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Research Article

Creation of Historical Building Information Modelling (HBIM) Library, A Case Study of Registered House (No:56), Akçakoca

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ABSTRACT

Building Information Modelling (BIM) is a methodology created by adapting information technologies to the construction industry, creating 3D parametric and object-based models, and adding time and cost data to the models. In recent years, the creation of digital cultural heritage is a current field in terms of protecting cultural heritage and transferring it to future generations. Development of technology and the increase in opportunities, destinations that cannot be physically visited due to access difficulties or pandemics are trying to transfer their cultural richness to digital environments. For this purpose, Historical Building Information Modelling (HBIM), which is the version of BIM applied to historical buildings, emerges as an important tool. The digitalization of cultural heritage structures by modelling is a process that requires intensive labour due to the lack of uniform details, and the fact that they were made with different construction techniques at different times and periods. For this reason, this process will be improved with the creation, dissemination, classification, and accessibility of parametric object libraries with HBIM. In this direction, the research method; is based on the analysis and synthesis of the literature review and case study in particular on modelling and library studies as a case study. As a field study, it was created in three dimensions with HBIM on a registered civil architecture example that has lost its originality in Düzce province, Akçakoca district, and the building and library elements were modelled and transferred to BIM. The original state of the building has been created to be experienced interactively. As a result, the building and its elements are defined by parametric objects. With the development of the HBIM library, the elements of the structures of similar typology become digitally accessible and digital legacies are created much more easily and effectively. HBIM studies create a comprehensive three-dimensional data set in digital documentation, restitution periods and restoration studies.

Keywords: *Historic Building Information Modelling (HBIM), Building Information Modelling (BIM), conservation of cultural heritage buildings, digital cultural heritage, HBIM library, Akçakoca, Düzce*

Tarihi Yapı Bilgi Modellemesi (HBIM) Kütüphanesi Oluşturulması, Tescilli Yapı (No: 56) Örneği, Akçakoca

Öz

Yapı bilgi modellemesi (BIM), bilgi teknolojilerinin inşaat sektörüne uyarlanarak 3B parametrik ve nesne tabanlı model oluşturulması, modellere zaman ve maliyet verisi eklenmesiyle oluşturulan bir metodolojidir. Son yıllarda kültürel mirasın korunması, gelecek kuşaklara aktarılması açısından dijital kültürel mirasın oluşturulması, güncel bir çalışma alanı haline gelmiştir. Teknolojik imkânların artması sayesinde erişim zorlukları, pandemi ve ekonomi gibi sebeplerle fiziki ulaşım sağlanamayan tarihi alanlar, sahip oldukları kültürel zenginlikleri dijital ortamlara aktarmaktadır. Bu amaç doğrultusunda BIM'in tarihi yapılar üzerinde uygulanan versiyonu olan Tarihi Yapı Bilgi Modellemesi (HBIM) önemli bir araç olarak karşımıza çıkmaktadır. Kültürel miras yapılarının modellenerek

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dijitalleştirilmeleri; tek tip detaylarının olmaması, farklı zaman ve periyotlarda, farklı yapım teknikleriyle yapılmış olmaları sebepleri ile yoğun emek gerektiren bir süreçtir. Bu sebeple HBIM ile parametrik nesne kütüphanelerinin oluşturulması, yaygınlaştırılması, sınıflandırılması ve erişilebilir hale getirilmesi ile bu süreç iyileştirilmiş olacaktır. Bu doğrultuda araştırma yöntemi; modelleme ve kütüphane çalışmaları özelinde literatür taramasının analiz edilerek sentezlenmesine ve alan çalışmasına dayanmaktadır. Alan çalışması olarak Düzce ili, Akçakoca ilçesinde bulunan özgünlüğünü yitirmiş tescilli bir sivil mimarlık örneği üzerinden HBIM ile üç boyutlu olarak oluşturulmuş, yapı ve kütüphane elemanları modellenerek, BIM'e aktarılmıştır. Binanın özgün hali interaktif olarak deneyimlenme imkânı oluşturulmuştur. Sonuç itibariyle bina ve elemanları parametrik objelerle tanımlanmıştır. HBIM kütüphanesi geliştirilmesiyle benzer tipolojideki yapıların öğeleri, dijital olarak ulaşılabilir hale gelmekte ve dijital miraslar çok daha kolay ve efektif olarak hayta bulmaktadır. HBIM çalışmaları dijital belgeleme, restitüsyon dönemleri ve restorasyon çalışmalarında üç boyutlu kapsamlı bir data seti oluşturmaktadır.

Anahtar Kelimeler: *Tarihi Yapı Bilgi Modellemesi (HBIM), Yapı Bilgi Modellemesi (BIM), kültürel miras yapılarının korunması, dijital kültürel miras, HBIM kütüphanesi, Akçakoca, Düzce*

I. INTRODUCTION

Building Information Modelling (BIM) is a methodology created by adapting information technologies to the construction industry to create 3D parametric and object-based models, adding time and cost data to the models. with the developing technology, the traditional methods of doing and executing business, such as making a new structure, and surveying the existing structure, are undergoing serious changes. The transformation that depends on the measurement technologies is the developments in photogrammetry and 3d laser scanning techniques. On the other hand, Building Information Modelling (BIM) provides detailed data on the stages of the structure such as design, construction, operation, repair, maintenance, and demolition by creating digital twins and provides serious advantages in obtaining an integrated project. BIM can provide many different data such as design alternatives, cost estimation, material identification and measurement, data management, obtaining as-built projects, construction site organization, and obtaining application projects [1]. In addition to these, information flow can be continued throughout the life cycle of the building on issues such as conflict analysis, interdisciplinary coordination, building, energy, acoustic simulations, production, prefabrication, project management, and real estate management. In existing buildings and historical/heritage buildings (HBIM), the purposes of using BIM methodology are; monitoring of conservation status, heritage management, preventive maintenance, analysis of response options, conservation and restoration planning, construction simulation, disaster preparedness, etc. BIM methodology is used for monitoring the conservation status, heritage management, preventive maintenance, analysis of response options, conservation, and restoration planning, construction simulation, disaster preparedness, etc. oriented towards goals [2]. Modelling and digitizing cultural heritage buildings; It is a labor-intensive process due to the lack of uniform details and the fact that they were made at different times and periods, with different construction techniques.

II. HISTORICAL BUILDING INFORMATION MODELING (HBIM)

The concept of heritage is divided into three as natural, cultural and mixed (natural and cultural) according to the definition of UNESCO (The United Nations Organization for Education, Science and Culture). [3]. All of these are values that reflect universal values and should be passed on as a legacy to future generations [4]. It is not possible to preserve all the artifacts from the past and transfer them to future generations due to economic problems, urbanization problems, natural disasters, wear and tear of materials [5]. The scale and understanding of protection is changing from the past to the present, and thus there are changes in the content and method of protection [6]. In recent years, a new method called "HBIM (Historical Building Information Modelling)" has emerged with the integration of Building

Information Modelling (BIM) in the protection of historical buildings [7]; [8]. Although it is not as common as BIM, it has been observed that the use of HBIM has started at the international level in recent years and the studies conducted with this method have been increasing [8].

BIM is a technological tool that provides a digital representation of the physical and functional properties of a new or existing building with parametric elements. While computer-aided drawing programs produce a project by transferring the project in mind to two dimensions with the traditional method, BIM creates the project in mind with three-dimensional parametric elements and automatically obtains two-dimensional drawings from this model. BIM provides a secure platform for coordinated data sharing in a multidisciplinary study [9]; [10]. The coordinated data sharing feature makes BIM a suitable platform for archiving, preservation, management and research of cultural heritage. BIM can function as a very good decision-making and management tool when it is maintained throughout the life cycle of the structure, such as maintenance, repair and operation of cultural heritage assets [11]. HBIM can be defined as a process that digitally demonstrates all the elements that make up a cultural heritage, or in technical terms as object-oriented parametric modelling. The HBIM process involves assembling 'smart' objects (building components and areas) into a building or a group of buildings in a virtual environment. HBIM objects corresponding to relevant pieces of information are integrated into the information model in a structured way. In this way, HBIM creates a digital information resource for the cultural heritage asset. [11]. In recent years, the creation of digital cultural heritage is a new and interesting area in terms of protecting cultural heritage and transferring it to future generations. Thanks to the development of technology and the increase in opportunities, historical areas that can not be reached due to access difficulties and pandemics are trying to quickly transfer their cultural diversity to digital platforms. For this purpose, Historical Building Information Modelling (HBIM), which is the version of BIM applied on historical buildings, emerges as an important tool. The digitization of cultural heritage structures by modelling them becomes difficult due to the fact that they do not have uniform details, they can show different angles and deviations, they are made with different construction techniques at different times and periods. For this reason, the creation and classification of parametric object libraries with HBIM is of great importance for the dissemination of HBIM. The availability of this library will greatly speed up and facilitate the transition to the HBIM process.

The HBIM process consists of the stages of data collection, laser scanning process for BIM, mapping information and information sharing, respectively (Figure 1) [12]. The second stage, called ”Scan to BIM", is the name given to obtaining a model using BIM techniques by obtaining a point cloud, especially through terrestrial laser scanning devices. The information shared as the final stage of HBIM has the potential to include historical analyses about the heritage structure, time and cost calculations, energy simulations, studies related to the processes of maintenance, repair and interventions. With the HBIM model obtained, the data integrated into the digital model can be used by different disciplines [13]. Beyond Virtual Reality (VR) or Augmented Reality (AR), it can also be done in the form of gamification, as seen in the application developed for the ancient city of Teos. [14].

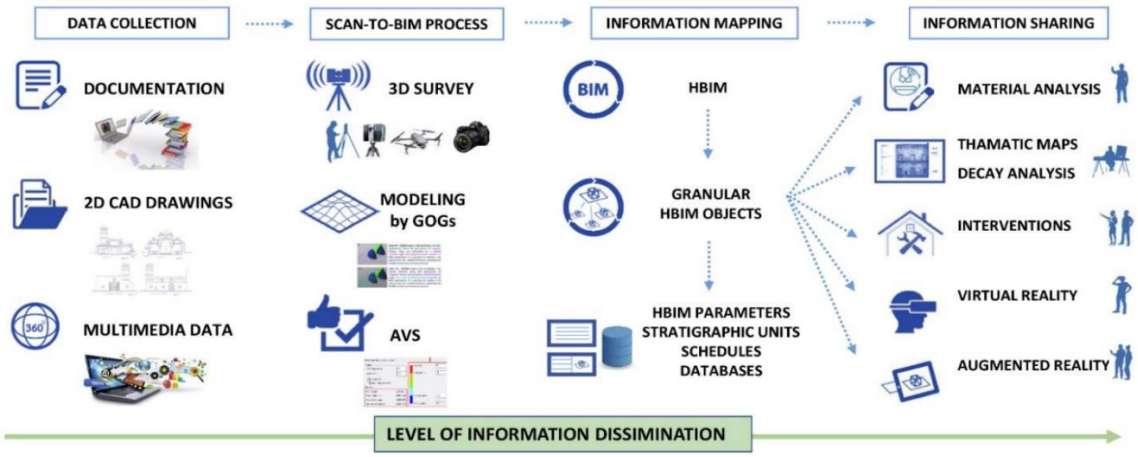


Figure 1. *HBIM process and phases of work* [12].

In the study conducted in this context, many international sources have been found and four new studies [15], [13], [16] ve [17] have been found in Turkey. Bastem and Çekmiş (2021) conducted a systematic literature review on the studies published between 2009 and 2020 in the nine most widely used academic databases. In this context, 194 primary studies have been identified about the HBIM process and its stages. By examining the identified studies, an up-to-date workflow was created for the usage areas and process of HBIM. The tools, methods and software that may be needed during the HBIM implementation and possible difficulties that may be encountered are expressed. In addition, it is foreseen that HBIM will replace the traditional relief and restoration process in the near future. By using the SWOT (strengths, weaknesses, opportunities, and threats) analysis method, Kömürcü and Benli Yıldız (2021) evaluated the HBIM working method, the opportunities and threats presented by using it, and identified the strengths and weaknesses of HBIM technology. As a result of the SWOT analysis, it is emphasized that HBIM application will make a positive contribution to heritage structures, eliminate their weaknesses and increase potential opportunities. On the other hand, Özeren and Kormaz (2021) evaluated the detail levels and usage possibilities of the 3D models to be used in the HBIM platform. In Turkey, 4 different levels of detail have been defined and it has been suggested to use these levels for heritage buildings. Within the scope of the study, a traditional house model was obtained as a field study and it was conveyed that additional technology, software and equipment were needed as the detail requirement increased. The point cloud data of the Augustus Temple in Ankara were obtained by Acar et al. (2022) and the model based on these data was placed in the field. It has been made available to people through the mobile application with AR. It has been stated that the development of such studies has a significant impact on the documentation, protection and transfer of cultural heritage. It has been stated that the interfaces to be developed can also be used in the field of education and tourism, and that building information models can become more compatible with the proliferation of research with mobile devices and applications. Within the scope of these studies, the relevant literature was scanned and analysed and a field study was carried out. As a field study, the building was created in three dimensions on a registered civil architecture example in Düzce province, Akçakoca district, and the building and library elements were modeled and transferred to BIM. In this way, the building, which has lost its original qualities with the major renovations it has undergone, and has become a place in the urban memory of the local people, has been created in a three-dimensional environment by providing access to the young generations in an interactive environment. Since it is not allowed to enter the building, it was modelled in the dimension of the exterior lines and joinery details of the building, transferred to BIM and interactively experienced from the outside of the building, creating knowledge and experience about the structure and its context.

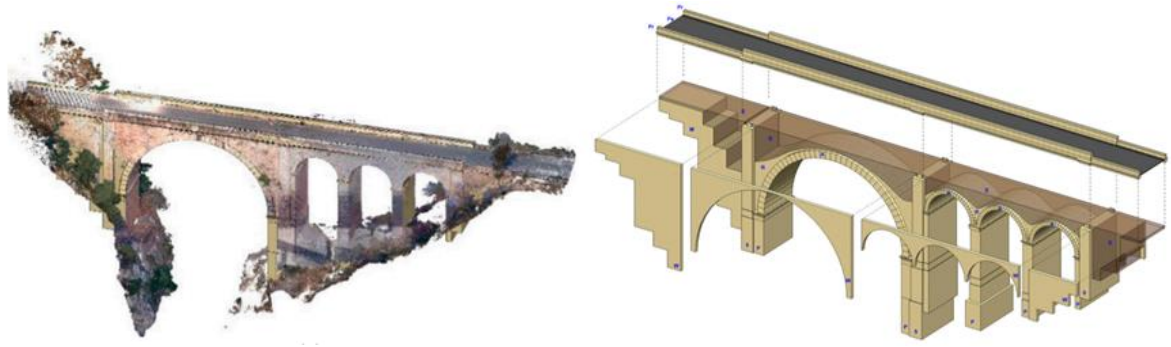
III. DOCUMENTATION, MODELING AND VISUALIZATION WITH HBIM

A SURVEY, RESTITUTION, RESTORATION AND DATA ANALYSIS I

Researching the historical processes of cultural heritage structures; It can be summarized as building production techniques, determination of traditions, and the process of obtaining data about the building. [5]. In this process, with the development of technology, in the documentation of historical buildings; terrestrial and aerial laser scanners, digital handheld cameras [18], point clouds and three-dimensional data obtained from photographs and motion cameras are used. By processing point clouds, 2-dimensional (2D) scaled precision images (orthophotos) such as site, floor, ceiling plans, sections and facades are obtained. Modelling can be started over these images by 2D drawings via computer aided drawing (CAD) programs [19] or directly with BIM programs after the point clouds are obtained. Photos, pictures and documents related to the original state of the building can be embedded in HBIM as semantic data. By obtaining restitution models according to the different periods of the building, it makes more information about the history of the building accessible.

B THREE DIMENSIONAL MODELING II

Today, the evolution of new information and communication technologies has led to a significant transformation in the activities of contemporary society. [20]. Technological advances have made it possible to create highly detailed 3D models of heritage buildings, sculptures and artifacts, faithful to their current conditions. [21]. With HBIM, real measurements can be made via point cloud data and heritage buildings, building elements up to door, window, woodworking details can be modelled with the software deemed appropriate from BIM programs. Through these models, data such as material, period, intervention can be processed and building survey and restitution models can be prepared. These models may also include historical, spatial, and intervention metadata for documentation purposes. Thus, many potential measures of protection, improvement, renovation or re-functioning, etc. restoration studies can be carried out with evaluations [22]. As shown in Figure 2, with the acquisition of a 3D model, the future changes of the structure can be easily updated by changing parametric objects or adding new ones [23].



(a) (b)

Figure 1. *(a) Point cloud of the historical Isbor Bridge (b) Modelling of building elements with family (rvt)* [24]

C CREATION OF THE HBIM LIBRARY III

The HBIM process involves combining 'intelligent/parametric' objects (building materials and components), a structure or a building community in a virtual environment. HBIM objects corresponding to relevant pieces of information are integrated into the information model in a structured manner, creating a digital information resource for the cultural heritage asset [11]. In this direction, with HBIM, a virtual library can be created in which all the information about that heritage, as well as the elements of the architectural heritage, are stored in the entire model. Thus, researchers and heritage-related experts from different countries can access and study information about structures that are not physically accessible at the moment thanks to the library created, and have the opportunity to use them in their projects when necessary.

With HBIM, parametric object libraries are created by examining the taxonometric and typological common features and the way they come together, of unique architectural elements belonging to a certain state, period, region, movement in the study of Almaimani and Nawarinin (2019), it is focused on converting Ottoman-era architecture belonging to Islamic architecture (HIAC) in Hejaz city into a BIM-based 3D object library in accordance with construction methods, structural elements and architectural components. Structural elements and architectural components are also arches, domes, wooden decorations, etc. It is divided into sub-sections and modeled parametrically. The authors report that they have developed the “Islamic architecture library” software add-on based on the examples mentioned (Figure 3).

Figure 2. *Transferring a historical bay window, from point cloud to 3D Model, then to BIM* [25]

Similarly, Baik et al. (2014) have established HBIM Library for civil architecture samples in Jeddah city. In this study, the process was accelerated by using laser scanning techniques and automatic/semi-automatic surface knitting utilities for custom-made or uniquely produced wooden ornaments. Gökmen et al. (2021), on the other hand, examined the muqarnas element, which was typically used in mosques of the Seljuk period, specifically for the only mosque in Kayseri, and defined it as a productive algorithm by computationally analysing the growth and branching behaviours through geometric and trigonometric relations consisting of the 2D projection of the muqarnas. (Figure 4).

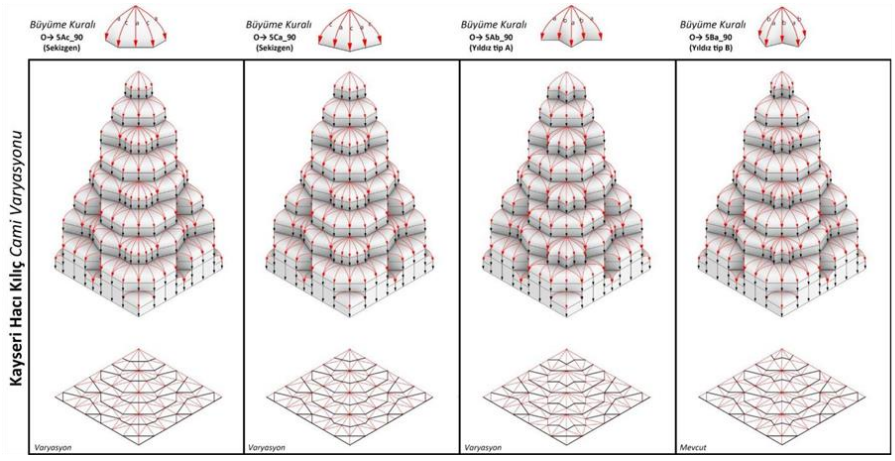


Figure 3. *Different Muqarnas variations* [25]

In the conference paper of Altun and Özkar (2021) , the pattern on the brick wall panel used in In Anadolu Selcuklu architecture was examined and algorithmically analysed. In this direction, it has been possible to reduce hundreds of different shape alternatives to a single object with minimal parameters, depending on the parametric relationship rules, through the HBIM/BIM Library. [26].

D FIELD STUDY: AKÇAKOCA DISTRICT, YUKARI NEIGHBORHOOD REGISTERED HOUSE WITH INVENTORY NUMBER 56 IV

Although the Upper neighbourhood of Akçakoca District, Düzce Province, has remained from the Ottoman settlement in general, organic planned urban texture is seen. A new orthogonal grid-textured settlement system was built in place of the houses that burned down as a result of a large-scale fire at

the beginning of the 20th century. There are 84 registered houses in the area, among other registered building types. The historical texture has largely survived to the present day due to the fact that there are a lot of registered buildings, they are partially well preserved, and life continues inside the buildings. Within the scope of the street rehabilitation project in the area, laser scanning, point cloud and orthophoto data were created in 2007 by the BHA zoning planning firm. The first study was not accepted by the Kocaeli Cultural Heritage Preservation Regional Board as a result of the failure to carry out the individual survey, restitution and restoration works of the registered buildings in the area, and the study was terminated after the street survey and application drawings were obtained.

Akçakoca Municipality's collective grant application to the Ministry of Culture and Tourism for the same area in 2018 resulted in a positive result for the street rehabilitation of Cumhuriyet Street and Gören Street, the preparation of the survey, restitution and restoration projects of the registered houses on these streets. The second street rehabilitation project was undertaken by Yıldız Architecture Office. Measurement details in the field; Measurement operations were performed with an on-site laser scanning device, a point cloud was obtained. The resulting raw scan data is combined with 3d laser scanning, scene 5.5 program. After the merging process was completed, the colour was assigned to the point data in each coordinate from the photos obtained with the integrated camera of the device and the colouring process was performed. The resulting point cloud data was transferred out of the program and converted to a format that can be used in computer aided design (CAD) programs. In addition, the obtained point cloud data was transferred as a 2-dimensional orthophoto in dwg format (Yıldız Architectural Office, 2020). In this process; While there are 12 registered houses within the scope of the project, the measurements and drawings of this house could not be made within the scope of the collective grant, as a result of the beneficiary's non-consent of one house. The house that is the subject of the field study of this study is the housing structure with inventory number 56, located on 251 Island 7 plots. Although the building is the most qualified residential structure that is often found in old photographs and is considered worthy of being recorded, it has lost its original qualities today. In two street rehabilitation studies carried out at different times in the same historical area, serious differences were determined on the basis of this structure (BHA Zoning Planning, 2007; Yıldız Architectural Office, 2020). In the first survey study, 2D CAD drawings and some photographs of the single facade of the original state of the building were obtained. Later in the building, the windows in the attic were closed, the windows were converted to plastic-based materials, the arches and ornaments on the roof were destroyed, the facade was plastered and painted. Thus, in the process of the second study conducted in the field, it became impossible to have an idea of the original state of the structure without previous reports and drawings. Within the scope of the street rehabilitation project in the building, an application project was proposed by taking the old survey and application drawings as reference. (Figure 5).

(a) *(b)*

Figure 4. *Current state of the building (a) (1. author, 2020), (b) Application project (BHA Architecture, 2007)*

The "scan to BIM" process of the study could not be followed because the registered house did not give permission, the previous laser scans could not be reached, and therefore the point cloud could not be reached. While 2-dimensional drawings with orthophoto and dwg extension of a single facade can be

accessed in the first relief drawings, the study was carried out in the form of transfer from two dimensions to three dimensions due to the fact that a maximum of 2 facades can be reached in the photographs. Within the scope of the HBIM study, the windows, doors, shutters of the two facades of the building were modeled one by one from the beginning (Figure 6). While modelling the building elements, Sketch Up software was preferred due to its ease of modelling, widespread use and ease of transfer.

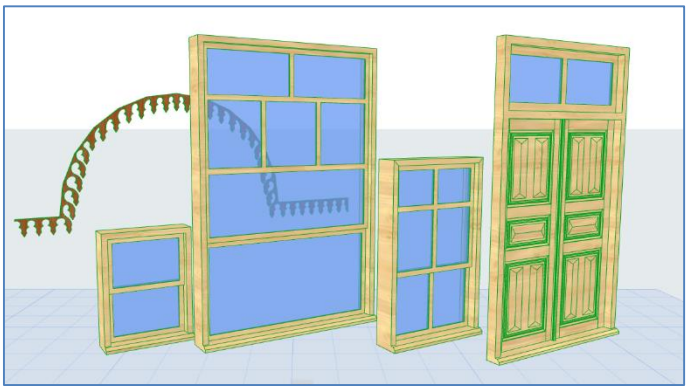


Figure 5. *Intermediate step of HBIM library creation.*

After the Sketch Up model was created, the models were defined as sub-elements of BIM objects in the Archicad (Graphisoft) program. Thanks to this, it is possible to access it from the settings of the corresponding building element. If the subject of the door leaf is to be detailed, after a door leaf is transferred to the BIM program individually, it is placed on the appropriate plane and defined as a "door leaf" sub-object, and then it is possible to reach various variations in accordance with the sub-parameters of the door element. As can be seen from Figure 7, hundreds of different types of doors can be easily obtained as a result of different combinations with many different sub-elements such as width, height dimensions, hadle and kick plate, opening lines, materials (separately for the door leaf, frame, handle), details of the door placement on the wall, brick arch, sill, interior-exterior moldings, shutter, hilly lighting.

a) *b)* *c)* *d)* *e)*

b)

Figure 6. *Creating door leaf alternatives as parametric objects 7a) Door parameters, 7b) single wing version 7c) Single wing, louvered version, 7d) Double-winged version with a mesh belt, 7e) Double wing, hilly version*

After the structural elements were modeled, the walls of the structure were described as three-dimensional with wooden carcasses and brick mesh. A photo-realistic image of the building, whose modelling was completed, was created in the BIM program. Thus, the modelling of the building in

accordance with the first survey project was completed and its phases at different times were brought together (Figure 8).

(a) (b) (c) (d)

Figure 7. *a) The old picture of the registered structure, b) current state, c) the modeled version of the structure, d) photorealistic image of the structure*

The created model was transferred to a program called Enscape, which provides photo-realistic image creation and interactive interaction, a similar data transfer is also possible for the Graphisoft BIMx program. It is possible to assign materials, control natural and artificial light, place landscape elements, people, vehicles in Enscape software. With this software, the model was transferred to the virtual environment via the web page and interactive access was provided by the web address [27] (Figure 9). In this environment, the user, employer or visitors can make interventions such as walking around the building, adjusting the perspective, and clarifying the edge contours. Easier and faster access is provided by transferring the web page to which the model is transferred to the data matrix. (Figure 9). As the next step, the QR code is placed in a corner of the building and it is aimed that the visitors coming to the historical neighbourhood will have the QR code read and experience the original state of the building on their mobile devices or with virtual reality glasses.

Figure 8. *Provided interactive access to the virtual environment of the proprietary structure (https://api2.enscape3d.com/v1/view/8e96842b-29a8-4408-ac83-99c07b6489de)*

Apart from this method, it is also possible to model directly by means of parametric window elements in BIM programs. In the Revit (Autodesk) program, family; in Archicad (Graphisoft) GDL (Geometric Description Language) are used to create parametric objects. It is also possible to create parametric doors and windows with the İdeCAD Odt program, which is a sub-program of IDECAD. Although it is possible to transfer models to each other in any program that can transfer files in 3ds, Obj, IFC (Industry

Foundation Classes) format, the number of polygons, surface quality and transfer success vary. The work flow chart of the case study is given in Figure 10.

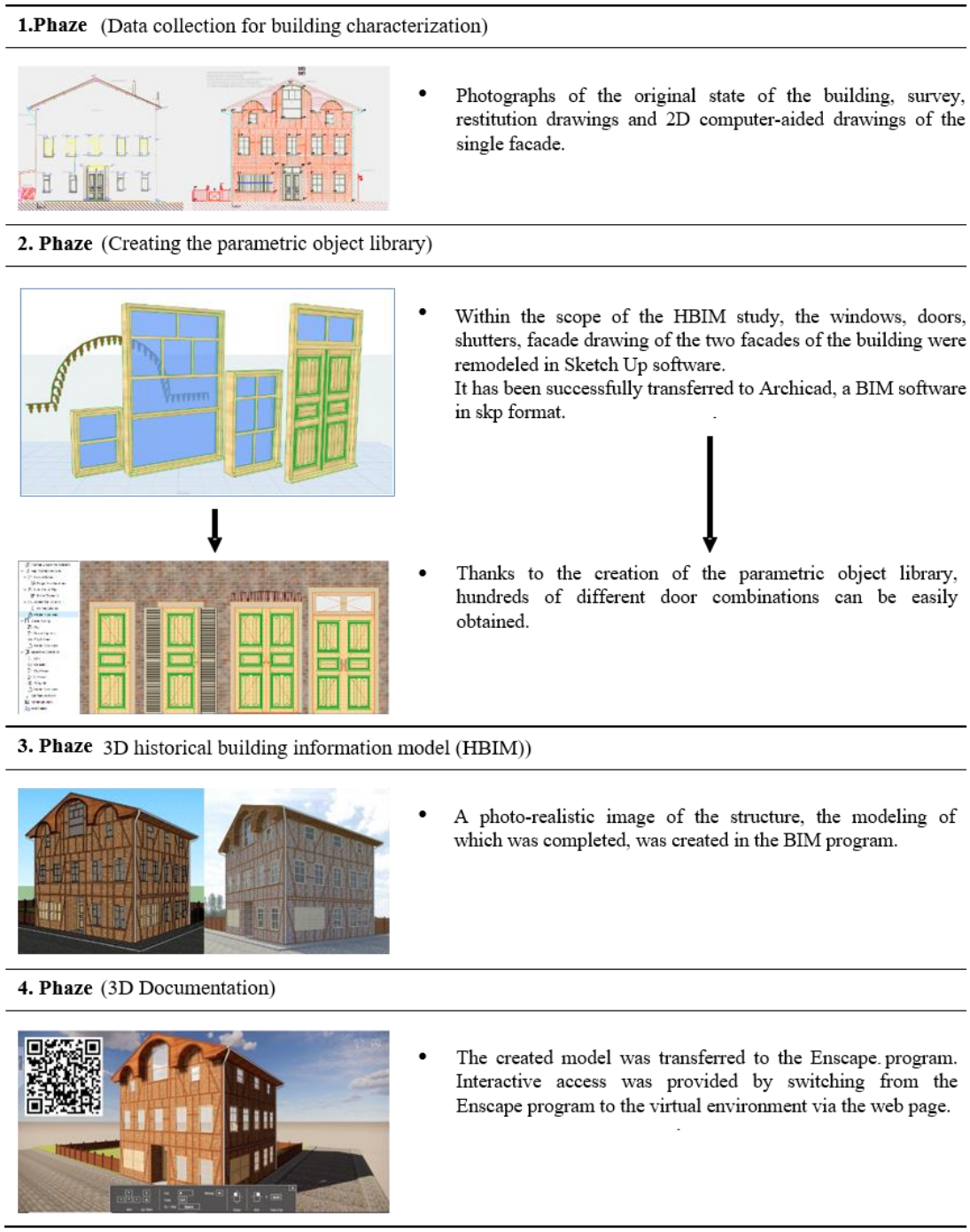


Figure 9. *HBIM Case study procedure sequence*

IV. DISCUSSION

When the literature review and the field study are evaluated, it is seen that parametric objects are one of the most important elements of BIM and HBIM. Unless metadata is not processed into the model, the information transfer part to the future will be inadequate.

Details such as doors, windows, shop shutters, railings, pediment decorations can be defined parametrically thanks to the use of parametric object-based software of the case study. In this case, as a result of creating, classifying these elements as parametric objects, sharing them as open sources would be expanded. Documenting structures in another part of Anatolian houses' elements, transferring them to the BIM environment, introducing them, and converting them into a digital heritage would provide great convenience and speed. At the same time, a large number of usage alternatives are created by providing a variety of objects such as doors and windows.

In geographies containing many cultural heritages, the conversion of buildings, and traces of structures into digital heritage will of course be a difficult, time-consuming and costly process. With the creation of HBIM libraries, this process can be shortened, simplified or even partially semi-automated.

With HBIM, the decision-making process can be managed through a single platform where more controlled analyses and simulations can be made. At the same time different stakeholders can provide information and control about the structure, periods and interventions, instead of sudden decisions that need to be taken during the repair. Similarly, it can be decided which of the repair alternatives to be made is more sustainable. Also, The HBIM model can be used for energy calculations. The supporting process of the building can be modelled by performing static calculations and simulations.

In addition, limiting the number of visitors according to the time and place, as in the process of epidemic diseases, can prevent both the risk of contamination and the damage of the building due to the crowd. By making fire evacuation simulations, emergency action plans can be developed. Besides it is possible to switch the building to smart building with the advanced technologies.

In cases where these studies are not carried out, it is possible for us to lose this cultural diversity and not to reach it with sufficient efficiency. As indicated in the field study, the measurements taken earlier provided qualified data on the original appearance of this particular building, so that it could be modelled, transferred to HBIM and virtual reality. Otherwise, the most qualified residential structure belonging to the historical neighbourhood would have been deleted from the urban memory along with people's memory. It has become impossible to make a match between the old photographs and the current state, and to define the place of the building in the memories.

V. CONCLUSION

Architectural Heritages are valuable universal values, and the preservation and transfer of these values to future generations is fixed by international conventions. HBIM is an up-to-date method that is frequently used at the international level for the protection and transfer of cultural heritage as digital heritage. With HBIM, cultural heritage is modelled with the help of parametric objects in a computer environment and historical background, material composition, structural components, distortions, etc. are added to these parametric objects outside the geometry of the structure all information can be integrated. Thus, it provides the opportunity to edit and update all the information about the architectural structure, to carry out conservation, evaluation and restoration interventions of the structure in the most accurate and effective way. Also, HBIM; It has led to the creation of new areas of use in taking the survey of historical buildings, 3D modelling, re-functioning, creating the HBIM library, embodying cultural heritage in the digital world with VR (virtual reality)-AR (augmented reality), increasing virtual museums and virtual applications in museums.

The use and dissemination of HBIM will make it easier for us to better protect our cultural heritage and pass it on to future generations; protect our cultural heritage buildings from threats. In addition to the protection of registered heritage buildings, the protection of non-registered rural heritage and modern heritage is almost as important. Archiving these structures using HBIM methods and keeping them as digital cultural heritage means preventing them from being completely lost.

There are multi-layered structures in geographies such as Turkey that have witnessed the lives of many ancient civilizations. It is not possible to reach all of these layers due to physical, temporal and economic reasons. With HBIM, heritage structures that cannot be reached in these layers can be digitized and their original state can be obtained digitally. With this model, concepts such as community awareness, common cultural heritage concepts, and urban memory can be kept alive for users living and visiting the historical area.

In terms of archiving, the digitization of archiving techniques in the Directorate of Surveying and Monuments will also increase the continuity and controllability of information. At the simplest level, archiving point clouds obtained as a result of laser scanning with cloud technology, which can also be accessed at the public's common service, will be much more effective than physical archives.
Transferring cultural heritage structures to HBIM is a more dynamic and accessible expression system in order to reflect data collecting. For this reason, sharing the HBIM library with open code under a certain legal protocol will be an important step for its widespread use.

One of the most important elements in the transition to digital with HBIM is the creation of a parametric object library. In this direction, HBIM libraries should be created regularly by classifying them in regional and historical terms. For this reason, architects need to master parametric design methods as well as three-dimensional modelling techniques. In this way, architects can take more creative, goal-oriented approaches that can actively contribute to the program, not just a user in BIM programs. Thus, it will begin to play an active role on object libraries and therefore on HBIM. It is possible to increase our influence in recognizing, promoting, disseminating our own cultural heritage and transferring it to younger generations.

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