Documentation of the Leprosarium of Chios

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Abstract. The documentation of an edificecan serve different purposes, such as restoration, renovation, repair, interventions, etc. When it comes to architectural heritage, documentation is the first step in the process of restoring a monument - the basic stage for its rescue and protection.

The evolution of technology has given an abundance of equipment and methods in order to use for reaching the desired precision and minimizing the measurements' time. The key factor, to the creation of a correct geometric diagram/plan, is the combination of these methods, especially when it comes to areas of historical importance.

Nevertheless, a substantial understanding of the historical building, a fundamental condition for any intervention, should include not only geometric documentation but also the recognition of the structure (i.e. the synthetic and functional composition) and its form (i.e. its building and construction characteristics). Also, the understanding of the historical and architectural knowledge it contains, the recording, analyzing, and interpreting as a tangible example of values.

In this paper the procedure of the documentation of the Leprosarium of Chios Island, is presented. First established in 1378, took its final form in 1933 and abandoned in 1959 is one of the longest-term health institutions of Greece. The very interesting building complex, in terms of historical and architectural value, was classified as a protected historical monument, in 2011. However, this was not enough for the protection of this important monument, as today it is completely abandoned.

The paper focuses on the geometric documentation of the Leprosarium, carried out with contemporary combined methods (e.g conventional reflectorless total station, geodetic GNSS, close-range photogrammetry, aerial measuring methods, etc).

It also attempts the overall recognition of the monument, based on the perspective of revealing, saving, and exploiting this unique historical monument of Chios.

Keywords:documentation, Cultural Heritage, Leprosarium of Chios, close-range photogrammetry, aerial photogrammetry, Orthophoto/Rectified Image

1 Introduction

Architectural Heritage, as a vital part of Cultural Heritage, is an expression of history and helps us to understand the relevance of the past to contemporary life. Constitutes a capital of irreplaceable spiritual, cultural, social, and economic value. An essential part of a community's identity that should be passed on to future generations as a part of the historical memory.

The issue of the protection and management of architectural heritage and the historic built environment nowadays is more topical than ever. The need to preserve important remains of the past and connect them with sustainable development policies, the functional activation of historical shells, and their integration into contemporary economic structures, alongside the need to directly connect the issue with the wider society.

Architectural Heritage is now treated as a single set of immovable cultural assets, part of the man-made as well as the natural environment, which must be globally protected, preserved as a non-renewable resource, and exploited through its integration into sustainable development, spatial and urban planning with the aim of producing social and economic surplus value [1].

The reuse of the Architecture of the past is an ancient practice that has greatly contributed to the preservation of historical structures, and to this day, it is an environmentally correct choice and offers great economic benefits. Reusing the past offers an invaluable experience, old spaces full of memories and values, which according to the prevailing ideology, must be preserved and highlighted in every way. By preserving historical structures communities can maintain their cultural heritage, provide educational and cultural opportunities, inspire new construction, and foster a sense of place and community identity.

Documentation is the basic tool, for the recording, analysis, and understanding of all kinds of constructions of the built environment. The first and necessary stage for the evaluation, restoration, preservation, and ″comprehensive″ protection of the architectural heritage in the present and in the future [10].

In this paper the procedure for the documentation of the Leprosarium of Chios Island is presented, a very interesting building complex in terms of historical and architectural value, today completely abandoned. The paper focuses on the geometric documentation of the complex, carried out with contemporary combined methods while it also attempts the overall recognition of the monument, based on the perspective of revealing, saving, and exploiting this unique historical monument of Chios.

2 The Leprosarium of Chios

The Leprosarium (or ″Lovokomeio″) of Chios is the first facility for the treatment leprosis, in Greece and one of the first in all Europe. It is located 1.5km north from

the city of Chios (capital of the homonym island) and 2km far from the port of Chios. The area around the complex and the supportive facilities is about 15000 sq.m.

It was first established in 1378, by Genoese in the area of ″Sifi″ (today is called Kofinas), in the Valley of Ypakoi, which took its name from the church Panagia Ypakoi (it still stands near the complex).The aim was to prevent the spread of the disease to the general population and to provide care and treatment for those who were affected. [2]

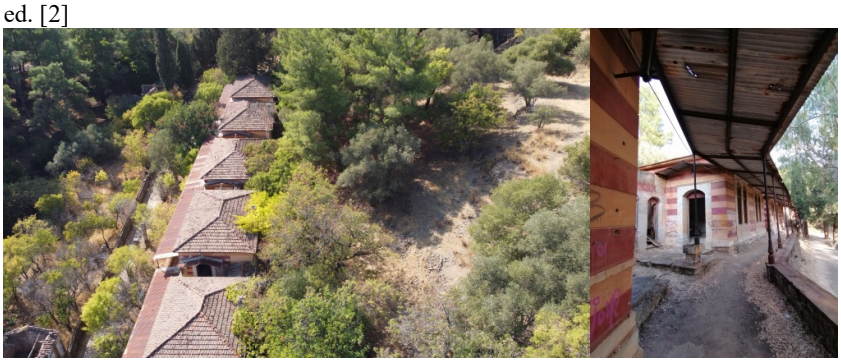

Fig. 1. The Leprosarium (or ″Lovokomeio″) of Chios.

During the prerevolutionary years the number of houses had reached 30 and accommodated up to 150 patients. In the massacre of Chios, in 1822, almost all the residents of the facility were slaughtered. Few years later, in 1931 the institution reopened, but during the catastrophic earthquake of 1881 it was completely destroyed. Its renovation started in 1885 with donations of wealthy locals but the conditions remained tragic and the institution was unable to meet its needs.

The first attempts for the full restoration started in 1909 with donations of Chians of the Diaspora, who were motivated by M. Kalvokoresis. With the designs of the engineer I. Veriketis, 16 antiseismic kiosks were built with 2 spacious rooms each, a covered outdoor space for the stay of patients, a small kitchen and a toilet. Each kiosk could accommodate 8 people.They were designed to accommodate both men and women, with separate quarters for each gender.

It took its final form in 1933. ″Lovokomeio″ by that time was a large complex of buildings, consisting, apart from the houses, of a chapel, a hospital and auxiliary facilities such as restaurant, laundry, recreation area and a sewerage network. There was also the possibility of hot water.

The materials were of excellent quality and many were imported from abroad, e.g. the iron poles for the roof from England, the tiles from France and the bricks from Asia. [3]

The chapel was an important part of the leprosarium and was used for religious services and other community gatherings. The hospital was equipped with modern medical facilities and was staffed by trained medical personnel. Patients were provided with medical treatment, including surgery, and were given the opportunity to participate in rehabilitation programs.

Despite its progressive design and purpose, life at the leprosarium was harsh and isolating. Patients were confined to the facility and were separated from their families and friends. They were subjected to strict quarantine measures and were not allowed to leave the facility or have visitors. This isolation was not only physically but also socially and emotionally damaging.

The colony shut its gates in 1957, leaving behind dilapidated ruins and memories of society's outcasts who inhabited the area for so long. [4]

In 2012 the complex was named as a modern monument from the Central Archaeological Council of the Ministry of Culture of Greece (decision ΥΑ ΥΠΠΟΤ/ΔΝΣΑΚ/99727/1801ΠΕ/5-3-2012, published in the Government Gazette 112ΑΑΡ/5-4-2012) [5]

Unfortunately, till today, the complex remains abandoned and fell into disrepair.

3 Documentation - Measuring techniques

Geometric documentation is the action of acquiring, processing, presenting and recording the appropriate data for the determination of the position and the actual existing form, shape and size of an object in the three-dimensional space at a particular moment. [6]

The process of geometric documentation involves the use of a variety of tools and techniques, including laser scanning, photogrammetry, and traditional surveying methods. These tools are used to create the drawing of the building or structure (e.g. topographic diagrams, elevations, floor plans, cross sections), which can then be used for further analysis and design work. From these data the

One of the key benefits of geometric documentation is that it provides an accurate and detailed representation of the building. This can be used to identify potential issues with the building's geometry and to ensure that it is built to the correct specifications. It can also be used to assess the structural stability of a building and to identify any potential safety risks.

Documentation is also useful for preserving the historical building. By capturing the details of a building's geometry, it is possible to create a digital archive of its design and construction. This can be used to inform future renovations or restoration work, and to ensure that the building is preserved for future generations[7], [8], [9].

The measuring techniques that were used in the specific case study and more or less can be used in almost every geometric documentation procedure are described below.

The duration of the measurement was 6 days combining conventional reflectorless total stations, geodetic GNSS, close-range photogrammetry, aerial measuring methods.

3.1 Conventional surveying methods

The conventional terrestrial surveying methods include the use of total stations and GNSS receivers for the calculation of the coordinates of specific points in a given reference system.

Depending on the accuracy and the size or geometry of the study area, the appropriate measuring method is chosen. The GNSS survey method can be used in an outdoor survey with clear horizon, but total station and its accessories can provide higher accuracy, which is necessary in documentation.

GNSS receivers were used to establish a geodetic network in the study area (static positioning) and to measure points in the perimeter of the study area (RTK technique). Total stations were used to establish a network of traverses along the building complex and to measure the points needed for the drawings [8].

3.2 Photogrammetry

Photogrammetry is a widely used documentation technique that involves the use of photographs to capture and analyze the geometry of a building or structure. This technique is particularly useful for capturing highly detailed and accurate information about complex shapes and structures that would otherwise be difficult to measure using traditional surveying methods.

Photogrammetry is based on the principle that photographs taken from different angles can be used to create a 3D model of the building or structure. To use photogrammetry, a series of photographs are taken from various positions. These photographs are then processed using photogrammetry software, which is used to extract information about the building's geometry [11].

One of the key advantages of photogrammetry is that it can be used to capture highly detailed and accurate information about a building or structure, even in difficult-to-reach locations.

Another advantage of photogrammetry is that it is a non-contact method, meaning that it does not require physical contact with the building or structure. This makes it ideal for the documentation of historic or delicate structures where direct contact could cause damage.

There are two main types of photogrammetry: aerial photogrammetry and close-range photogrammetry, both of which were used in the specific application,

Aerial photogrammetry was used to capture large-scale data, such as information about the topography of the landscape of the wider area. Moreover, it was used to capture the photographs just exactly above of the complex so that the orthophoto to be produced. Finally, it was used to take photographs from the facades

For the needs of the application the DJI Mavic Mini was used [12]. It is a light, compact and easy-to-use drone with a 12MP camera, suitable for close-range flights and applications.

Close-range photogrammetry is used to capture detailed information about smaller structures [13]. The principle is the same as previous. It involves taking multiple overlapping photographs of the object with a handheld camera. It is a quick and cost-effective method (compared to other techniques), without the need for specialized equipment.

It the specific project was used to take photographs of the facades of the complex in order to produce the corresponding orthophotos.

4 Measurements - Final products

One of the most important tasks in such projects is the preparation of the improvised sketches. The vast number of pointsthat are going to be measured and the amount of information that is depicted on each sketch, impose the need for legible and clear sketches.

A proper and detailed sketch provides a visual representation of the features of the-structure, giving a better understanding of it. It can also help in the decision of the shape of the geodetic network (traverses and station setups).

Finally, a sketch is a one-way in order to draw correctly the plans of the structure.

Different improvised sketches were prepared for the topographic plans, the floor plans (fig. 2), facades (fig. 3) and the cross-sections.

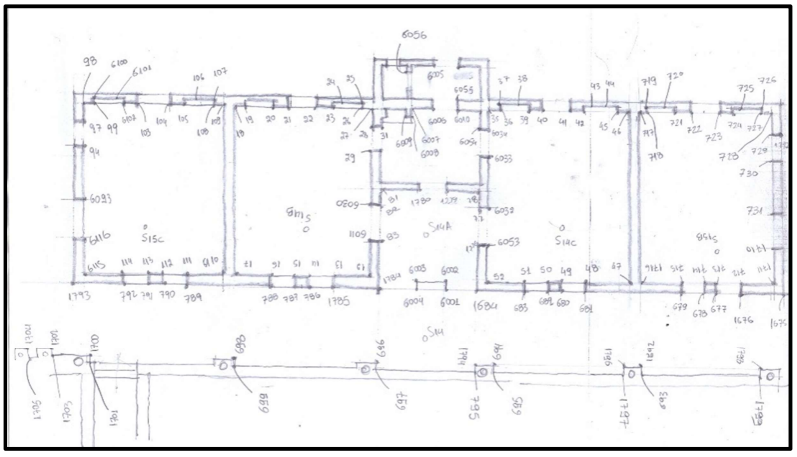

Fig. 2. Improvised sketch of the floor plan of a specific house block.

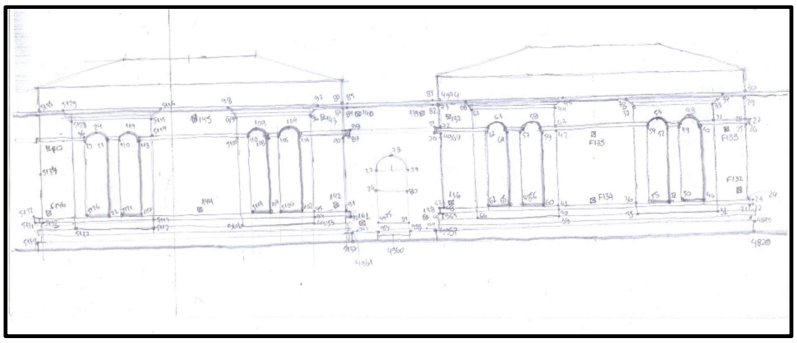

Fig. 3. Improvised sketch of the façade of a specific house block.

The network that was formed consisted of three (3) trigonometric points measured with GNSS static measurements and 95 station setups.

The points measured for the project were almost 1500 points for the topographic plan, 1400 points for the floor plan, 1200 points for the facades, 1000 points for the cross-sections.

For the creation of the orthophotos 80 photos were taken and 100 points were measured as GPSs.

The final products of the specific project were the all the drawings and orthophotos produced that describe the complex of Lovokomeio.

These include:

- Topographic plans of the wider area and the area of the complex in scale of 1:1000 and 1:200, respectively. They depict the building complex, the roads, the paths and the streams around it, the significant vegetation, height information (contours, and height points), cadastral information and information from the forest maps.
- Floor plan for the whole complex with precision of the scale 1:50(fig. 4). It depicts the whole complex with a total span of 225m. It includes information about the position, the size and shape of each kiosk, the different rooms in each kiosk with internal and external dimensions and their area, the position of doors and windows and height levels
- 4 façade plans (one for each façade) with precision of the scale 1:50 (fig. 5).They have information about the outline of the building, the location of wall, doors and windows as well as height levels.
- 3 cross-sections with precision of the scale 1:50. They have information about the height of the structures in the places where the cross-sections are made, the thickness of the walls and the roof, the projected windows and doors.
- 1 orthophoto of the south façade with precision of the scale 1:50. (fig 6). It complements the south façade plan, giving more information about the materials used and condition and the pathology of the façade.
- 1 orthophoto of the complex with precision of the scale 1:200 (fig 7), complementing the topographic plan.

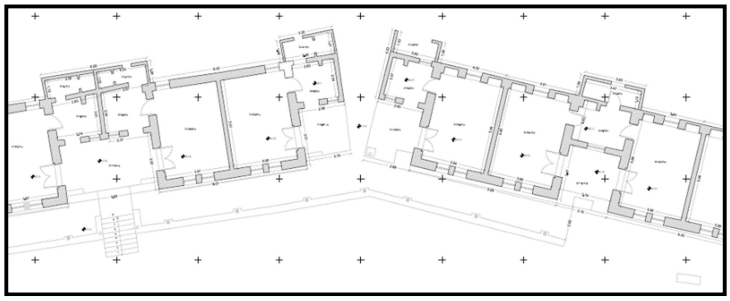

Fig. 4. Detail from the floor plan of the complex of Lovokomeio.

Fig. 5. Detail from the south façade of the complex of Lovokomeio.

Fig. 6. Orthophoto of the south façade

Fig. 7. Orthophoto of the complex

5 Results

The evolution of technology has given an abundance of equipment and methods in order to use for reaching the desired precision and minimizing the measurements' time. The key factor, to the creation of a correct geometric diagram/plan, is the combination of these methods, especially when it comes to areas of historical importance.

Nevertheless, a substantial understanding of the historical building, a fundamental condition for any intervention, should include not only geometric documentation but also the recognition of the structure (i.e. the synthetic and functional composition) and its form (i.e. its building and construction characteristics). Also, the understanding of the historical and architectural knowledge it contains, the recording, analyzing, and interpreting as a tangible example of values.

In this paper a complete case study of the combination of different terrestrial and aerial methodologies is described. The scope of the paper is to illustrate the basic advantages and possibilities of each of the different methods in order to conclude about the proper use of them in the documentation of the Leprosarium of Chios.It also attempts the overall recognition of the monument, based on the perspective of revealing, saving, and exploiting this unique historical monument of Chios.

Today, the Leprosarium of Chios is a testament to the history of public health in Greece and serves as a reminder of the challenges faced by people with leprosy in the past. It is a valuable cultural heritage site and could provide an opportunity for visitors to learn about the history of leprosy and its impact on society.

Finally, it should be noted that like the Leprosarium of Chios, many other monuments in Greece do not receive the respect or the attention they should. Geometric documentation is the step in the process of restoring a monument - the basic stage forits rescue and its protection so that, their history can be revealed and recognized by tourists or residents

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