

UDC 004.94:624.03

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INFORMATION MODELING AS MEANS OF THE BUILDINGS AND STRUCTURES LIFE CYCLE MANAGING

А.А. Вольвач. Інформаційне моделювання як засіб управління життєвим циклом будівель і споруд. В умовах швидкого науково-технічного прогресу, темп розвитку технологій проектування будівель та споруд став опереджати практичне застосування їх на вітчизняному ринку порівняно з країнами західного світу. Українські засоби проектування будівель перестали бути конкурентно-спроможними на міжнародному рівні. За цих обставин особливо актуально є запровадження нових та удосконалення існуючих методів та засобів моделювання будівель і споруд. Важливим завданням для сучасного проектувальника є можливість використання комп'ютерної моделі на різних етапах життєвого циклу будівлі, а саме: проектування, будівництво, експлуатація. Для вирішення цієї проблеми можна застосувати новий метод проектування – інформаційне моделювання будівель (BIM). Метою даного наукового дослідження є з'ясування можливостей використання технологій інформаційного моделювання будівель як засобу управління їх життєвим циклом. Наукова і практична значущість роботи виступає у можливості впровадження технологій інформаційного моделювання будівель не лише як новітнім методом проектування, але й як засобом управління життєвим циклом будівлі на всіх його етапах. Результати дослідження базуються на аналізі літературних джерел та практичному досвіді авторів. У статті розкрито можливість використання інформаційного моделювання будівель як засобу управління життєвим циклом будівель та споруд. Розглянуто варіанти та основні проблеми застосування інформаційного моделювання на різних етапах життєвого циклу будівель. У даній роботі було проаналізовано та сформульовано основні функції інформаційного моделювання будівель, які є необхідними для управління життєвим циклом будівель та споруд. Практична значущість результатів даної роботи полягає у представленні запропонованих функцій та перспектив розвитку засобів інформаційного моделювання будівель.

Ключові слова: комп'ютерні технології, інформаційне моделювання будівлі, життєвий цикл будівлі

A. Volvach. Information modeling as means of the buildings and structures life cycle managing. In the conditions of rapid scientific and technological progress, the technologies development pace of designing buildings and structures began to outstrip the practical application of them in the domestic market in comparison with the countries of the western world. Ukrainian building design tools have ceased to be internationally competitive. In these circumstances, it is especially important to introduce new and improve existing methods and tools for modeling buildings and structures. An important task for a modern designer is the ability to use a computer model at various stages of the building's life cycle, namely: design, construction, operation. To solve this problem, one can apply a new design method - Building Information Modeling (BIM). The purpose of this research is to explore the possibilities of using information modeling technologies for buildings as a means of their life cycle managing. The scientific and practical importance of the work stands in the possibility of introducing of information modeling technologies of buildings not only as a new design method, but also as a means of managing of the life cycle of the building at all its stages. The results of the research are based on the analysis of literary sources and practical experience of the authors. The article revealed the possibility usage of building information modeling as means of managing of the life cycle of building and structures. There is considered options and the main problems of information modeling application on different stages of buildings life cycle. In this paper, the main functions of building information modeling, which are necessary for managing of the life cycle of buildings and structures, have been analyzed and formulated. The practical importance of the results of this paper is in the presentation of the proposed functions and development prospects of building information modeling tools.

Keywords: computer technologies, building information modeling, building life cycle

Introduction

In the conditions of rapid scientific and technical progress, the pace of development of technologies for the design of buildings and structures began to outpace their practical application in the domestic market compared to Western countries. Ukrainian building design tools have ceased to be internationally competitive. In these circumstances, it is especially important to introduce new and improve existing methods and tools for modeling buildings and structures.

An important task for a modern designer is the ability to use a computer model at different stages of the life cycle of the building, namely design, construction, operation. To solve this problem, a new design method can be used. This is building information modeling (BIM).

Analysis of recent research and publications

In the late XX-early XXI century computer-aided design technologies are beginning to be implemented actively. Foreign scientists V. Talapov, P. Parsanezhad, and many others, as well as domes-

DOI: 10.15276/opus.2.61.2020.12

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tic scientists V. Belyaev, M. Barabash, O. Gorodetsky, S. Bushuyev, and others, dealt with the issues of scientific expediency of using information modeling of buildings. Some useful attempts to apply building information modeling technology to life cycle management can be found in the results of relevant research [1, 2]. The authors [1] consider the advantages of using BIM technology in the last stages of the building life cycle. It is emphasized that it is necessary to create an information model of already constructed buildings for their further management. On the other hand, the authors [2] consider options for the introduction of computer-aided design technologies at the initial stage of creating a building model. A detailed analysis of computer modeling methods for various tasks at all stages of the building life cycle was developed by a domestic scientist [3].

The purpose of the article

The purpose of this research is to clarify the possibilities of using information modeling of buildings as a means of managing of their life cycle.

Presenting the main material

The concept of information modeling of buildings contains a fundamentally different approach to design and includes complete information on the construction, equipment, maintenance, as well as reconstruction and demolition of the building. Due to the high accuracy and detailed description of the model, this technology allows to perform various calculations (e.g., energy efficiency and energy consumption of the building, complex calculations for durability, fire resistance and strength of the whole building and its individual elements) and analysis of the results [4].

In addition, BIM technology can also be used as a means of managing of the life cycle of buildings and structures. The life cycle of a building is a continuous process where all stages have certain needs that must be taken into account to extend the structure period of operation. Thus, the authors in their article [5] studied the works of 12 different scientists from Canada, the Czech Republic, Finland, Germany, Italy, Poland, Portugal, Norway and Sweden and assessed the impact of the construction process at all stages. The BIM environment provides features for all construction professionals to work together throughout the building's life cycle without the risk of data loss, inaccurate transmission, or ambiguity.

According to the authors, the first stage of the life cycle is the most important. Since the model of the building is informative, the correct filling of its information allows not only to build a convenient basis for design, but also provides the opportunity to use the same model in other subsequent stages. This way of streamlining the workflow reduces labor costs, eliminates the possibility of inaccuracies or errors and allows you to track the process of change, and the corresponding decisions. The main problems that arise when filling the model with information are considered by European scientists in their work [6]. According to the authors, the evaluation and quality control of information models is an important task and requires close attention. In addition, understanding the nature of input errors can help determine the best algorithms and information flows. During the design phase, in addition to the development of the model design, integration between architectural and calculation complexes is possible (for example, REVIT, AllPlan, ARCHICAD, TEKLA are integrated with LIRA-CAD). This greatly facilitates the creation of working documentation in accordance with the results of the calculation.

During the construction phase, the model continues to grow and be supplemented by sections for managing the construction of the facility. One of the most important components of information modeling functions at this stage is construction logistics. The integrated approach allows you to plan the needs for materials and determine the required amount of raw materials, components. Thus, the possibility of resources lack on the construction site, incorrect calculation of the necessary materials is eliminated. It is allowed to establish calendar schedules of raw materials deliveries, equipment, products and executors.

In the third stage of the life cycle (operation) the information model can also find its place. Its need arises in providing management processes for maintenance, operation, repair and improvement of the building and surrounding areas. This method of modeling allows you to easily design the re-equipment of an existing building with new engineering equipment, bringing its performance to the

current level of requirements. Also at this stage the information model can act as a source of information about the building and its systems. Monitoring the current condition of the building (especially important for architectural monuments) and taking timely measures for restoration is not the last acceptable way to use the information model of the building. Prospects for the development of this area are quite broad and require further study.

Information modeling plays an important role during the demolition of a building. Due to the high accuracy and wide range of possibilities, it is allowed to make adjustments and necessary refinements in stages, nonlinearly, as required by design tasks. This eliminates the possibility of uncontrolled destruction of the building during dismantling or partial demolition. This way of designing buildings allows you to model the environment after the dismantling of the building, develop the concept of a new project and repeat the entire life cycle for another object.

In accordance with the above, we can conclude that the possibility of using information modeling of buildings as a means of managing of the life cycle of the structure and give the main functions of this method of management at different stages (Figure).

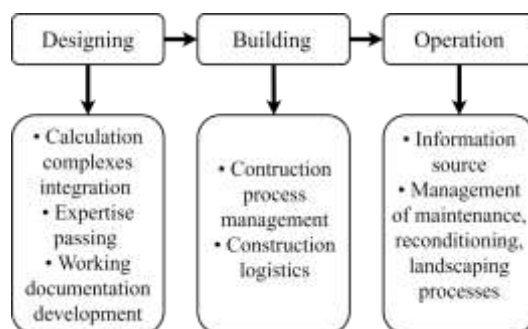


Figure. Functions of the information model at different stages of the life cycle of the building

Results of the research

In the article the possibility of using information modeling of buildings as a means of managing of the life cycle of buildings and structures was covered. Possible options for the application of information modeling at different stages of the life cycle of buildings are considered.

Conclusions

In conclusion, the use of information modeling of buildings in modern design as a means of managing of the life cycle of the building will reduce labor costs and increase the allowable complexity of the building. Tasks that are solved by means of information modeling at different stages of the life cycle of the building are different in structure and content of information, which indicates the possible potential for improving thematic-oriented software packages. Thus, nowadays the study of information modeling of buildings is not complete in the world and requires additional, more detailed study and analysis.

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Received May 06, 2020

Accepted July 10, 2020