

DOCUMENTATION OF HISTORICAL OBJECTS AS AN ASPECT OF ARCHITECTURAL EDUCATION

Ana Momčilović-Petronijević ¹

Milanka Vasić ²

Mila Cvetković ³

UDK: 72:374

DOI: 10.14415/konferencijaGFS2018.050

Summary: Historical buildings represent a very complex part of cultural heritage. Recording their data and making technical drawings are a crucial part of their preservation. Unfortunately, sometimes this is the only mark left behind these buildings. The buildings which are highly damaged or completely ruined can be analysed and explored just from technical documentation. Creation of technical documentation and recording these buildings should be an integral part of education of architecture students. Besides contributing to better understanding of the construction, construction details and materialization, it also develops a better sense for a team-work among students, a better corporation on projects and, especially, mutual responsibility. This paper displays some of the aspects of examination of historical objects, as a form of education of future architects.

Keywords: cultural heritage, documentation, historical building, student education

1. INTRODUCTION

Historical buildings represent a very complex part of cultural heritage. A great attention is brought upon their preservation, promotion and protection. Recording data about historical buildings through written documents and photography is not sufficient. Making technical documentation is obligatory when it comes to preservation.

Technical documentation is necessary in cases of reconstruction or when it comes to tracking changes that happen over time. Works on repairs, revitalization or rehabilitation of facilities are possible only with the possession of detailed data and extensive documentation about it. Engineering techniques are nowadays sufficient enough to enable virtual presentations and promotion of cultural heritage, but for this we also need technical documentation.

The Law on Cultural Property of the Republic of Serbia prescribes the recording of objects as a compulsory part in the procedure of legal protection and proclamation of a particular object as a cultural monument. Unfortunately, sometimes this is the only

¹ Ana Momčilović-Petronijević, PhD, Assistant Professor, Faculty of Civil Engineering and Architecture, University of Nis, Aleksandra Medvedeva 14, Niš, Serbia, tel:+38166330258, e-mail: ana.momcilovic.petronijevic@gaf.ni.ac.rs

² Milanka Vasić, architect, assistant, Faculty of Civil Engineering and Architecture, University of Nis.

³ Mila Cvetković, MscArch, PhD student, Faculty of Civil Engineering and Architecture, University of Nis.

possible way of preservation. A clear image of ruined or completely destroyed buildings we sometimes get only from this kind of documentation.

Today, a large number of techniques for collecting and processing data are available, but depending on conditions and equipment, the most used ones are: laser recording, photogrammetry and manual measuring and drawing. Depending on what kind of documentation is needed, one of these techniques would be used. Adoption of a certain geodetic exploration also depends on the type of a monument (if it is an individual monument or one of a more complex form).[1]

Recording of historical objects should be a crucial part of education of architecture students. Besides helping a better understanding of building construction, construction details and material characteristics, this kind of recording develops the sense for teamwork and mutual responsibility among students. This paper displays a short historical overview on object documentation. It also shows some of the methods mostly used in this area. It displays an overview on student activities at the Faculty of Civil Engineering and Architecture in Niš, within the subject of vernacular architecture, at the field of recording and documenting objects of traditional architecture. This aspect of education, and field-work training is very important in education of architecture students.

2. DOCUMENTATION OF HISTORICAL OBJECTS THROUGHOUT TIME

Documentation of historical objects which are part of cultural heritage, their digitalization and construction of 3D models is a crucial part of cultural heritage preservation. The method of collecting data on objects has evolved significantly through history [2]. Through history, new tools for this purpose appeared, and new documenting needs along with them. Although a large number of modern techniques of recording objects are available, manual data collecting is still in use by taking measures with sticks or tapes, and hand drawings. This part of documentation is a very important part of education of architecture students.

Recording the buildings, taking measures and drawing, has an important pedagogical role in forming an architect [3]. Documenting process is itself a crucial part of education of architects. Vitruvius, Leonardo da Vinci, Le Corbusier are some of many famous creators in the field of architecture and art who used the documentation of existing buildings as an integral part of their opus [3]. Starting with Vitruvius, who left behind architectural treatise *The ten books on architecture (De architectura, libri decem)* [4], as a kind of testimony to the architecture of the ancient era, many architects recorded data on architectural objects of their time. The entire period of the Renaissance is based on the analysis of the architecture of ancient buildings. Andrea Palladio [5] in his work *Antiquities of Rome (La Antichita di Roma)* gave a systematized description of old ruins and their history. Vignola, Serlio are a few of many names with their opus based on the analyses of antique architecture [3]. Drawing and sketching existing objects was one way of understanding the history, understanding construction, shapes, details... Architects from later periods, like Corbusier and many after him, did sketches and analyses of historical buildings.

The cultural monuments protection services are today at a very high level in the world. In Serbia, the cultural monuments preservation started in 1947 by forming The Institute for preservation and scientific studies of cultural monuments, Republic of Serbia, based in Belgrade [6]. Up to now, Serbia has a web of services, each with its own territorial jurisdiction, doing implementation of laws on immobile cultural goods. The law on cultural heritage in the Republic of Serbia [7] establishes documentation and archiving of data on protected objects as one of the basic requirements of protection. Institutes thus became one of the basic sources of information about our architectural heritage. In the beginning, they possessed archives of field documentation, and documentation which was made later. That documentation was made of large number of pencil on paper drawings, ink on tracing paper or regular paper. With the development of drawing software, field documentation began to be developed on computer, thus obtaining data in AutoCAD or some other software. Comprehensive digitization has begun with the creation of software packages for archiving, systematization and data management. In the past years, object recording, like a direct contact with objects that were built, was a structural part of education of students. This concept was abandoned over time. It is necessary that the student, through fieldwork, develops the skill of noticing, observing, understanding the spatial structure of objects. In order for the student to draw the foundation and cross-section of the building, it is necessary to understand its spatial structure. Based on field drawings, with the help of photography and modern modelling methods, it is possible to accomplish a complete building presentation. Therefore, the recording of objects represents a very important part of architectural education.

3. DOCUMENTATION PROCESS

Documentation of architectural objects is a very complex process. It includes several phases: collecting information about the object in the field, taking measures, making sketches, taking notes, interpreting the data in office conditions and developing the field sketches, and digitalizing drawings. The new era of digital measuring devices and scanners greatly shortens the process of data collection. For instance, a LiDAR technology is an example of a laser field recording [8], which enables positioning underground objects with high precision, so according to these recordings a precise situation could be achieved even without archaeological excavation.

With the digital era, digital documentation also took part in monument preservation. In this way, it is possible to replace the physical archives with digital files (which reduces the required physical space for the archive, it is ensured from decaying over time), digital data is available for various types of scientific research [9], and a number of other advantages. By digitalization of object recordings, mistakes that happen during conversion of analogue plans to digital ones could be avoided. Human work throughout the documentation process is minimized. Adopting the methods for documentation that include procedure automation means that students are likely to be distanced from material culture and heritage that surround them [3].

In the past, with only available hand-held accessories for measuring and drawing, such as ribbons, pin meters, students were in direct contact with historical constructions. Today, due to all previously stated, students do not have close contact with historical buildings. Photogrammetry, recording with total station... enable objects to be recorded

from large distances, automatically digitalized, and therefore the student, or any other recorder, is not directly related to the object itself.

Students of the Faculty of Civil Engineering and Architecture at the University of Niš, within the subject of vernacular architecture, have assignment to record a certain object that contains elements of traditional architecture, so they have a chance to explore and learn in this field. Also, the Institute for preservation of cultural monuments in Niš, has great cooperation with the Faculty of Civil Engineering and Architecture and often engages students to record cultural heritage objects. This cooperation is beneficial for both institutions, as the Institute in this way completes its documentation and gets help in collecting it. Students, on the other hand, are very much using such experience as education in the recording techniques, but also as learning about the procedures and phases that are necessary to protect the cultural heritage and other objects that are in the process of protection, and which are of cultural and historical importance.



Figure 1. Training students to work with total station, hand drawing of rampart of the Acropolis at Caričin Grad, foto: Č. Vasić

Caričin Grad (Figure 1.), Mediana are only some of archaeological sites in whose recordings students participated. The students were also engaged in recording of objects of traditional architecture during the preservation study of Gostuša [10], and also during reconnaissance of the field in various purposes.

4. A CASE STUDY – OBJECTS OF VERNACULAR ARCHITECTURE

Vernacular architecture, as an aspect of cultural heritage, is often wrongly neglected. The objects of vernacular architecture, as a special form of cultural heritage represent the testimony about lifestyle in certain period of time, testimony about nature and characteristics of available materials, and also about the way of building, which was different for every region. Given the nature of the materials from which they were built, some of them are more exposed to decay than others. Wooden skeletons of post-and-pan constructions, fillings made of plaits, tugs or baskets, mud plaster and the like, are porous materials, they absorb moisture from the air. They are not resistant to atmospheric influences, unlike more permanent objects made of stone. One the other

hand, these objects are nowadays mostly abandoned and left to ruin, due to massive migrations and movement that take place in rural areas.

In other parts of the world, by rural development policies, the preservation of national architecture is viewed as a priority goal. Most of the funds allocated for this purpose are intended to convert old objects of vernacular architecture into attractive rural tourist institutions or to tourist destinations [11]. In our region, the situation is slightly different. Small family houses are inappropriate from the aspect of revitalization and conversion to objects of different contents, such as inns, restaurants, wineries, and the like. It should also be noted that the institutional and demographic capacity of a modern village today is most often such that there is no need for this type of facility [12].

Architectural recording and documentation of these objects becomes one of the ways of recording and keeping them from complete oblivion and permanent loss. Within the subject of vernacular architecture at the Faculty of Civil Engineering and Architecture in Niš, for many years now, students can have, during educational activities and programs on which this subject was based on, a practical training by using recording methods and by drawing these objects, as part of educational process.

In the previous semester, a generation of students that had this subject during the school year 2017/2018, at the fourth year of their studies, made records and drawings of objects of national architecture on the territory of the Gadžin Han municipality. These objects were firstly measured and sketched, and after that, digitalisation of these drawings was carried out. A complete textual description of objects was made, from functional analysis, object history, applied materials and construction techniques. 3D models of recorded objects were also made.

4.1 DRAWING OBJECTS BY HAND

Students are measuring buildings in the field by using measuring tapes, ribbons, laser tapes. They are recording dimensions from drawings they made. They are also collecting information about materials, fillings, they are taking photographs of the interior and the exterior. They are getting in touch with objects which were used in these houses (Figure 2).

Field drawings are later, in the office, converted to digital ones, by using measures taken in the field. A special aspect of this kind of education is a direct contact with objects, but also with residents who are often descendants of people who built them. In direct contact, through conversation, students hear interesting family stories, which are related to the construction of the house and the former life in it.

The objects are measured no matter what state they are in. Some are completely rehabilitated and conditioned for life, and as such are still in function, but there are others which are abandoned, partially demolished. With great caution and only with the consent of the professor, such facilities are measured, with the primary concern for the safety of students in the field. In these cases, with the consultation of available photographs and literature, access to the collected field material is accessed and the building partially reconstructed in the drawing.

The developed field documentation is an excellent basis for creating a 3D model of the object. Such drawings are a necessary part in the process of a possible proclamation of a cultural monument, and its legal protection (Figure 3).

4.2 THREE-DIMENSIONAL OBJECTS

According to digitalised floor plans, cross-sections and facades of objects, students make 3D models of these buildings, in some of software programs, AutoCad, ArchiCAD, 3dsMAX Studio, etc. As an example of a three-dimensional representation of objects of national construction, in order to understand the constructive framework, the model of a konak (overnight stay) in Rudare is shown. The image on the left shows the post-and-pan house construction without filling, along with a roof construction without covering. The image on the right shows the same object with the finishing coating. (Figure 4)



Figure 4. 3D model – construction and external appearance of the house, student work (author: Tačić Strahinja)

4.3 PHOTOGRAMMETRY

During drawing and modelling of certain objects, the most precise way is to take measures right on the spot, because they can give us real dimensions and proportions. However, there are cases when this is not possible. Photogrammetry is suitable in occasions where access to objects is difficult, where there is no possibility of precise measures (for example, because of the height), in cases where field conditions are not safe because of the possibility of collapse, etc. [13]

Photogrammetry is a method that aims to convert the previously photographed building, or any object, from an analogue to a digital form, and thus enable its subsequent processing in different software [14]. It also includes measuring and data processing [15]. It allows us to get 3D model out of photographs, and materialization of the interior and the exterior. Photogrammetry is not an ideal dimensioning method, but it is fast and simple. One of the programmes that offers photogrammetry modelling is SketchUp. (Figure 5)

One of the areas where the models obtained in this way also have the application is the creation of Google Earth 3D display. Today, there is a new option of ‘walking’ through the planet, and online viewing of every part of the Earth. One more change is, so called, augmented reality. Augmented reality (AR) programs have a wide application in archeology and the virtual heritage system [16].

Our faculty has been organizing Summer Schools of Traditional Architecture in the last few years as a special kind of educational program for interested students, and at the initiative of the Association from Dimitrovgrad. From 2015 to 2017, students spent time

in Poganovo and Gornji Kravidol, the Dimitrovgrad municipality, Serbia and Mirkovo, Republic of Bulgaria, because cooperation has been achieved with the University of Architecture and Geodesy in Sofia. The goal is to get acquainted with the objects and life in these places in direct contact on the spot, and as a result of the work at these schools are the preliminary projects of reviving or replacing the objects of traditional architecture in those places. This type of cooperation of students and teachers on the field, in a continuous period of 7 to 10 days, with team work both on the recording of the objects themselves, and on the development of conceptual projects with a few lectures, gives very good results.

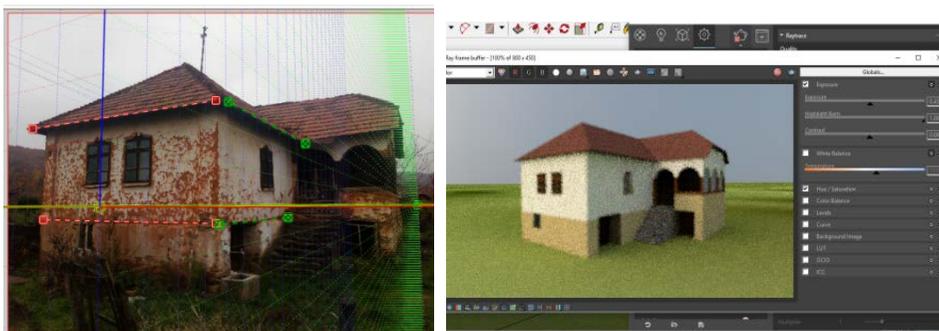


Figure 5. Photography and 3D model created based on it, author: Mila Cvetković

5. CONCLUSION

Historical buildings, as already mentioned, represent a very complex part of the cultural heritage. Preservation, revitalization and restoration of major part of this heritage today becomes a moral act and goal of experts in this field. However, recording data on historical buildings through historical facts and photographs is not enough, therefore, the preparation of technical documentation is a necessary part of preservation and represents the first stage of objects preservation procedure. It is crucial for their reconstruction and tracking of the changes that happen over time. With possession of detailed documentation, and considering the level of technical support that we have available, and which enables very good virtual presentation and promotion of cultural heritage, this aim may be achieved.

At the Faculty of Civil Engineering and Architecture in Niš, within different subjects, especially during the course of vernacular architecture, great attention is paid to training students, future architects, to learn how to independently and as a part of the team, measure and record data on historical objects. For the purpose of their more efficient work, during the summer, the mentioned summer school has been lately organized for those students who show special interest.

As the final stage after the complete graphic work has been completed, the exhibitions of student works are organized, and they show the works of best students. This presentation represents a stimulus for other students, so that this method of educational process, apart from a direct one, has an indirect positive effect.

Motivation of students in the process of education, besides the skills they master during this process, is one of the basic driving mechanisms that good teaching programs can offer, and engaged and dedicated teachers and professors can transfer. Training future architects to document data on cultural-historical monuments, historical objects or objects of cultural heritage independently or team-based by field measurements is an important part of the overall architectural skills and later architectural practices.

Acknowledgements

The paper was written within the project Optimization of architectural and urban planning and design in function of sustainable development in Serbia, (TR36042) funded by the Ministry of Education and Science, Republic of Serbia.

REFERENCES

- [1] Tomić S.: Fotogrametrijsko skeniranje kulturno istorijskih spomenika. *Zbornik radova XII Međunarodna naučno – stručna konferencija Savremena teorija i praksa u graditeljstvu*, 7-8. decembar **2016**, Banja Luka .Univerzitet u Banjoj Luci, Arhitektonsko-građevinsko-geodetski fakultet. pp. 337-344.
- [2] Núñez Andrés M^a A., Buill Pozuelo F.: Evolution of the architectural and heritage representation. *Landscape and Urban Planning* 91, **2009**, pp 105–112
- [3] Warden R., Woodcock D.: Historic documentation: a model of project based learning for architectural education. *Landscape and Urban Planning*, 73, **2005.**, pp. 110–119
- [4] Vitruvije M. P.: *O arhitekturi*. Prevod, predgovori komentari Zoja Bojić, Zavod za udžbenike i Dosije studio. Beograd, 2009, 313 str
- [5] Wundram M., Pape T.: *Andrea Palladio Architect between the Renaissance and Baroque*. Taschen GmbH, **2004.**, 248 p
- [6] Republički zavod za zaštitu spomenika kulture Beograd (odg. urednik Mileta Milić): *Čuvari baštine, 50 godina rada Republičkog zavoda za zaštitu spomenika kulture*, Beograd **1998**, 188 str
- [7] Zakon o kulturnim dobrima - Službeni glasnik RS br 71/94
- [8] Ivanišević V., Bugarski I.:Primena LiDAR tehnologije u analizi topografije Marguma/Morave i Kuliča. *Starinar LXII*,**2012**, Arheoloki institut Beograd, pp.239-255
- [9] Đorđević M.: Značaj digitalnog dokumentovanja u zaštiti graditeljskog nasleđa, *Nauka+Praksa*, Institut za građevinarstvo i arhitekturu Niš, **2009**, v. 12, no. 1, pp. 22-25.
- [10] Vasić-Petrović E.: *Studija zaštite sela Gostuša u opštini Pirot sa predlogom za proglašenje za prostorno kulturno istorijsku celinu*. Zavod za zaštitu spomenika kulture Niš i Fondacija arhitekta Aleksandar Radović, Niš **2016**, 222 str
- [11] Fuentes J. M.: Methodological bases for documenting and reusing vernacular farm architecture. *Journal of Cultural Heritage* 11, **2010.**, pp 119-129.
- [12] Vasić M., Momčilović – Petronijević A., Mitković M.: Social and economic integration of cultural heritage – in case of traditional architecture on rural area in Serbia. *Proceedings International Scientific Conference PRESERVATION OF*

- CULTURAL HERITAGE BASA 2017*, 23-25 november 2017, Sofia, Bulgaria. Bulgarian Academy of Science and Arts, Scientific Institute for Architecture, Construction and Urban Planning, pp 55-66
- [13] Stojaković V.: Virtuelne trodimenzionalne reprezentacije arhitektonskih objekata kreirane na osnovu perspektivnih slika. *Nauka+Praksa*, Institut za građevinarstvo i arhitekturu Niš, 2009, v. 12, no. 1, pp. 208-211.
- [14] Ilić N.: *Primena fotogrametrije za generisanje digitalnog modela*, 2017. <http://www.arhns.uns.ac.rs/givsf/primena-fotogrametrije-za-generisanje-digitalnog-modela/> accessed, february 2018.
- [15] *Introduction to Photogrammetry*, Department of Civil and Environmental Engineering and Geodetic Science, The Ohio State University, Columbus, 2005. pp 95, <http://www.mat.uc.pt/~gil/downloads/IntroPhoto.pdf>, accessed, february 2018.
- [16] Noh Z., Shahrizal M., Pan Z.: A review on Augmented Reality for Virtual Heritage System, part of the *Lecture Notes in Computer Science*,. M. Chang et al. (Eds.): Edutainment 2009, LNCS 5670, Springer Berlin, 2009., pp. 50–61.,

ДОКУМЕНТОВАЊЕ ИСТОРИЈСКИХ ОБЈЕКТА КАО ВИД АРХИТЕКТОНСКЕ ЕДУКАЦИЈЕ

Резиме: *Историјске грађевине, представљају веома комплексни део културног наслеђа. Бележење података о њима и израда техничке документације представљају обавезни део поступка заштите. Некада је, на жалост, то и једини траг који о овим грађевинама остаје. Објекте, који су веома оштећени или потпуно порушени, можемо упознати и добити представу о њиховом изгледу, управо из техничке документације. Израда теренске документације и снимање оваквих објеката требала би да буде саставни део едукације студената архитектуре. Осим што помаже бољем разумевању склопа грађевине, његових детаља и материјализације, код студената развија осећај за тимски рад, сарадњу на пројекту и посебно заједничку одговорност. У раду су приказани неки од аспеката документовања историјских објеката као вида едукације будућих архитеката..*

Кључне речи: *културно наслеђе, документација, историјска зграда, студентска едукација*