Introduction of Building Information Modeling (BIM) Technologies in Construction

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Introduction of Building Information Modeling (BIM) Technologies in Construction

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Abstract. The issues of introduction of building information modeling (BIM) in construction industry are considered in this work. The advantages of this approach and perspectives of the transition to new design technologies, construction process management, and operation in the near future are stated. The importance of development of pilot projects that should identify the ways and means of verification of the regulatory and technical base, as well as economic indicators in the transition to Building Information Technologies in the construction, is noted.

1. Introduction

BIM (Building Information Modeling) — information modeling of buildings, which allows one to model not only the construction objects themselves, but also their characteristics, as well as all possible changes in time — is persistently introduced to the construction industry [1–6].

In practice, the use of BIM technology is integrated into all stages of production and life support of buildings: data collection, design work, construction, equipment, operation, repair work and demolition. That is, all the necessary information is located in the computer models: architectural, construction, technological, economic, etc.

In the work of Z. Pezeshki and S. A. S. Ivari [7], a classification and review of the literature from 2000 to 2016 on building information modeling (BIM) are provided. It is shown how various methodologies of BIM were developed during this period. Three main types of future trends of methodology development of information modeling and related research and development are noted by the authors:

- BIM methods, as a rule, are developed in the direction of expertise.
- It is proposed to implement various social science methodologies using BIM as another type of methodology.
- The ability to constantly change and learn is the driving force of BIM's methodologies and will become the key to future intellectual applications.

Work [8] is directed towards the development of the discriminant model of readiness for introduction of BIM to a construction organization. For empirical check of the proposed model, the authors received 164 questionnaires filled out by construction organizations with the involvement of contractors, architects, heads of construction and engineers.

In work [9], the issue of application of cloud technologies as a necessary tool for further development of building information modeling technologies is considered. The issues of data management, introduction of new technologies and interaction of participants of the BIM-process are analyzed.

In review [10], the main focus is on the identification of the future tendencies for development of the process of building design, taking into account building information modeling (BIM) technology. The authors note that nowadays the use of BIM technologies is widely implemented both into the construction industry, and into the academic environment. The benefits of BIM, such as systematicity of the modeling process, a powerful platform for interactive visualization and standardized data exchange are shown in the study.

2. Materials and methods

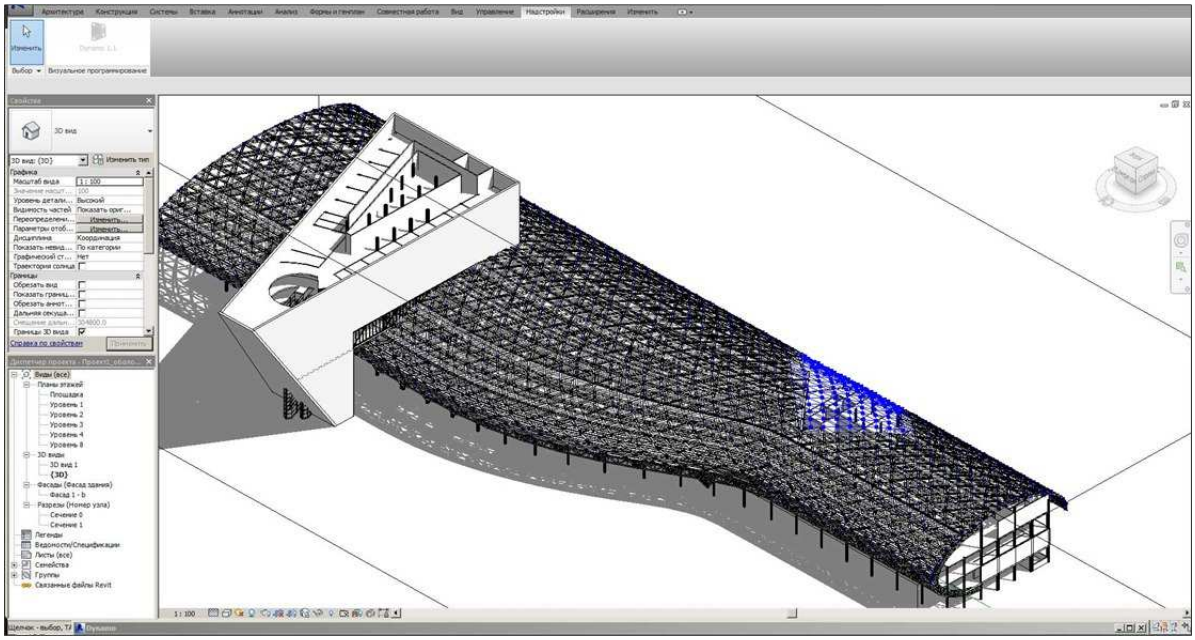
The result of the building information modeling is an object-oriented digital model both of the whole object and the process of its construction. First of all, it allows one to assemble the components and systems of future construction created by different specialists and organizations in the virtual mode, selecting them according to purpose, perform corresponding calculations, alignment and coordination, check their viability, functional suitability and operational qualities in advance, and also avoid internal disagreements (collisions) unpleasant for designers [2].

The most important advantage of BIM technology is the complete interdependence of all types of information, each of which is updated automatically upon a single introduction of any changes (Fig. 1). And the created information model may be a computer model of a real building throughout its life and reflect all the changes and additions of the current and future state.

The main competitive quality of BIM technology is significant cost savings, first of all, due to the increase in speed of design; besides it is possible to talk about creation of quite complex and unique objects (Fig. 1, 2). The process of information modeling divides the design work into two stages:

1. Development of primary design objects, both construction (windows, doors, floor slabs, wall types, roof types, etc.), and elements of different systems (heating, ventilation, electricity, water supply, sewerage, etc.), which include all necessary technical and economic characteristics.

2. Modeling of the object itself, which occurs in the form of customary formation of technical drawings and specifications of layouts, sections, facades, three-dimensional views and other forms of information presentation.



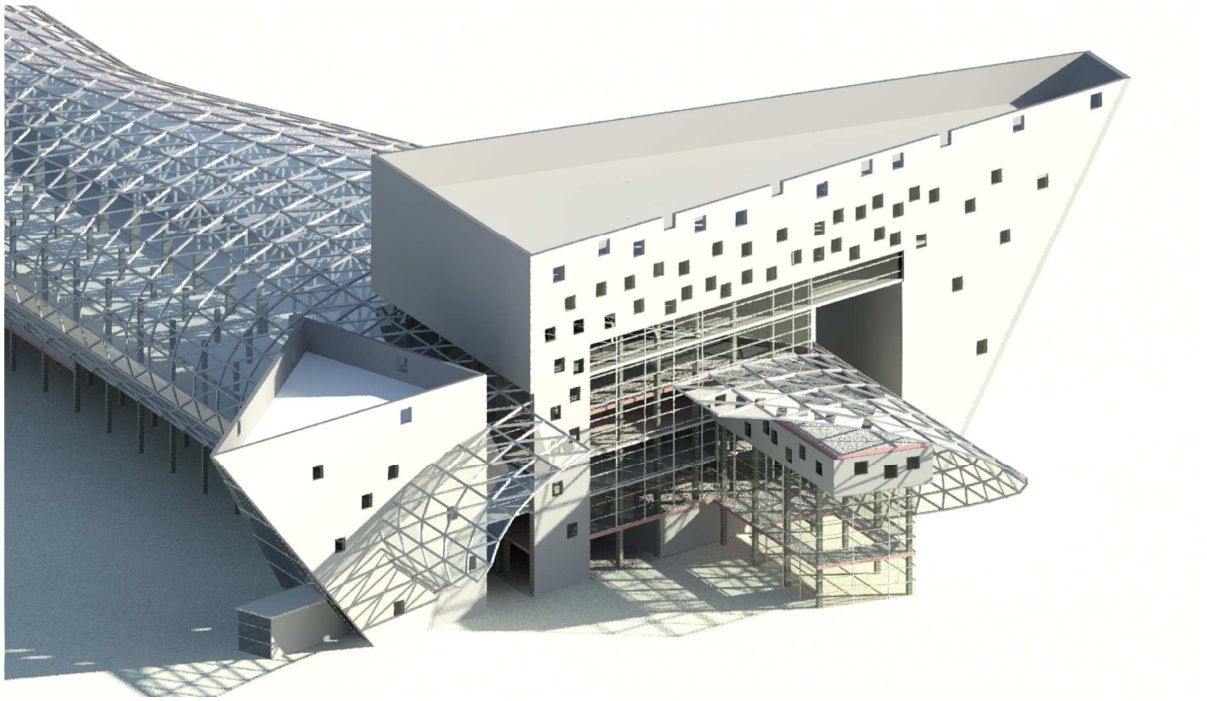


Figure 1. A project of a multifunctional center (author: A. Zemtsov).

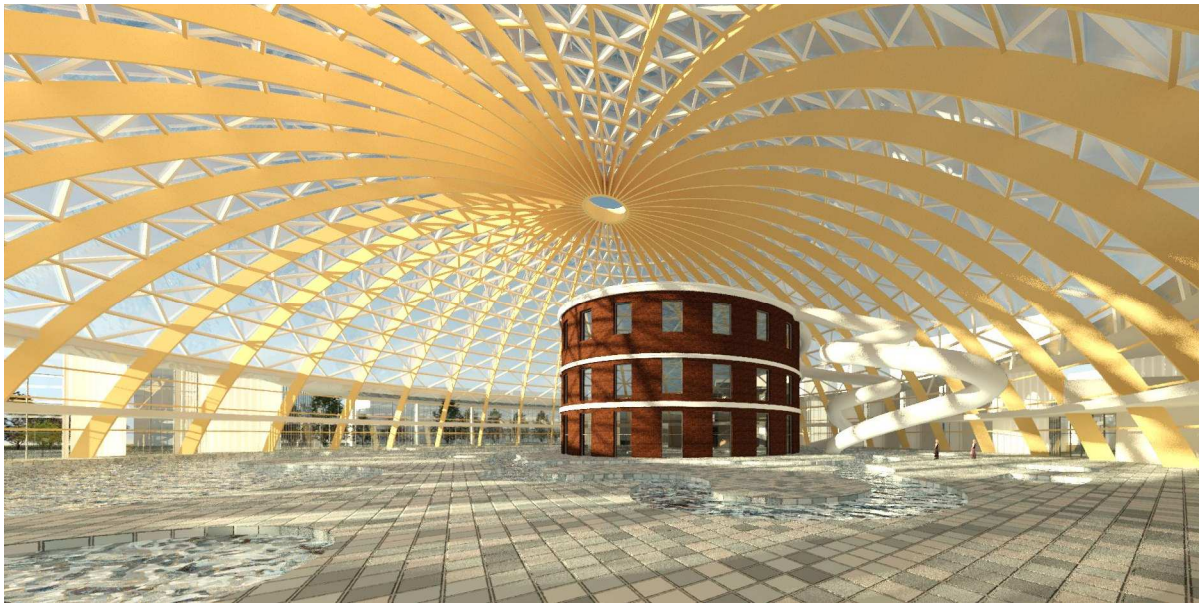


Figure 2. A project of a dome of the water park (author: V. Chugreev).

In March 2015, the «Plan of a step-by-step implementation of BIM technologies in the field of industrial and civil construction» was approved by the order of the Ministry of Construction and Housing and Communal Services of the Russian Federation.

Implementation of this plan is associated with the significant changes in the whole construction industry, affecting every smallest part of it. Besides, a detailed interaction of these smallest parts is an essence of BIM, as huge reserves lie in maximum automation when moving information from one link to another, which results in a significant reduction in the project cost [11].

According to the above mentioned plan, since 2020, the use of information modeling technologies (BIM) in the design, construction and operation of buildings and structures constructed from the budget of the Russian Federation will be mandatory.

A uniform information space shall be built on a platform of national standards, and these standards have to harmoniously fit into already existing world standards. All construction products, structural elements, materials and types of work have to be connected with this standard using electronic qualifiers. It is necessary to connect all object element libraries with the electronic directories of cost indexes and labor costs. And at present, this work has already begun [11].

3. Conclusion

Information systems in the organizations and construction industry enterprises, functioning within the concept of information modeling, require significant expenditures for the introduction of a new approach towards design and support of the construction process. Certainly, the details of a new approach can be accepted only after a careful elaboration of pilot projects, which should identify the ways and means of verification of the regulatory and technical base, as well as economic indicators.

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