}, p_i^{max}\}, \\ w_i \le [w], \end{cases} \tag{2}$$

where $i = 1, 2, 3, \dots, n$ – the considered solution option;

q_i^{min}, p_i^{min}, $p_i^{max}$and $[t_н], [q], [w]$ – respectively, the minimum, maximum and maximum permissible values of the corresponding technical and economic indicators.

Since the beginning of the 2000s, there has been a rapid development of new methods for designing construction and restoration projects based on the use of computer application programs and a new high-performance material base - computer networks.

Over time, information technologies based on the principle of representing parameters of various essences with numerical values, the so-called BIM technologies, were introduced into the practice of restoration design.

Information modeling (BIM technologies) has become the norm everywhere in the development of projects for the restoration and museumification of architectural monuments [56-58], which is due to the possibility of presenting design results not only in the form of a 3-dimensional graphic model, but also in the form of a multidimensional parametric image (Fig. 2).

Presentation of the results of designing the restoration process in the form of a multidimensional parametric image (Fig. 2) is a necessary condition not only for the creation of an electronic library of parametric elements of architectural monuments [58], but also, most importantly, for the introduction of modern information-numerical methods of organizational and technological design into practice restoration of architectural monuments.

One of the latest works reflecting the current state of the methodology of organizational and technological design for the restoration of architectural monuments is the work of Doctor of Architecture N.I. Orlenok [59].

In these works, using the example of the restoration of outstanding architectural monuments - the Assumption Cathedral of the Kiev-Pechersk Lavra and St. Vladimir's Cathedral in Chersonese's, production experience is generalized and the methodology of organizational and technological design developed at the turn of the millennium in the corporation OJSC "Ukrrestavratsiya" is presented.

It should be noted that in general, such elements of the methodology as the essence, principles and methodology of organizational and technological design strictly correspond to the general methodology for designing construction processes that has developed in new construction, reconstruction and repair of buildings.

Rational decisions are made according to the criteria of their technical and technological feasibility (possibility) in the conditions of the existence of certain architectural, construction, artistic and aesthetic restrictions regulated by the restoration project of an architectural monument, and indicators of technical and economic efficiency are taken into account as secondary criteria-limitations - are within acceptable values.

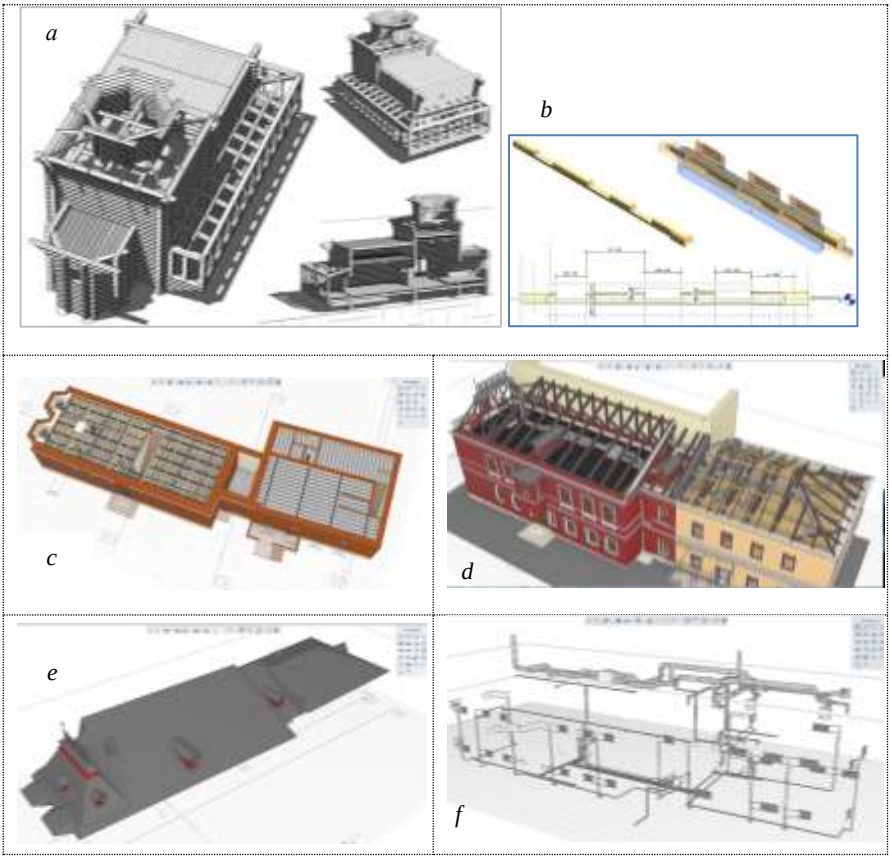

Fig. 2. Examples of information models for the process of restoration of architectural monuments:
a, *b* – assembly model of the log structure of the Spasskaya Church of the Image Not Made by Hands from the Zashiversky fort and, accordingly, a multi-parameter model of its typical crown [70];
c, *d*, *e*, *f* – assembly models, respectively, of the interfloor ceiling, rafter system, roofing, heating and ventilation systems of the "House-Museum of A.P. Chekhov" [58]

Conclusions. In general, we can conclude that the methodology for designing restoration processes developed together with the development of the fundamentals of the theory of restoration processes, which, in turn, developed under the significant influence of the general theory of construction processes and the basic principles of construction organization.

Therefore, such fundamental elements of the methodology as the essence and basic principles of justification and selection of decisions, criterion space and algorithms are largely borrowed.

Many specific properties, special conditions and limitations are highlighted, which only emphasizes that, in general, the methodology for designing restoration processes is devoid of originality - this is where it's fundamental phenomenological immaturity lies.

References:

1. Bernhard, V.R. (1901). Arches and vaults. Guide to the device and the calculation of arched and vaulted ceilings. Part I. Vol. I. The text is supplemented with. St. Petersburg: Class. Ehrlich, 198.

2. Pokryshkin, P.P. (1916).Quick Tips on repair of monuments and art. Pskov: Pskov, 34.

3. Grabar, I.E. (1966). Lectures on restoration, given to the first year of the Fine Arts Department at Moscow State University in 1927. About ancient Russian art.P. 291–356.

4. Zasypkin, B.N. (1928). Architectural monuments of Central Asia: Problems of research and restoration. *Restoration issues: Collection of Central State Restoration Workshops*. Issue. II. P. 207–284.

5. Levinson, N.R. (1929). Repair and restoration of architectural monuments. *Moscow local historian*. Issue. 7–8. P. 85 – 102.

6. Balanos, N. (1936). Les monuments de L`Acropole: Relevement et conservation. Paris. 120 p.

7. Maksimov, P.N., Toropov, S.A. (1949). Architectural measurements: A manual for fixing architectural monuments. M.: Publishing house. Academy of Arch. USSR. 151 p.

8. Maksimov, P.N. (1958). Basic provisions of the scientific methodology for the restoration of architectural monuments. *Practice of restoration work*. Sat. 2. P. 5–18.

9. Vologodsky, B.F. (1958). Engineering work during the restoration of architectural monuments. M.: Soviet Russia. 31 p.

10. Vologodsky, B.F., Zvorykin, N.P., Maksimov, P.N. etc. (1961). Restoration work. Methods of restoration of architectural monuments: A manual for architects-restorers. P. 101–176.

11. Altukhov, A.S., Baldin, V.I. (1961). Development of restoration projects for architectural monuments. Methods of restoration of architectural monuments: A manual for architects-restorers. M.: Stroyizdat. P. 85–100.

12. Leon, P. (1951). La vie des monuments francais. Paris. 584 p.

13. Porogalli, C. (1954). Monumenti e metodi di valorizzazione. Milano. 152 p.

14. Barbacci, A. (1956). Il restauro dei monumenti in Italia. Roma. 427 p.

15. Ataev, S.S. (1989). Technology of industrial construction from monolithic concrete. M.: Stroiyzdat. 336 p.

16. Afanasev, A.A. (1990). Intensification of work during the construction of buildings and structures made of monolithic reinforced concrete. M.: Stroiyzdat. 384 p.

17. Beliakov, Yu.Y., Rezunyk, A.V., Fedosenko, N.M. (1986). Construction work during the reconstruction of enterprises. M.: Stroiyzdat. 224 p.

18. Beliakov, Yu.Y.,.Snezhko, A.P. (1988). Reconstruction of industrial enterprises. K.: Vyshcha shk. 255 p.

19. Budnykov, M.S., Nedavnyi, P.Y., Rybalskyi, V.Y. (1961). Basics of continuous construction. K.: Hosstroiyzdat. 415 p.

20. Budunova, N.Y. (1974). Ways to increase the economic efficiency of reconstruction of industrial facilities. M.: Stroiyzdat. 208 p.

21. Husakov, A.A., Ylyn, N.Y., Borh, R., Paulson, B. (1984). Organization of large-scale construction management. Ed. A.A. Husakova. M.: Stroiyzdat. 280 p.

22. Husakov, A.A. (1993). Systems engineering in construction. M.: Stroiyzdat. 368 p.

23. Zhukov, A.A. (1977). Optimization of technology and construction organization. K.: Budyvelnyk. 182 p.

24. Prykyn, B.V., Ysh, V.H., Shyrshykov, B.F. (1991). Fundamentals of management. Production and construction systems. M.: Stroiyzdat. 336 p.

25. Rezunyk, A.V., Beliakov, Yu.Y. (1987). Technology and complex mechanization of construction and installation works. K.: Vyshcha shk.. 263 p.

26. Rybalskyi, V.Y. (1979). Automated construction management systems. K.: Vyshcha shk.. 479 p.

27. Fedosova, E.V. (1988). Industrial construction and technological systems are accelerators of scientific and technological progress. K.: Vyshcha shk.. 165 p.

28. Fokov, R.Y. (1969). Selection of optimal organization and technology for building construction. K.: Budyvelnyk. 192 p.

29. Chernenko, V.K. (1982). Methods of installation of building structures. K.: Budyvelnyk. 208 p.

30. Hartman, W., Mothes, B. (1982). Modernisieren und rekonstruiren. Leitung – Organisation – Effektivitat. Berlin. 136 p.

31. Muller, R. (1982). Sanierung historisch Bausubstanz. Koln-Braunsfeld. 115 p.

32. Schmitz, H., Bohning, J., Krings, E. (1989). Altbaumodernisierung im Detail. Koln. 236 p.

33. Steinle, A., Stuttgart, V. (1991). Bauen mit Betonfertigteilen im Hochbau. Berlin. 173 p.

34. Beliakov, Yu.Y., Romanushko, E.H., Zaporozhchenko, S.A. (Mechanization means for the reconstruction of industrial buildings. K.: Budyvelnyk. 144 p.

35. Bubes, E.Ya., Popov, H.T., Sharlyhyna, K.A. (1980). Optimal long-term planning of capital repairs and reconstruction of the housing stock. Ed. E.Ya. Bubesa. L.: Stroiy-zdat. 190 p.

36. Honcharenko, D.F. (1989). Installation of building structures during the reconstruction of machine-building plants in the city of Kharkov. Kh.: Kharkovsk. obl. pravl. NTO Stroiyndustryy. 59 p.

37. Nyzhnykovskyi, H.S. Davydov, V.A., Dydenko, L.M., Kolesnyk, L.A. (1982). Installation work during the reconstruction of industrial enterprises. K.: Budyvelnyk. 172 p.

38. Sokolov, V.K. (1986). Reconstruction of residential buildings. M.: Stroyzdat. 248 p.

39. Terry, Yu., Zalesky, S. (1975). Repair of buildings and strengthening of structures: abbreviated translation from Polish. M.: Stroiyzdat. 175 p.

40. Ushatskyi, S.A., Lubenets, V.H., Maidanov, V.M. at al (1992). Organization of creation and reconstruction of biological structures: beginning. K. 183 p.

41. Fedorenko, K.H., Nahornyi, V.A., Denysenko, N.P. (1983). Efficiency of using capital investments in the reconstruction of enterprises. K.: Budyvelnyk. 96 p.

42. Shepelev, N.P., Shumylov, M.S. (2000). Reconstruction of urban development. M.: Vyssh. shk. 271 p.

43. Iavorskyi, V.H. (1981). Installation of building structures during reconstruction of buildings. [2nd ed., rev. and additional]. K.: Budyvelnyk. 192 s.

44. Bessonov, B.H. (1989). Study of deformations, calculation of load-bearing capacity and structural strengthening of ancient spacer systems. M.: Rosrestavratsyia. 164 p.

45. Haevoi, A.F., Zhvan, V.D., Kotliar, N.Y., Pylyhramm, S.S. (1990). Reconstruction of industrial facilities. Kh.: Prapor. 62 p.

46. Hendel, E.M. (1980). Engineering work during the restoration of architectural monuments.. M.: Stroiyzdat. 200 p.

47. Hrabar, Y.E. (1969). About Russian architecture. Research. Protection of monuments. M.: Nauka, 1969. 424 p.

48. Cantaciusino, S., Brandt, S. (1984). Restoration of buildings; lane from English A.G. Rappaport; edited by O.I. Prutsyna. M.: Stroiyzdat. 264 p.

49. Snezhko, A.P. (1979). Organization of an information system in construction flow management. K.: Budyvelnyk. 76 p.

50. Gusakov, A.A., Ginzburg, A.V., Veremeenko, S.A. and others. (1994). Organizational and technological reliability of construction; edited by A. A. Gusakova. M.: SvR-Arhus. 472 p.

51. Holovnev, S.H. (1983). Optimization of winter concreting methods. L.: Stroiyzdat. 235 p.

52. Reusov, V. A., Torkatiuk, V.Y., Pushkarenko, V.V. (1988). Formation and assessment of the quality of design solutions in construction. K.: Budyvelnyk. 207 p.

53. Tian, R.B., Chernyshuk, N.M. (1994). Organization of production. Dnepropetrovsk: Science and Education. 254 p.

54. Chernenko, V.K., Barannykov, V.F. (1988). Technology and organization of installation of building structures. K.: Budyvelnyk. 276 s.

55. Chernenko V.K., Osypov O.F., Tonkacheiev M.H., Osypov S.O. and others. (2011). Technology for installation of building structures; ed. VC. Chernenko. [2nd view]. K.: Horobets. 371 p.

56. Talapov, V. Application of BIM to existing buildings, from: http://isicad.ru/ru/articles.php?article_num=14159&compage=2

57. Kozlova, T.Y., Kulykova, S.O., Talapov, V.V., Huanyn, Chzhan. BIM technology: a unique opportunity to work with wooden architectural monuments, from: https://ardexpert.ru/article/6134

58. Application of BIM in the restoration project of the house-museum of A.P. Chekhov, from: https://bimlib.pro/articles/primenenie-bim-v-proekte-restavracii-doma-muzeya-ap-chehova-519

59. Orlenko, M.I. (2015). St. Volodymyr's Cathedral in Chersonesos: methodical plantings, chronology of creation. Kyiv: Feniks. 320 p.

Список літератури:

1. Бернгард В. Р. Арки и своды. Руководство к устройству и расчету арочных и сводчатых перекрытий. Ч. I. Вып. I. Текст с дополнен. СПБ: Тип. Эрлих, 1901. 198 с.

2. Покрышкин П.П. Краткие советы по вопросам ремонта памятников старины и искусства. Псков: Псковское губернское Правление, 1916. 34 с.

3. Грабарь И.Э. Лекции по реставрации, читанные на первом курсе отделения изобразительных искусств в МГУ в 1927 году. О древнерусском искусстве. М., 1966. С. 291–356.

4. Засыпкин Б.Н. Архитектурные памятники Средней Азии: Проблемы исследования и реставрации. *Вопросы реставрации: Сборник Центральных государственных реставрационных мастерских*. М., 1928. Вып. II. С. 207–284.

5. Левинсон Н.Р. Ремонт и реставрация памятников архитектуры. *Московский краевед*. 1929. Вып. 7–8. С. 85 – 102.

6. Balanos N. Les monuments de L`Acropole: Relevement et conservation. Paris, 1936. 120 p.

7. Максимов П.Н., Торопов С.А. Архитектурные обмеры: Пособие по фиксации памятников архитектуры. М.: Изд. Академии Арх. СССР, 1949. 151 с.

8. Максимов П.Н. Основные положения научной методики реставрации памятников архитектуры. *Практика реставрационных работ*. Сб. 2., 1958. С. 5–18.

9. Вологодский Б.Ф. Инженерные работы при реставрации памятников архитектуры. М.: "Советская Россия", 1958. 31 с.

10. Вологодский Б.Ф., Зворыкин Н.П., Максимов П.Н. и др. Производство реставрационных работ. *Методика реставрации памятников архитектуры: Пособие для архитекторов-реставраторов*. М., 1961. С. 101–176.

11. Алтухов А.С., Балдин В.И. Разработка проектов реставрации памятников архитектуры. *Методика реставрации памятников архитектуры: Пособие для архитекторов-реставраторов*. М.: Стройиздат, 1961. С. 85–100.

12. Leon P. La vie des monuments francais. Paris, 1951. 584 p.

13. Porogalli C. Monumenti e metodi di valorizzazione. Milano, 1954. 152 p.

14. Barbacci A. Il restauro dei monumenti in Italia. Roma, 1956. 427 p.

15. Атаев С.С. Технология индустриального строительства из монолитного бетона. М.: Стройиздат, 1989. 336 с.

16. Афанасьев А.А. Интенсификация работ при возведении зданий и сооружений из монолитного железобетона. М.: Стройиздат, 1990. 384 с.

17. Беляков Ю.И., Резуник А.В., Федосенко Н.М. Строительные работы при реконструкции предприятий. М.: Стройиздат, 1986. 224 с.

18. Беляков Ю.И., Снежко А.П. Реконструкция промышленных предприятий. К.: Выща шк., 1988. 255 с.

19. Будников М.С., Недавний П.И., Рыбальский В.И. Основы поточного строительства. К.: Госстройиздат, 1961. 415 с.

20. Будунова Н.И. Пути повышения экономической эффективности реконструкции промышленных цредцриятий. М.: Стройиздат, 1974. 208 с.

21. Гусаков А.А., Ильин Н.И., Борг Р., Паулсон Б. Организация управления крупномасштабным строительством. Под ред. А.А. Гусакова. М.: Стройиздат, 1984. 280 с.

22. Гусаков А.А. Системотехника в строительстве. М.: Стройиздат, 1993. 368 с.

23. Жуков А.А. Оптимизация технологии и организации строительства. К.: Будівельник, 1977. 182 с.

24. Прыкин Б.В., Иш В.Г., Ширшиков Б.Ф. Основы управления. Производственно-строительные системы. М.: Стройиздат, 1991. 336 с.

25. Резуник А.В., Беляков Ю.И. Технология и комплексная механизация строительно-монтажных работ. К.: Вища шк., 1987. 263 с.

26. Рыбальский В.И. Автоматизированные системы управления строительством. К.: Выща шк., 1979. 479 с.

27. Федосова Е.В. Индустриальные строительно-технологические системы – ускорители научно-технического прогресса. К.: Вища шк., 1988. 165 с.

28. Фоков Р.И. Выбор оптимальной организации и технологии возведения зданий. К.: Будівельник, 1969. 192 с.

29. Черненко В.К. Методы монтажа строительных конструкций. К.: Будівельник, 1982. 208 с.

30. Hartman W., Mothes B. Modernisieren und rekonstruiren. Leitung – Organisation – Effektivitat. Berlin, 1982. 136 s.

31. Müller R. Sanierung historisch Bausubstanz. Köln-Braunsfeld, 1982. 115 p.

32. Schmitz H., Böhning J., Krings E. Altbaumodernisierung im Detail. Köln, 1989 236 p.

33. Steinle A., Stuttgart V. Bauen mit Betonfertigteilen im Hochbau. Berlin, 1991. 173 s.

34. Беляков Ю.И., Романушко Е.Г., Запорожченко С.А. Средства механизаций при реконструкции промышленных зданий. К.: Будівельник, 1987. 144 с.

35. Бубес Э.Я., Попов Г.Т., Шарлыгина К.А. Оптимальное перспективное планирование капитального ремонта и реконструкции жилищного фонда. Под ред. Э.Я. Бубеса. Л.: Стройиздат, 1980. 190 с.

36. Гончаренко Д. Ф. Монтаж строительных конструкций при реконструкции машиностроительных заводов города Харькова. Х.: Харьковск. обл. правл. НТО Стройиндустрии, 1989. 59 с.

37. Нижниковский Г.С., Давыдов В.А., Диденко Л.М., Колесник Л.А. Монтажные работы при реконструкции промышленных предприятий. К.: Будивэльнык, 1982. 172 с.

38. Соколов В.К. Реконструкция жилых зданий. М.: Строиздат, 1986. 248 с.

39. Тьерри Ю., Залески С. Ремонт зданий и усиление конструкций: сокращенный перевод с польського. М.: Стройиздат, 1975. 175 с.

40. Ушацький С.А., Лубенець В.Г., Майданов В.М. та ін. Організація зведення і реконструкцій будівель та споруд: навч. посіб. К., 1992. 183 с.

41. Федоренко К.Г., Нагорный В.А., Денисенко Н.П. Эффективность использования капитальных вложений при реконструкции предприятий. К.: Будівельник, 1983. 96 с.

42. Шепелев Н.П., Шумилов М. С. Реконструкция городской застройки. М.: Высш. шк., 2000. 271 с.

43. Яворский В.Г. Монтаж строительных конструкций при реконструкции зданий. [2-е изд., перераб. и доп]. К.: Будівельник, 1981. 192 с.

44. Бессонов Б.Г. Исследование деформаций, расчёт несущей способности и конструктивное укрепление древних распорных систем. М.: Росреставрация, 1989. 164 с.

45. Гаевой А.Ф., Жван В.Д., Котляр Н.И., Пилиграмм С.С. Реконструкция промышленных объектов. Х.: Прапор, 1990. 62 с.

46. Гендель Э.М. Инженерные работы при реставрации памятников архитектуры. М.: Стройиздат, 1980. 200 с.

47. Грабарь И.Э. О русской архитектуре. Исследования. Охрана памятников. М.: Наука, 1969. 424 с.

48. Кантакьюзино Ш., Брандт С. Реставрация зданий; пер. с англ. А.Г. Раппапорта; под ред. О.И. Пруцына. М.: Стройиздат, 1984. 264 с.

49. Снежко А.П. Организация информационной системы в управлении строительным потоком. К.: Будівельник, 1979. 76 с.

50. Гусаков А.А., Гинзбург А.В., Веремеенко С.А. и др. Организационно-технологическая надежность строительства; под ред. А. А. Гусакова. М.: SvR-Аргус, 1994. 472 с.

51. Головнев С.Г. Оптимизация методов зимнего бетонирования. Л.: Стройиздат, 1983. 235 с.

52. Реусов В.А., Торкатюк В.И., Пушкаренко В.В. Формирование и оценка качества проектных решений в строительстве. К.: Будівельник, 1988. 207 с.

53. Тян Р.Б., Чернышук Н.М. Организация производства. Днепропетровск: Наука и просвещение, 1994. 254 с.

54. Черненко В.К., Баранников В.Ф. Технология и организация монтажа строительных конструкций. К.: Будівельник, 1988. 276 с.

55. Черненко В.К., Осипов О.Ф., Тонкачеєв М.Г., Осипов С.О. та ін. Технологія монтажу будівельних конструкцій; під ред. В.К. Черненко. [2-е вид.]. К.: Горобець, 2011. 371 с.

56. Талапов В. Применение BIM к существующим зданиям. URL: http://isicad.ru/ru/articles.php?article_num=14159&compage=2

57. Козлова Т.И., Куликова С.О., Талапов В.В., Гуаньин Чжан. Технология BIM: уникальная возможность работы с памятниками деревянной архитектуры. URL: https://ardexpert.ru/article/6134

58. Применение BIM в проекте реставрации дома-музея А.П. Чехова. URL: https://bimlib.pro/articles/primenenie-bim-v-proekte-restavracii-doma-muzeya-ap-chehova-519

59. Орленко М.І. Свято-Володимирський собор в Херсонесі: методичні засади хронологія відтворення: Монографія. К.: Фенікс, 2015. 320 с.

С.О. Осипов

Методологія проектування технології реставрації пам'яток архітектури. Сучасний стан та перспективи розвитку

У статті викладено результати узагальнення минулого розвитку методології проектування технологій реставрації пам'яток архітектури з оцінкою сучасного стану та перспектив розвитку. Автором вперше запропоновано розподіл минулого розвитку методології проектування технології виконання реставраційних процесів на чотири основних періоди, які відображають у сукупності загальну історію розвитку реставрації, як будівельної справи, сумісно із розвитком основних концепцій і принципів реставрації, а саме: перший період - розробка початкових основ методології організаційно-технологічного проектування на основі узагальнення вихідного практичного досвіду та теоретичних принципів реставрації пам'яток архітектури; другий період - становлення сучасних основ методології організаційно-технологічного проектування технології реставрації, включаючи її природничо-наукову сутність, топологію та методи прийняття рішень з урахуванням прийнятих принципів реставрації пам'яток архітектури та історії, рішень Всесвітнього

Венеціанського конгресу реставраторів; третій період – впровадження та пристосування основ інформаційно-аналітичного моделювання організаційно-технологічних рішень стосовно умов проектування реставрації пам'яткою архітектури та історії; четвертий період - становлення сучасних інформаційно-чисельних методів організаційно-технологічного проектування з поданням результатів проектування у вигляді багатовимірного параметричного образу. Встановлено, що вибір раціональних технологічних рішень виконання реставраційних процесів здійснюється нині, як і загальної технології будівельного виробництва – на засадах варіантності вибору та багатокритеріального техніко-економічного аналізу. Вперше встановлені головні причини недосконалості елементів методології проектування реставраційних технологій, які обумовлені феноменологічною її незрілістю та суттєвим обсягом запозичень з загальній технології будівельного виробництва щодо основних положень теоретичних основ і логіки теорії.

Ключові слова: методологія проектування, технологія, процес реставрації, реставрація пам'яток архітектури.

Посилання на статтю:

APA: Osipov, S.A. (2023). Methodology for designing technology for restoration of architectural monuments. Current state and prospects for development. *Shliakhy pidvyshchennia efektyvnosti budivnytstva v umovakh formuvannia rynkovykh vidnosyn*, 52(1), 110-122.

ДСТУ: Осипов С.О. Методологія проектування технології реставрації пам'яток архітектури. Сучасний стан та перспективи розвитку. *Шляхи підвищення ефективності будівництва в умовах формування ринкових відносин*. 2023. №52(1). С. 110-122.