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SCIentific RESearch and Information Technology
Ricerca Scientifica e Tecnologie dell'Informazione
Vol 13, Issue 1 (2023), 67-82
e-ISSN 2239-4303, DOI 10.2423/i22394303v13n1p67

CASPUR-CIBER Publishing, http://www.sciresit.it

CULTURAL HERITAGE RECOVERY IN RURAL SPAIN THROUGH DIGITAL MEANS OF SURVEYING AND GRAPHIC RECONSTRUCTION. CASE STUDY OF EL PAULAR WOOL COMPLEX.

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Abstract

The article exposes a research experience around the recovery of the industrial and cultural heritage located in the Spanish rural environment that is in ruins and with clear signs of disappearance. As an example, we will analyze the large wool processing center built in 1624 by the Royal Monastery of El Paular in the small village of Trescasas (Segovia) and which today has practically disappeared after being abandoned and plundered after the French invasion (1808-1814). The methodology can be summarized in a deep historical archival documentation, in the survey work with new digital means (laser scanner, drone, photogrammetry, etc.), in the elaboration of the hypotheses, as well as in the virtual reconstruction through 3D modeling and image rendering. Consequently, the primitive configuration of the building is exposed, determining the morphology of its rooms, its function and its historical offices, contributing to the preservation of this cultural heritage.

Keywords

Rural environment; Ruined heritage; Virtual reconstruction; Industrial heritage; Survey.

1. *Introduction*

The value and recognition of industrial heritage has increased significantly after the relatively recent recognitions that support and seek to promote its protection and safeguarding (ICOMOS & TICCIH 2003; ICOMOS & TICCIH 2011). However, from the Spanish rural area the interest in its conservation and regulation is less proactive due to the depopulation that this environment suffers as a result of the gradual transfer of its inhabitants to large cities (Camarero, 2020; Jurado & Pazos, 2022). The absence of population, institutional and economic support, coupled with the general lack of knowledge of the heritage, has resulted in the abandonment, death and destruction of the cultural, architectural and archaeological samples of each territory (Sardaro et al., 2021; López et al., 2017)

Today, digital media applied to virtual reconstruction represent a particularly useful and essential tool to promote the recovery and knowledge of cultural heritage, especially in cases where it is in an advanced state of destruction and cannot be interpreted with the naked eye, nor accessible (Barrile et al., 2022; Pietroni & Ferdani, 2021). In this sense, we have several recent examples that promote the recovery of heritage through virtual reconstruction and that use different representation systems depending on, among other factors, the available information, the integrity of the preserved remains, the geometry of the objects or the capacity to deepen the reconstruction (Verdiani, 2017; Mascio et al., 2016). As an example, research on virtual reconstruction has recently been published in which the architectural definition of an object is explained in detail and analyzed according to its geometry (Aiello & Bolognesi, 2020; Bassoli & Fallavollita, 2022), the scientific evidence of restitution (Aparicio-Resco & Figueiredo, 2016), the setting of the object (Demetrescu et al., 2016) and the search for a photorealistic representation (Valle, Fernández & Rodríguez, 2022). These experiences have served as references to address the research presented here.

Furthermore, progress in introducing new tools and methodologies for heritage surveying has facilitated and enhanced capacities for the registration of cultural heritage. In fact, there are many studies outlining recent experiences of surveys, the tools and methodologies for carrying them out and the solutions to avoid possible

mistakes during these processes, whose application has increased remarkably in the recent period (Cianci & Colaceci, 2022; Chizhova et al. 2019; Manferdini & Russo, 2015). For example, according to the typology to be registered (Molina et al., 2021), to its construction (Trizio et al., 2021), etc. Thus, from a deep data collection on the ground it is possible to develop a graphic reconstruction according to the morphology of the surviving archaeological remains, for which it is particularly important to have other historical documents on which to base the hypothesis and to contrast it (Sabine et al., 2020).

In the case at hand, we find a building implemented in 1624, being enlarged and improved to reach its maximum splendour in 1741. Unfortunately, after the French invasion (1808-1814) and the consequent collapse of the wool industry (García Sanz, 2011), the building was dismantled by its owners for commercial purposes and subsequently plundered throughout the 19th century (Fig. 2). As a result, the building was mutilated and transformed from then on, losing most of its architecture and making it impossible to understand in its current condition. This led to a general ignorance of this cultural heritage among the population, who are unaware of the original function and importance of these ruins for the wool industry, society and the population itself.

Fig. 2: Aerial photography. National Geographic Institute (Spain), Interministerial flight, photo.0483B0009, 1973.

Therefore, the aim of this contribution is to share the research and fieldwork experience developed around the example of this large and ruined industrial complex owned by the Royal Monastery of El Paular in Segovia. Explaining the methodology applied for the virtual reconstruction of the building, the 3D survey techniques used by laser scanner and drone (UAV), the process for 3D modeling and the production of digital images, as well as the important documentary and archival work that have allowed to shape and describe the hypothesis that supports this graphic reconstruction.

Fig. 1: Full photogrammetric survey model of cultural heritage. Aerial perspective. By the author.

Fig. 3: Concentrarion of ruins inside the complex. Partial aerial view of the photogrammetric survey model. By the author.

With all this, this research seeks to contribute to the general knowledge of this element of the cultural heritage through its documentation and the dissemination of accessible images and plans that allow the comprehensive understanding of this valuable cultural element in danger of disappearing; laying the foundations for the preservation, recovery and intervention of the cultural heritage. In addition, this research aims to open a path towards fixing populations in rural areas through the enhancement of heritage as a means of contributing to the Sustainable Development Goals (SDGs) set by the United Nations (Mihai & Iatu, 2020; García-Delgado et al., 2020; Signes-Pont et al., 2022).

2. *Methodology*

The particularities of the cultural heritage object of this research have determined the phases and methodological means used in order to deepen and offer a graphic reconstruction of this example of industrial architecture implemented at the beginning of the 17th century. In this sense, it is worth mentioning the lack of information regarding this building, the large area that occupies its perimeter, as well as the state in which it currently finds after suffering severe dismantling and plundering. Therefore, the work processes that we will describe in detail below have been developed in a parallel and transversal way, in such a way that the data obtained at each stage could be contrasted with the reality objectified during the different visits and fieldwork.

2.1 Research in historical archive

One of the fundamental problems we had in approaching the research was the total absence of bibliographic documents that would allow us to start the work. As a consequence of this, we undertook an intensive search for archival documents in order to locate the primary sources and whose greatest difficulty was that the Royal Monastery archive, where all the documents of our interest should be located, was dispersed and lost for the most part. As a result, we have mainly gone to the Provincial Historical Archive of Segovia, where legal acts carried out in the region are kept in the form of Notarial Protocols, and the National Historical Archive of Spain, which houses part of the monastery's original collection.

After a very extensive search we have been able to locate several original documents that provide information concerning the different phases of construction of the building, whose initial step can be dated without any doubt to the year 1624. Since then, there has been a cascade of improvements, extensions and renovations that lasted until the year 1654 and that speak to us about the experimental nature of this building, the first documented of this typology. Finally, a great reform would take place in 1741 in which occurs the so-called “rebuilding” of the complex and that will provide it with all the necessary improvements for its proper development conforming its definitive image. Later, in 1796 the building was bought by Manuel Godoy, Prime Minister of Charles IV, keeping a record of the

Fig. 4: Inside view of point cloud model of cultural heritage. By the author.

return of goods to the monastery, listing the rooms where the Carthusians stayed. Unfortunately, none of the documents found has preserved traces or drawings that would allow us to understand the configuration of the building and to interpret the historical texts, despite the fact that they expressly mention their existence.

In general, the most relevant sources for the research are the contractual documents signed by the monastery and the different construction guilds involved in the actions to be carried out on each project, all of which we have identified, and establish the work conditions through a list of execution orders. This last information constitutes the fundamental support on which the hypothesis of graphic reconstruction has been built, despite the fact that its interpretation has been especially complex in the absence of explicit mention of the situation of the numerous rooms that made up the building. For this reason, the set of these documents has been treated in a transversal way, relating the layout of each room according to the references made in the various contracts located.

In any case, during the first readings we were able to conclude that the numerous and spacious rooms enunciated in the contractual documents could not coincide only within the few vestiges that today can be seen today in the ruins, but rather that the building must have been substantially higher, as we were able to verify later.

2.2 Fieldwork and survey

The fieldwork and survey has been carried out through the complementary use of different means of heritage digitization due to the particularities and circumstances of the cultural element under investigation: its wide territorial extension, the existence of different spaces (essentially open but also closed), the significant height of the walls that make up the ruin, the impossibility of accessing all the spaces and objects and, finally, the need to collect graphically the elements that are difficult to access, as a means of correctly interpreting the vestiges that constitute this cultural heritage. It is also particularly important for the research to make a correct reading of the walls and specifically of the existing historical plastering, which make it possible to determine the primitive location of the preserved remains (interior or exterior) as well as the existence of possible buildings that today are missing (Fig. 5).

Fig. 5. Difference of historical plastering show old interior spaces. By the author.

For all this, two key technologies are used: the laser point cloud scanner and aerial photogrammetry taken by means of drones (UAV). The first allows us to collect in milimetric way all the remains discussed from the ground plane, at a height of 1,10 meters, and to enter the interior spaces, leaving out of this area the elements that are arranged horizontally at a greater height than the scanner: roofs, raised window sills, cornices and upper parts of the walls. The second, on the other hand, allows us to document all the

Fig. 6: Axonometric view of the photogrammetric survey model. By the author.

inaccessible elements from the lower heights and to carry out a sweep through a sequence of aerial images that record the complete morphology of the ruin.

The models of the scanners used is Leica RTC360 with the capacity to take 2,000,000 points per second, with a precision of 1mm/10m; and Leica BLK365, with the capacity to take 360,000 points per second, with a precision of 4mm/10m. The drone used is the Mini 3 PRO model of DJI, equipped with a camera of 48 MP resolution. During the fieldwork, 26 full definition scanning stations have been taken according to the attached drawing (Fig. 7), including 360 spherical imaging and HDR off; and 176 aerial photographs taken mainly at an altitude of 17 meters, including a previous reconnaissance sweep at 33 meters, at a resolution of 4030x3024 px.

The programming of the work campaigns was complex due to the unfavorable winter weather in the surrounding mountains, making it necessary to delay the campaigns on two occasions due to strong wind and rain. After requesting the municipal permits and carrying out a first prior reconnaissance visit, the digital survey campaign was carried out in a full day (approx. 3.5h to scan and 1.2h to fly). It was chosen to carry out the campaign in winter to avoid the proliferation of vegetation that could obstruct the view of the ruins, obtaining very good results in this regard. However, operating in rural areas forced us to have numerous batteries due to the impossibility of finding means to recharge, as was observed in the first reconnaissance visit, using 4 complete batteries for the drone and 3 for the scanner. For this reason, and according to the times of each instrument, before the survey different plans were drawn up indicating the location and specific number of stations, the number of aerial photographs necessary, as well as the location of each one of them, allowing the development of an effective field work.

Fig. 7: Location of scanning stations. Combined plan of scanner and photogrammetry models. By the author.

The laser scan has been processed with the Cyclone Register 360 software. Through this, we have exported and obtained a substantial set of orthophotographs sectioning the model in the horizontal and vertical plane of the space, which has allowed us to obtain plans, sections and elevations of the cultural heritage. The aerial photographs taken with the drone have been

processed with the Agisoft MetaShape program, forming the three-dimensional model through photogrammetry, which has allowed the export of a 3D mesh of the complex and the terrain that is fundamental to support the virtual reconstruction.

Ultimately, the analysis of both documents allows the comprehensive understanding of the object of study and fulfill the initial objectives, in addition to serving as a record of the current state of cultural heritage. Likewise, the digitally generated files serve as a support for the elaboration and modeling of the different reconstructive hypotheses, through which the definitive images will be generated, as we will see below.

2.3 Virtual reconstruction

For the development of the reconstruction phase, we first transferred the set of starting data to an editable digital support in order to work and reflect on the images and plans obtained during the survey work. Thus, starting from the point cloud model and the orthophotographs extracted from it, we proceeded to draw the plans, elevations and sections of the ruin in 2D using a CAD format in the program AutoCAD 2022. We also developed the base 3D modeling of the surviving remains through the Rhinoceros v7 program (Fig. 8). In this sense, the photogrammetric mesh has served as a tool for formal and geometric control of precision and relationship between the real object, the modeling and the reconstruction.

Secondly, we began the process of developing the reconstructive hypothesis through the interpretation of the writings and the study of the survey, for which we used both hand-drawn and digital drawing on the 2D and 3D files previously traced. In general, the steps taken during this phase have been the following: the volumetric and general determination of the building, the definition of the courtyards and internal communication spaces, the identification of the main interior rooms and, accordingly, the location of the functional programme of the building. For this last phase, we use the unpublished manuscript by Friar Alonso Cano (1764) found in the National

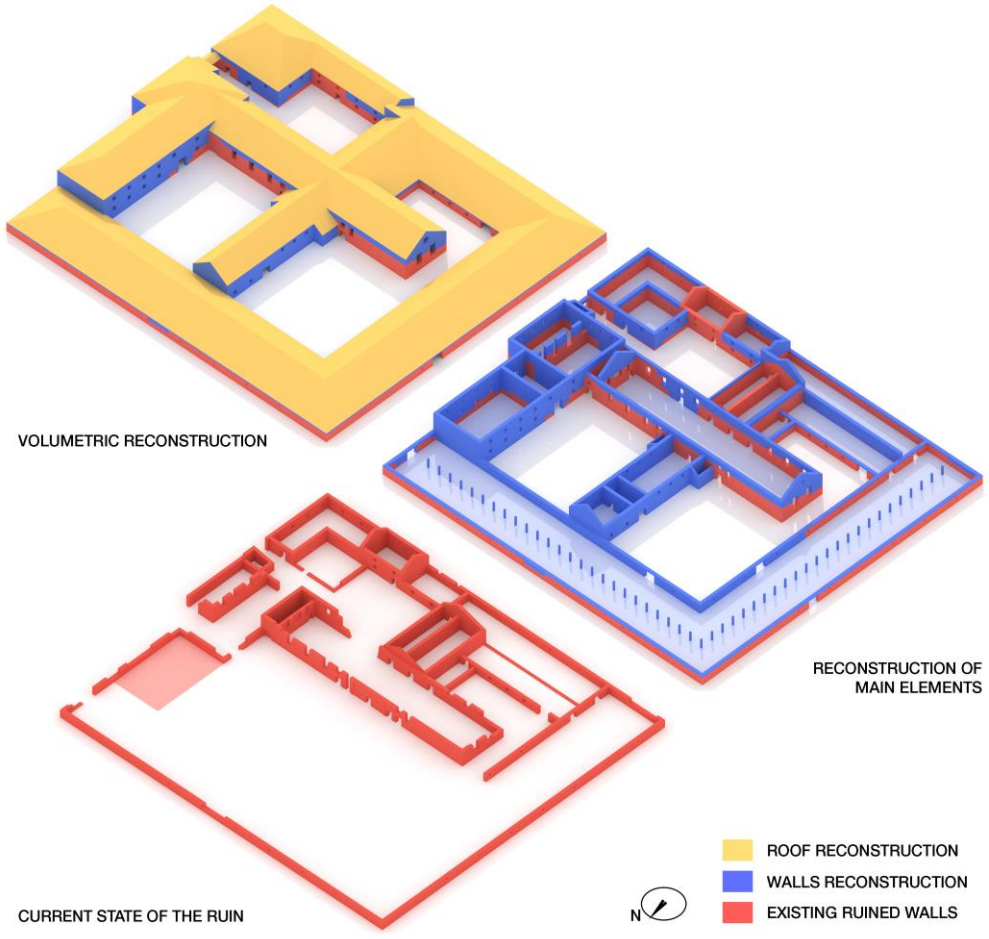

Fig. 8: Axonometric synthesis of the interpretative process of reconstruction after the last reform of 1741. By the author.

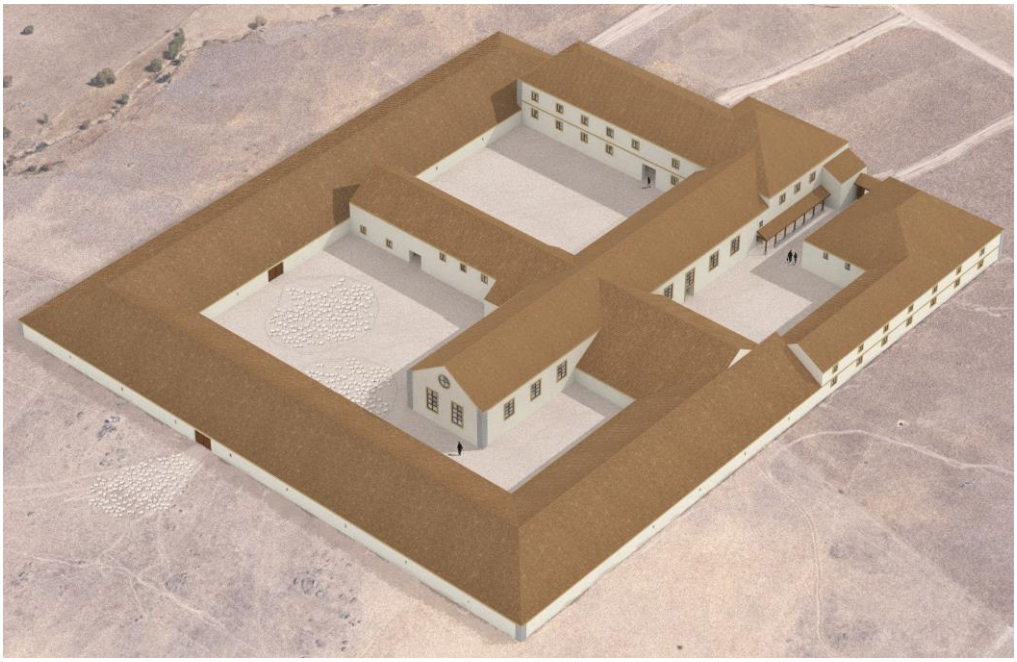

Fig. 9: Aereal view of the reconstructed building in its back façade. By the author.

Library of Spain, in which he describes the operability of this type of building when he visited a nearby complex. Subsequently, we determined the structural systems and finishes of those rooms whose characteristics were included in the works contracts found, such as the pen or the shearing room.

During this process, which was the most time-consuming of the research, we were able to confirm, as we previously noted, that the original building does not correspond to the current set of ruins that are preserved in the cultural heritage. It was much larger and completely occupied the interior space delimited by the square perimeter wall that closes the complex. A circumstance that is due to the fact that the building was dismantled at first in an orderly manner to trade with the materials, removing in this process any vestige of its architecture. The remaining part, after being abandoned, was plundered uncontrollably, generating the ruin that we observe today and that has remained practically the same since the beginning of the 20th century, when it was photographed by the first American flights between 1945 and 1956 (Fig. 2). All of this has hampered the process of graphic reconstruction due to the absence of vestiges that could serve as immediate witnesses.

Once the definitive hypothesis has been determined, we develop the drawings in dihedral system using AutoCAD 2022, through which we expose the scale plans of the floors, sections and elevations of the building. This system allows, through the geometric definition of the complex, to name the use and nomenclature of each room, to contrast the location of the remains with respect to the proposed reconstruction, allowing anyone at all times to compare the dimensions of the spaces and construction elements.

We also developed 3D modeling of cultural heritage through the Rhinoceros v7 program, in which all the elements and details have been built. To simplify the management of the archive, we have worked with blocks to represent those elements that were repeated in the model (windows, trusses, etc.) which also allows easy changes of all these objects by just modifying the reference block. Once the modeling has been completed, we carried out the rendering process to obtain the virtual reconstruction images using the V-Ray engine for Rhinoceros, and we proceeded to assign textures and materials. Finally, we post-produced the images using Adobe Photoshop 2022, introducing the environmental elements that provide scale to the spaces, such as people and animals, and adjusting the levels and values of the primitive renders (Fig. 9).

In the same way, we have developed other renders of an abstract nature for which solid coloured materials have been used and which have served us to show the analytical synthesis and to indicate the constructive elements of the building. For this purpose, we developed a parallel archive of Rhinoceros and used simple materials of

different diffuse RGB colors, using the same V-ray rendering engine (Fig. 8).

3. *Results*

One of the first results of the investigation is the discovery of the documents that make it possible to comprise the primitive building. Its reading allows us to understand that it is not a project carried out in a single phase, but that from its origin it is an experimental project, subjected to trial and error, which was expanded as the needs required. In fact, it is the first building of this type that has been documented, which later served as an archetype for the implementation of other similar buildings throughout the 18th century. Below, Table 1 shows a selection of the main constructive actions and the most important documents that have been used for the graphic reconstruction.

Tab. 1: Historical documents and facts

Year	Event	Reference[1]
1624	Construction of the shearing room, sweating room and pen	SPHA, P.1014.
1625	Construction of the wool warehouse and housing	NHA, Clero, b.19798.
1626	Stone paving of the large courtyard	NHA, Clero, b.19789.
1628	Paved from the other courtyard	NHA, Clero, b.19789.
1632	Construction of the main stone doorway	SPHA, P.1098
1639	Extension of the pen	SPHA, P.1112
1641	Reform and extension of the Carthusian house	SPHA, P.1115
1647	Construction of a room	SPHA, P.1123
1741	Rebuilding of the complex	SPHA, P.2727
1750	Description of the building	SPHA,Catastro, E-242
1796	Partial goods inventory	NHA, Clero, b.17806

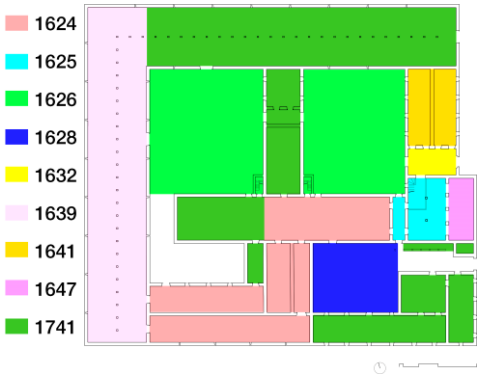

Fig. 11: Plan of the areas affected by the documented reforms. By the author.

Thanks to these documents, as well as the work methodology outlined above, we have determined the composition and internal structure of the building in its final state, that is, after the great reform undertaken in 1741, the last documented one (Fig. 9). Also, the main function for which it was built: to shear the huge transhumance livestock owned by the Royal Monastery of El Paular and which provided it with great economic benefits from the sale of its wool and, this, in the shortest possible time to place it first on the market, obtaining an advantageous price for its sale (Bilbao, 2001; García Martín, 1992).

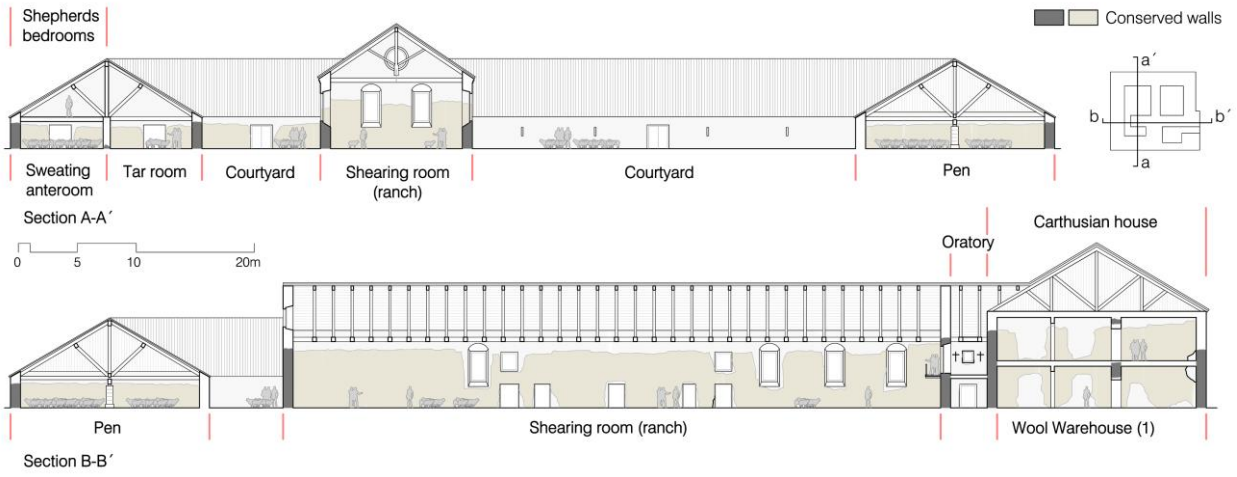

Fig. 10: Reconstruction of sections of the building. By the author.

[1] Segovia Provincial Historical Archive (SPHA), National Historical Archive (NHA); Notarial protocol (P); Book (b).

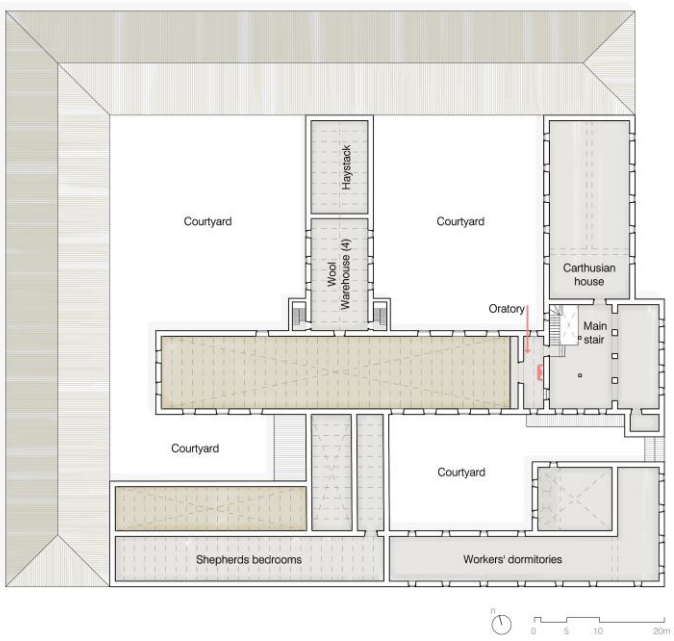

Fig. 12: Reconstruction of the upper floor. By the author.

This complex was organized inside the perimeter square that currently delimits the ruin, occupying its entire surface, and was articulated around four patios, two smaller and two larger; as reflected in the description of 1750 (see table 1).

Likewise, we have deciphered the organization and morphology of the courtyards, two of which were externally connected to each other (as can be seen in the survey), however, the others had internal corridors that allowed passage from one to the other, according to the functional program that surrounded them (Fig. 13).

On the other hand, we have located the different rooms that made up the building and their location, as well as giving meaning to its name and utility, since these are original spaces designed exprofessionally to carry out a specific function, whose name is entirely unique and has been lost over the centuries. With this, we have detected the existence of three nuclei in the

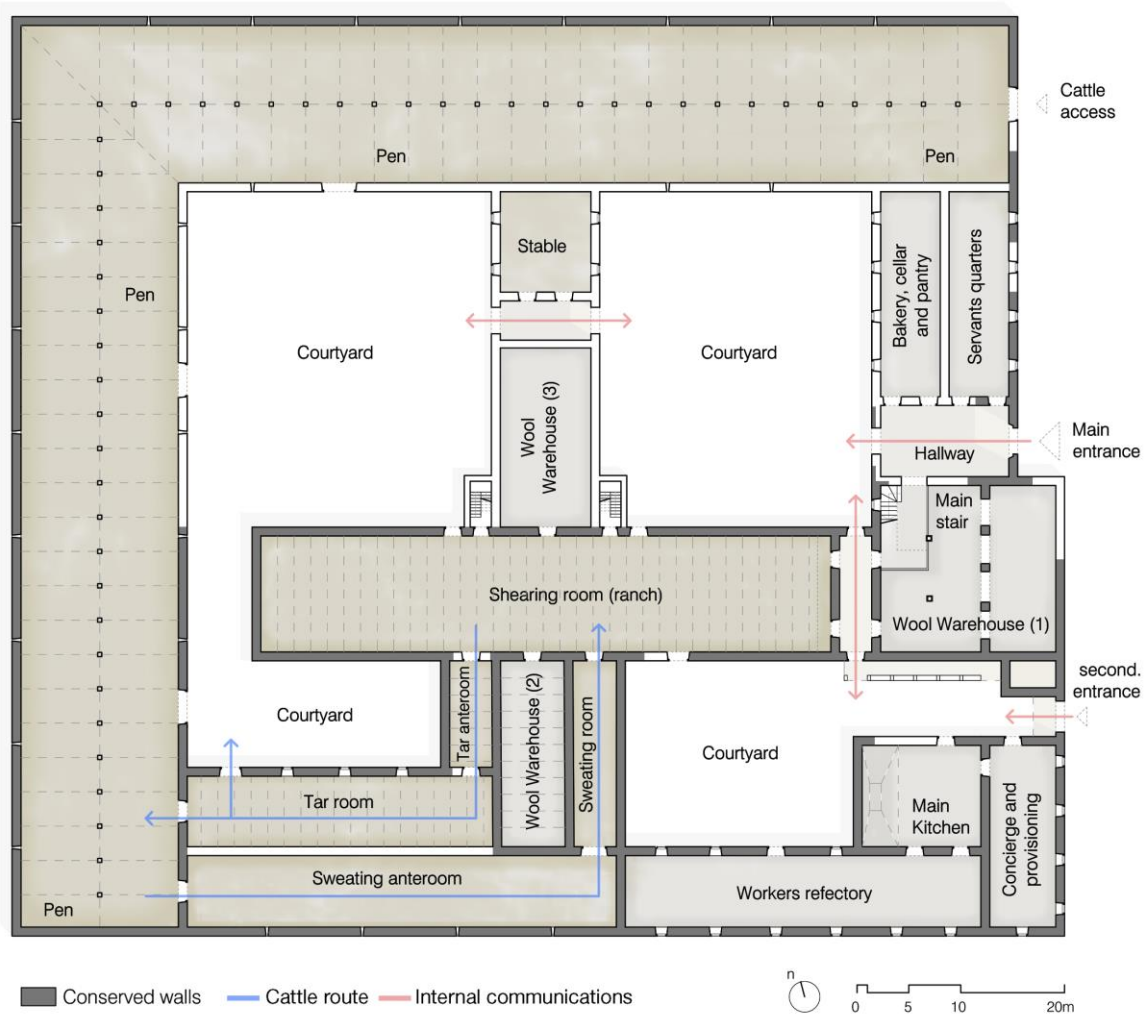

Fig. 13: Reconstruction of the ground floor. By the author.

Fig. 14: Reconstruction of the northwest patio, where the sheared cattle were located. Narrative representation. By the author.

Fig. 15: Reconstruction of the southwest courtyard, highlighting the shearing room gable. Narrative representation. By the author.

building: (1) the industrial one, (2) the residence of the Carthusians and (3) the spaces for provisioning the workers. All this confirms that it was a enormous and particularly heterogeneous complex, in which very diverse functions and people of very different social classes were integrated uniformly, coliving even with cattle. These facts allows us to understand and value the interest of this cultural heritage.

3.1 Industrial core

During the investigation, we were able to discover that this space was the most occupied of the entire complex taking all of it an area of 5,170 m^2 built. It is also the most documented in the historical archives, thanks to which we locate its rooms taking as reference the explanations of Friar Alonso Cano (1764). In short, this nucleus comprised a set of specific rooms, connected to each other, that attended to a unique circuit of this typology fundamentally served to shear the wool, store it and pack it in the shortest possible time (Fig. 13). In summary, the circuit began by introducing the cattle into the pens two days before being sheared to avoid getting the wool wet. The night before being sheared it was led to the sweating room, where the sheep imprisoned one with the other began to sweat profusely, serving to soften its wool and facilitate the entry of the scissors. At dawn, the effective cutting took place in the shearing room, the centerpiece of this building, a double-height space profusely iluminated by numerous windows. Once the wool was extracted, it was stored in the different warehouses, and the cattle were taken to the tar room, where the livestock mark was signed with boiling pitch on the back of the cattle. At the end of the process, the herds were brought back into the

pen in order to prevent them from being exposed to the elements and, if the weather was fine, they were taken out to the adjacent courtyards to get used to their new unsheltered state (Figs. 14 and 15).

In addition, and in order to carry out the tasks efficiently, there was a set of specific guilds—shearers, transporters, sheep healers, sweepers, classifiers, storekeepers, water carriers, stevedores, etc. —with proper and unique names already in disuse, which numbered about 350 in this building. In addition, we have been able to determine that the main shearing room was designed in such a way that in one of its gables there was a large opening that visually connected with the private oratory of the Carthusians and that allowed all the workers to receive mass without ceasing to perform their task (Fig. 12).

The greatest finding has undoubtedly been the determination of the building´s pen, which occupied two of the flanks of the perimeter, leaning on the current perimeter wall that delimits the ruin, and which constituted the largest space of the entire complex; as well as a transversal volume that divided the two largest courtyards and that contained different wool warehouses on its two floors. In the same way, the persistence of documentation regarding some of the rooms has made it possible to unequivocally determine the way in which two of these spaces were constructed: the shearing room (Fig. 16) and the pen (Fig. 17). In both cases, the roofs were solved by a complex wooden structure that allowed to save the great span between supports, following the constructive tradition of the region that had an important nearby forest (Valsaín) where there were large reserves of great pine trees. The rest of the roofs, already of lesser spans, have been assumed according to structural logic having as reference the architecture of the region (Nuere, 2000; Chaves & Layuno, 2015).

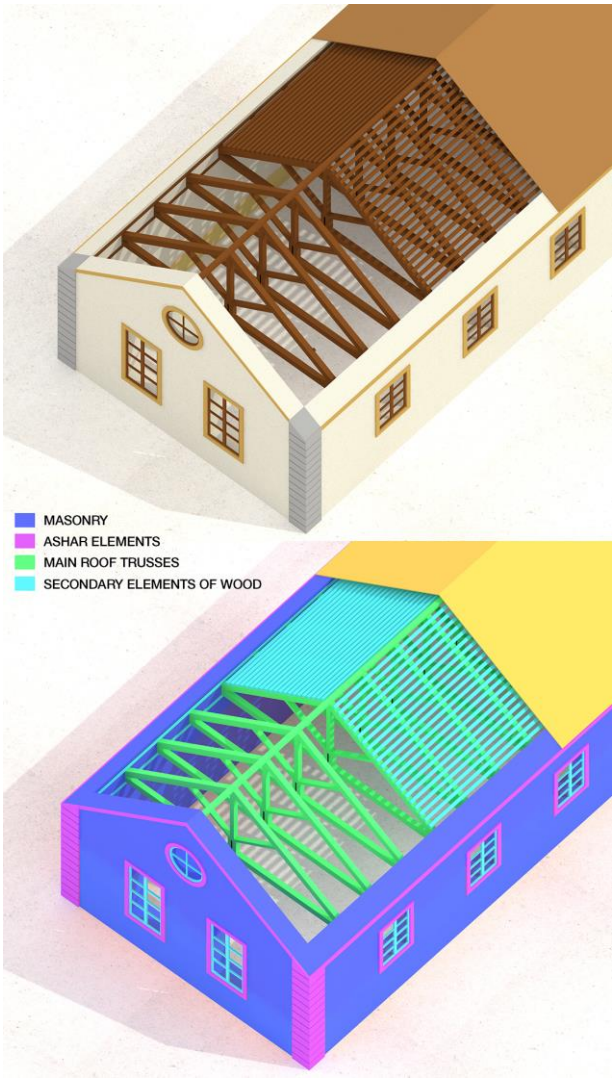

Fig. 16: Constructive system hypothesis of the shearing room. By the author.

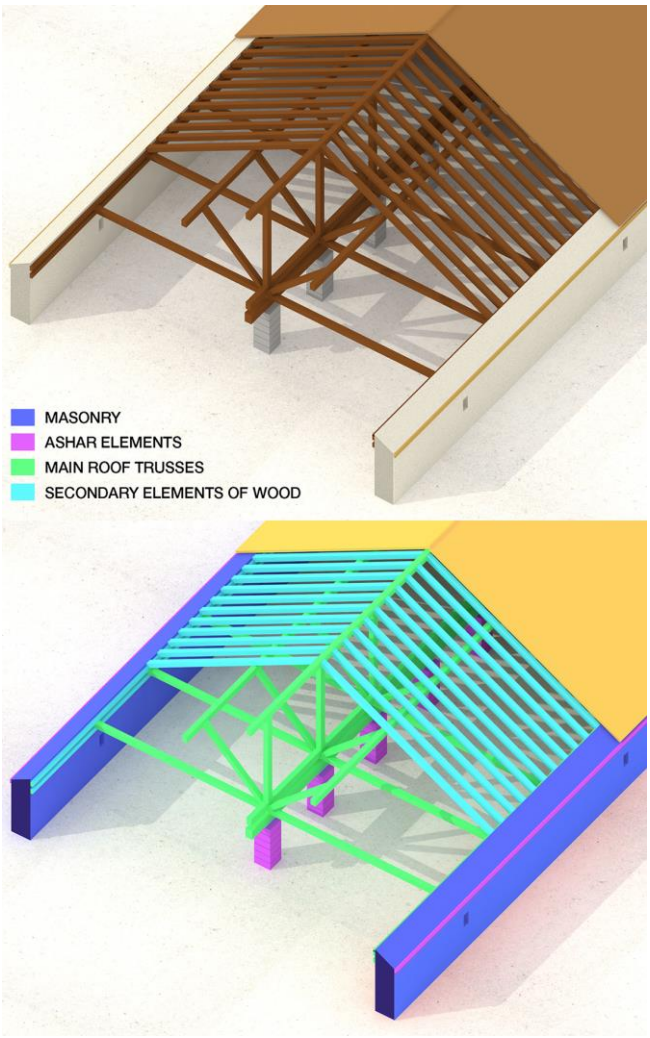

Fig. 17: Constructive system hypothesis of the pen. By the author.

3.2 Carthusian house

Another of the major findings of the investigation has been the discovery of the location of the Carthusian house, which was located on a current mound generated by the demolition and uncontrolled plundering mentioned above; as well as the existence of a large missing entrance, the main one of the building, which gave access to the dwelling and the rest of the complex. This dooray accessed a large passageway that communicated with the northeast courtyard. Inside it was located the staircase of the house, in whose intermediate sections was the private oratory, as recorded in the historical documents and in the ruin itself. In addition, we have discovered that after the oratory the monks had a privileged space in the shearing room through a cantilevered gallery from which they controlled all operations (Fig. 18).

Likewise, during the research we found that the Carthusian dwelling was entirely on the top floor and contained all the elements for its autonomous development (reflecting the monastery itself) and occupied an area of 594 m^2. There were at least eight cells for the monks (those in charge of livestock management), a priory room, refectory, kitchen, priory pantry, toilet, as well as

Fig. 18: Reconstruction of the shearing room from the cantilever gallery located after the oratory, through which the monks observed the execution of the operations. Narrative representation. By the author.

Fig. 19: Reconstruction of the main northeast patio, around which the Carthusian house was located (left), as well as the shearing room (in the background) and the passage to the next courtyard (right). Narrative representation. By the author.

Fig. 20: Reconstruction of the southeast patio around which the spaces for provisioning the workers were located, as well as the access to the shearing room (on the left). Narrative representation. By the author.

several bedrooms for the highest-ranking livestock workers and to the building manager. Finally, we determine that the lower floor of the house was occupied by other spaces intended for provisioning, such as the bakery, the cellar, the pantry, and the rooms of the servants, which were also accessed through the main hallway.

Unfortunately, it has not been possible to determine the internal distribution of the Carthusian house, as well as the other rooms on the upper floor, since the documents found and the existing architectural remains prevent its complete and unequivocal reconstruction. However, we have been able to determine the program associated with each space, as well as its perimeter geometry (Fig. 12).

3.3 Spaces for workers

Another of the findings involves the determination of the spaces for the provisioning of the workers of the complex. This was an essential element, since all the workers (about 350) as well as the many transhumant shepherds (about 200) were accommodated in the building due to the lack of infrastructure nearby. In this way, the maximum use of natural light was achieved to carry out the tasks, facilitating the immediate rest of the workers.

In general, this nucleus was located around the southeast courtyard of the building, corresponding for the most part with the ruins that still exist today, although they are very transformed. Through historical documents we find the location of the large refectory for all the workers, the associeated kitchen, etc. —all of them on the ground floor— as well as the shepherds' dormitories —situated above the sweating room and anteroom— and that of the shearers and other workers —situated above the refectory—; completing with all this the puzzle of the building.

4 Conclusions

This contribution advances in the study of this cultural heritage located in the Spanish rural environment, which is in an unfortunate state of abandonment, and to share the experience of research on its recovery, valuation and reconstruction. Thanks to this, we determine the primitive configuration of this large wool complex located in the small village of Trescasas (Segovia), which reached the exorbitant figure of 8,700 m^2 of built area, thus making it the largest of its kind. We also exposed the methodology followed for the documentation, surveying and graphic reconstruction of this industrial heritage of architecture, which can serve as an example for the study of other similar cases.

One of the main difficulties has been the lack of a bibliographical support on which to work, which has required a great deal of archiving and searching for the original sources. With this, we document, discover and contribute the different construction phases carried out by the Carthusians of El Paular, thus detecting the set of all the works that began in 1624 and concluded in 1741, and that have been the basis for drawing up the graphic reconstruction.

In addition, the dismantling carried out after the debacle of the industry have generated great difficulty in directly transferring the different

reconstructive hypotheses. For this reason, an in-depth study of the ruin has been necessary to record its morphology and detect mutilations and historical plastering. To do this, we developed an in-depth an innovative survey using a laser point cloud scanner and a drone that have served effectively and complementary to digitize this cultural heritage due to the particularities of its state of conservation and extension. On the one hand, the use of the scanner has allowed us to register unprecedented all the internal and external spaces from the horizontal plane of the ground, while the drone has allowed access to those inaccessible and elevated elements.

With regard to graphic reconstruction, the experience of 3D modeling and rendering has been presented, in which two types of graphic expression have been used depending on the objective of the communication: realistic or analytical. As a result of this work, a significant set of original images is exhibited that allow understanding and interpretation of the primitive configuration of this archetype. Through them, we can virtually explore the whole of its courtyards, its volumes and facades, as well as the interiors of its most significant rooms, delving into the most outstanding aspects of its construction details. In this sense, the complex operating system of the building is exposed in a summarized way, as well as a part of the historical trades, all in order to value the cultural and anthropological legacy of this rich cultural heritage.

The results of this research have laid the foundations for the recovery of this sample of Segovia's industrial heritage, which is in a deplorable state of abandonment. In fact, the most obvious proof of the ignorance that exists on the part of the public administrations with regard to this building — or rather, towards its ruins — is the local planning regulations that do not include it in the catalogue of heritage classification and protection. In this sense, any possible destructive action would produce an irreparable loss for the knowledge, study and conservation of this industrial complex peculiar to the Segovia region. Consequently, by disseminating the results of this investigation, the aim is to redirect this situation, and to promote and guarantee the protection, recognition and dignity of the ruins that currently make up this heritage, proposing to do so the cataloging of the building, the prohibition of building inside and the consolidation and signaling of the existing vestiges. All this, in addition, together with a work of dissemination and management that would generate an attractive space for the population where citizens could recognize themselves around their culture and history (Skoczek, M.. 2003; Quintana et al., 2020).

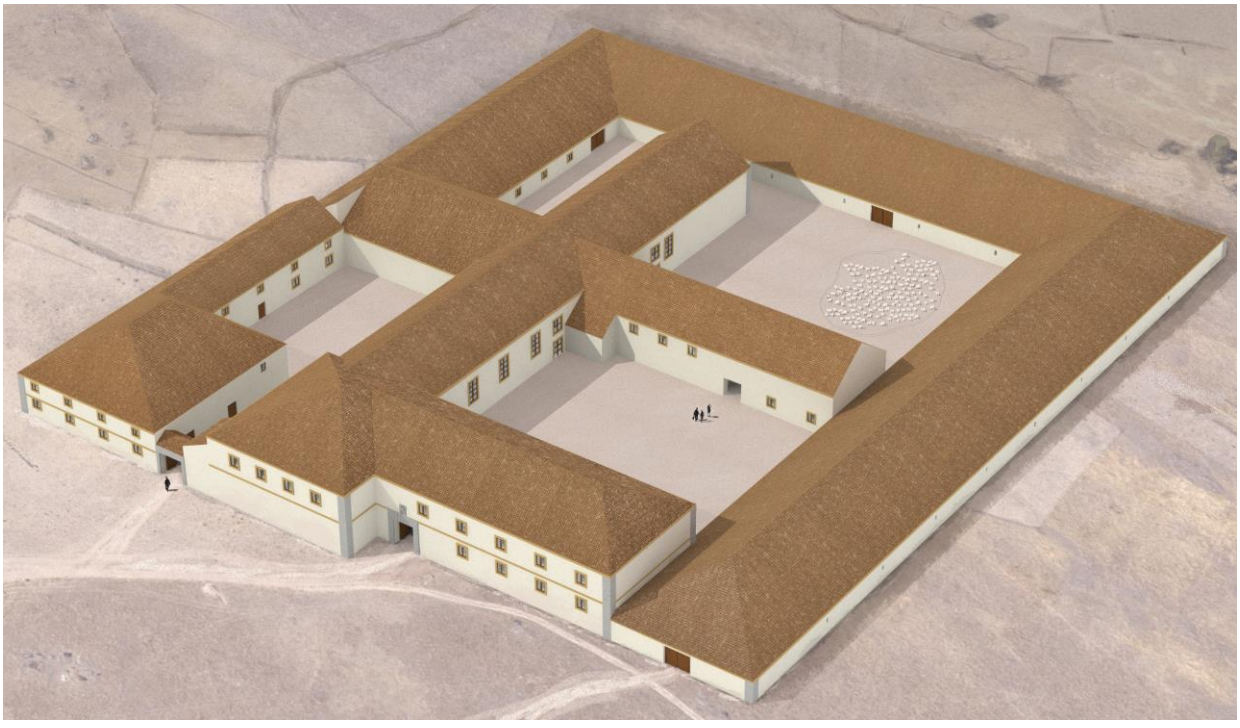

Fig. 21: Aereal view of the reconstructed building in its main façade. By the author.

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