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PERSPECTIVES OF UNDERSTANDING AND IMPLEMENTATION OF INFORMATION MODELLING TECHNOLOGIES IN THE CONTEXT OF RESTORATION OF ARCHITECTURAL MONUMENTS

PhD (arch), professor, Samarkand state university of architecture and construction named after Mirzo Ulugbek, Republic of Uzbekistan

D. Kamalova

Absract: The article is devoted to the analysis of the purpose and peculiarities of application of the latest technology of building information modelling (BIM) when working with architectural monuments. BIM technology at its creation was aimed primarily at the design and construction industry, but its application in historical and architectural work can fundamentally change in the direction of better storage and processing of huge amounts of information, and this type of activity. By means of comparative analysis, the following are considered: the relationship between the components of the information model of an architectural monument, the peculiarities of creating such a model, the necessity and importance of developing libraries of elements for historical buildings. Special attention is paid to the cultural connection through BIM of past epochs and modern architecture. It also considers the prospects for the application of BIM-technologies in the context of reconstruction and restoration of buildings and monuments of architecture.

Keywords: BIM-technologies, restoration, architecture, design. information modeling, preservation of cultural heritage.

Introduction. Studying the history of architecture of the ancient world and the Middle Ages in the various territories of Central Asia, one can note the connection between the political life of states and the rise and fall of architectural creativity. The period of the Middle Ages is particularly significant for Uzbekistan, which has left many unique structures on its territory, which the State takes particular care to preserve. The Constitution of Uzbekistan stipulates that citizens are obliged to protect the historical, spiritual and cultural heritage of the people of Uzbekistan; cultural monuments are protected by the State [1]. The protection of cultural heritage sites is not only about studying and promoting the history of the State, but also about fostering in the younger generation a sense of respect and careful attitude to the invaluable historical heritage, national identity, and the establishment of high spirituality in society. Uzbekistan is a country with a rich history of urban development and unique monuments of architecture. Thanks to this and the conditions created in recent years, the republic has become particularly attractive for tourism. Within the framework of work on the creation of appropriate infrastructure, the issue of systematization of historical stages of urban development on the example of objects - from the earliest examples to the present day remains relevant. This project will make it possible to show the whole panorama of styles in the region. For various reasons, the buildings of the early Middle Ages, praised by ancient authors, suffered irreparable losses. This can be seen on the example of 12 cities founded by Alexander the Great in Bactria and Sogdiana. It is known that the era of the great commander and his successors was marked by the blossoming of urban art in the countries of the Hellenistic world. The unprecedented scale of original cities, the foundation of seventy of which is attributed to Alexander the Great, caused the practical realization of new ideas. This can also be traced in the urban planning of the Central Asian interfluve. Many of the sites often visited by tourists - medieval religious buildings of the Islamic period - are unique monuments of Uzbekistan's architectural creativity. Unfortunately, there are no authentic objects that could create a holistic panorama of historical styles of urban

development of our country in the periods of antiquity and early Middle Ages. At present, 2079 architectural monuments and 4308 archaeological sites are under state protection in Uzbekistan [2]. The state has developed a system of local history, art history, art history and other museums, among which three museum-reserves stand out: the Bukhara, Samarkand and Ichan-Kala museums in the city of Khiva. Museum business and the protection of cultural monuments are elevated to the rank of state policy, which is enshrined in the Law of the Republic of Uzbekistan "On the Protection and Use of Cultural Heritage Objects" and the Law "On Museums" [3]. Ichan-Kal'a in Khiva (1991), the historical center of Bukhara in 1993, the historical center of Shakhrisabz in 2000, and Samarkand as a crossroads of cultures in 2001 were inscribed on the UNESCO World Heritage List. During the years of independence, large-scale restoration and improvement works have been carried out on 1004 historical sites with the involvement of specialists from China, Japan, France, Poland and other states. in addition to UNESCO, the International Council on Monuments and Sites (ICOMOS, International Council on Monuments and Sites) [2] also monitors the competent restoration and preservation of their medieval architecture, which has become the property of the world community.

Metods. Built architectural structures, as well as architectural monuments, emotionally affecting people, reflect the life of the present and past society, its ideology. Physical aging of monuments, the impact on them of natural and climatic influences, seismic loads require qualified restoration work [3]. In the process of preservation of architectural monuments there are terms - conservation, restoration and reconstruction [4]. Conservation is understood as preserving the appearance of historical monuments in the spirit of its time at the time of its discovery and registration without making any changes. Restoration (Latin restauratio - restoration) is understood as the restoration in the original form of architectural works, damaged by time or distorted by subsequent alterations. Restoration processes are constantly being updated due to the development of new technologies, techniques, and scientific research. The term new construction means the restoration of a completely lost monument. Reconstruction (from Latin re - again and constructio - construction) - means restoration of a lost or severely damaged monument by "constructing anew" with the preservation of bearing structures and their reinforcement - walls, floors, stairs, possible changes in the construction of partitions, floors, ceilings, communications, changes in overall dimensions and other. At the same time, architectural monuments should not only be preserved, restored, but also actively used for the needs of modern society. However, in this direction are not running out of emerging problems associated with incompetent approach to the study and implementation of restoration work. The reports about mistakes made in the restoration and reconstruction of architectural monuments covered in the print and electronic media affect the development of tourism and hamper the promotion of the country's image in the international arena [5]. The field of restoration is a constant improvement and search for new technologies and techniques. However, many restored objects of architectural monuments do not meet the objectives of restoration, reconstruction. In particular, according to the research of a number of scientists because of illiterate restoration for history irretrievably lost some monuments of Bukhara, the Shah-i-Zinda ensemble, the arch of the Oqsaroy palace in Shakhrisabz and many other historical monuments, "everything that 'reconstructed' is 'new-made' and has nothing to do with the preservation of historical monuments" [6]. Ignorant restoration can lead to the fact that Bukhara, Samarkand and Khiva, where restoration and improvement works are being carried out in order to develop tourism, will be on the UNESCO "alarm" list. To solve the problems related to restoration the only method is international cooperation. The exchange of knowledge and practical experience will solve the problem of historical heritage preservation [7].

Results. In the age of modern technology, the use of innovative devices and technologies will simplify and at the same time accelerate the work of architects and designers in the development of projects for the reconstruction of architectural monuments. Preserving historical buildings has been very important at all times, as architectural monuments reflect the majesty and uniqueness of the whole country. The use of 3D laser scanning technology will improve survey work in the survey of architectural monuments. 3D scanning will simplify the work in obtaining measurement drawings of facades, will also increase their detailed elaboration and thanks to the created 3D model from a cloud of points you can get drawings in any form and at any time without additional measurements. Further, with the help of professional software complexes the information model of the monument of architecture BIM model is made. Creation of such a model significantly facilitates work with the object, because it allows to connect and coordinate all components and systems of the building in virtual mode and check their functionality [8]. One of the main new opportunities that BIM technology opens up for designers is the virtual prediction of all stages of the life cycle at the stage of its design, conducted with the help of the so-called research model. The technology of information modeling of buildings is usually considered in the framework of new design. However, so much has already been built in the most developed world centers that reconstruction and restoration of existing buildings and structures is coming to the forefront there. Thus the advantages of BIM over traditional design can be identified: 1) ability to model changes in building design; 2) design re-equipment of the building with new engineering equipment, bringing its performance characteristics to the current level of requirements; 3) track the current state of the building (especially important for architectural monuments) and take timely restoration measures; 4) properly operate existing facilities. Trends in restoration are developing following the technologies of the information space.

More and more often one can see references to the use of BIM-technology for restoration of architectural monuments, which is one of the most new and rapidly developing methods of restoration. (Fig.1).

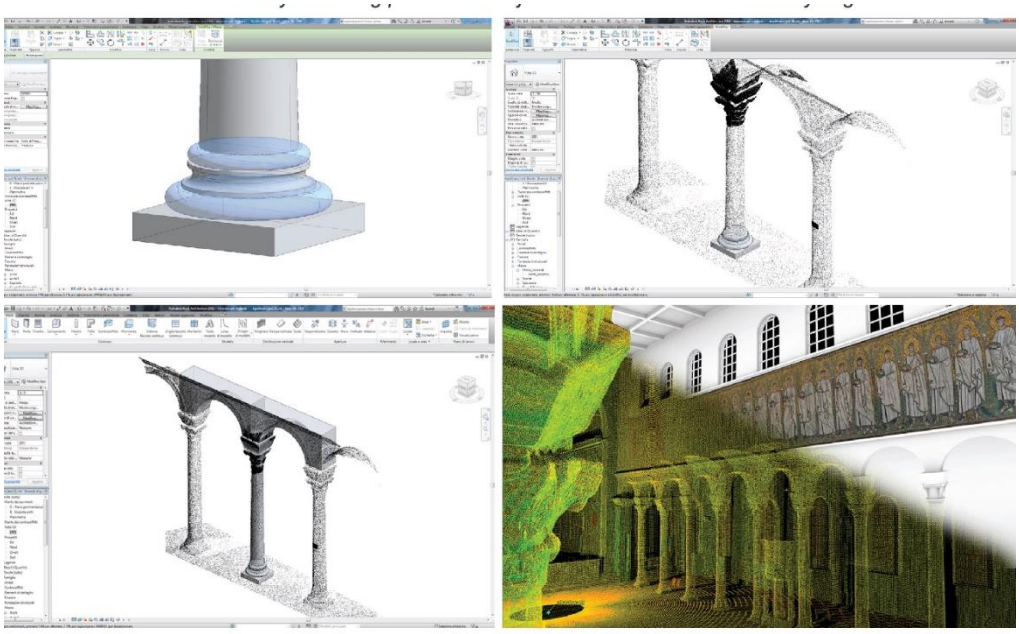

Figure 1. Once models as mass Revit families sinale components can be imported into the master model

Discussion. Very often all architectural and construction elements (decorative ornamentation of facades, brickwork, window frames, platbands, doors, stairs, fences, etc.) of historical monuments are unique, so you can not use ready-made libraries of elements or previous developments [9]. Practically for each architectural monument all basic elements have to be made “from scratch”.

Drawings, sketches, photographic materials and verbal textual descriptions are important for recreating the building's appearance. The technology of information modeling allows to make corrections to the model at any moment of its creation. The modeling process is connected with the work with databases, where each element of the model can be assigned additional unique parameters. Making changes in the parameters of building elements lead to automatic changes in other related parameters and objects, up to drawings and specifications, visualizations. (Fig.2).

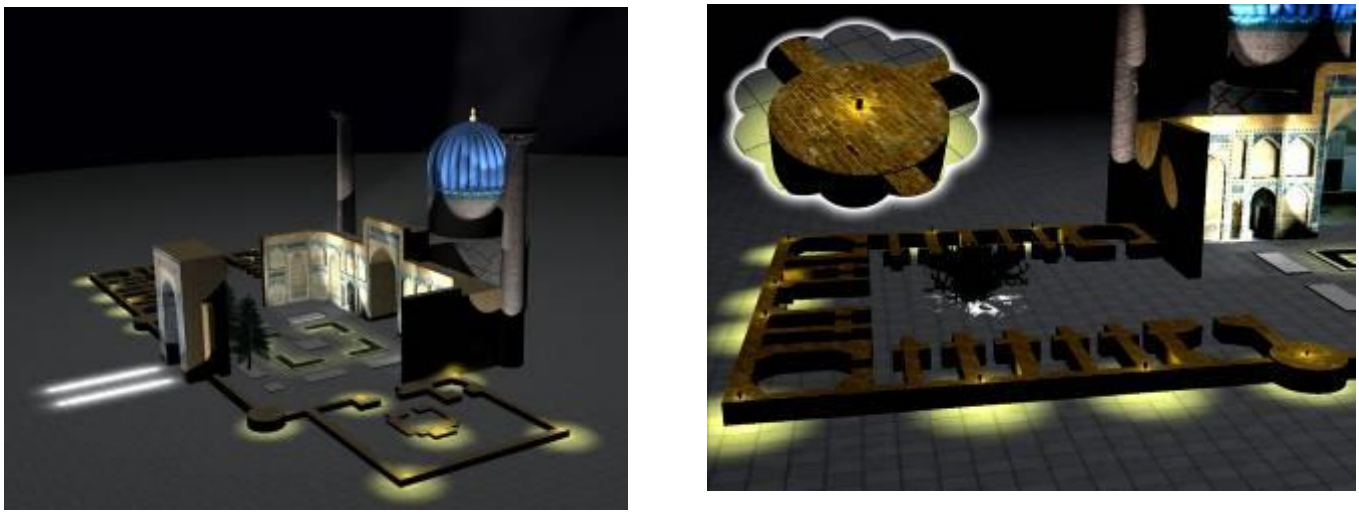

Figure 2. Gur-Emir ensemble. Samarkand. (project-proposal)

At present, automated systems that restore the appearance of objects that have been partially or more than 80% lost are widely used in museums. Exactly the same is possible with respect to architectural monuments. For an architectural monument its appearance has always been of paramount importance. Therefore, the information model of a historical building, especially for restoration design, should have a 100% verified geometry of this object in its basis, but executed in one of the BIM programs to become the

basis for other sections of the model. This determines the interest in studying the possibilities and working out the methodology of modeling of architectural monuments in BIM technology. The work is carried out in the Revit family of programs, which Autodesk has very far-sightedly and free of charge provided to all students and teachers.

Conclusions. Libraries of elements of historical buildings are the basis of BIM when working with objects of cultural heritage. But these libraries have one property that is worth emphasizing: they can also be used in modern design and construction. And this makes it possible with much less effort to use the styles of previous eras in a single time period of modern construction, to "return" the elements of historical buildings in our lives, to create for existing architectural monuments environmental unity with the surrounding new development [10]. This makes BIM a unique technological bridge between the culture of previous centuries and modernity. Previously, there was no such tool for processing and utilizing large amounts of information in the hands of architects and historians. At the present stage, mankind has realized that the culture of each nation is part of the universal treasury of spiritual heritage, which will survive the centuries. To stop the destruction of monuments of architectural heritage should be considered in the following positions: - interest of state structures in preservation of historical values; - fulfillment of competent projects for restoration (reconstruction) objects on the basis of conducted surveys of architectural monuments taking into account historical and archaeological data and requirements of the world standards; - qualified choice of technologies and materials for restoration of historical monument and fulfillment of all mentioned restoration operations in full compliance with the developed requirements; - qualified selection of specialists – restorers.

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