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THE 19TH AND 20TH CENTURY INTERVENTIONS ON THE DORMITORY WING OF THE JERÓNIMOS MONASTERY IN LISBON: AN ACCOUNT WITH A FOCUS ON THE CONSTRUCTIVE ASPECTS

Vincens, Baptiste*¹, Vasconcelos, Graça**², Hughes, Moriah*, Gourd, Constantin*,
Joudeh, Safa*, Sepulveda Cruz, Saray*, Mendes, Nuno**

¹*baptistevincens@hotmail.fr*, ²*graca@civil.uminho.pt*

* SAHC graduate student, University of Minho, Department of Civil Engineering

** University of Minho, Department of Civil Engineering, ISISE

Keywords: Jerónimos, manueline, historical, masonry, museum

ABSTRACT

The dormitory wing of the Jerónimos Monastery, that nowadays houses the National Museum of Archeology, is a monument with a very complex history of interventions. This paper presents the result of an extensive historical survey based on the study of written documents, drawings and photographs. The profusion of photographs that document the restoration and extensions give a special angle to the survey because it allows the understanding of constructive aspects that normally remain uncertain without the use of invasive methods. The main structural systems of the original building and more recent extensions are presented, explained and compared. A critical analysis of the construction works carried out, which relies on these constructive aspects, is then presented and completes already formulated critiques of the conceptual aspects of these interventions.

1 INTRODUCTION

The Jerónimos Monastery in Lisbon was commissioned by King Manuel I in 1499 after the discovery of a new maritime route to India by Vasco de Gama. The monument was intended from the start to be erected to the glory of Portugal. To this end, a new style was employed, the “Manuelino”, very peculiar to Portugal, which consists in late gothic structural systems (in particular vaults with intricate skeletons of ribs) associated with a new ornamental vocabulary that makes a use of vegetation in an unprecedented way. The composition is typical: the two-storey cloister is lined on one side by the church of Santa Maria de Belém and on two other sides by buildings containing various spaces. Jutting out from this complex towards the West and facing the Rio Tejo is a peculiar long and low building that housed the dormitory until the middle of the 19th century (see Figure 1).

This building has a particularly complex history of interventions starting in the second half of the 19th century and finishing only in the 1950s. These interventions are very well documented in written sources. A particularly large number of photographs, certainly explained by the national importance of the monument, were gathered from several archives in Lisbon. These document the more practical aspects of the interventions. The first photographs date from the mid-19th century (a few years after the invention of photography) and increase rapidly in number in the 20th. These sources were combined to in situ observations in order to propose a critical reflection on these interventions with a focus on the constructive aspects.

With this paper, we aim to show an example of a historical construction where the historical survey is absolutely necessary both for the architects and engineers. For the architects, it allows the dating of the different parts and the understanding of the attitude of the designers in the past interventions and for the engineers it produces a detailed documentation on the composition of the structures that cannot be replaced by in situ non-destructive investigations.

First, a description of the original building is proposed, followed by a chronological account of the interventions presented along with corresponding photographs. A comparative analysis of the main constructive systems employed in the different phases finally allows us to elaborate a critical reflection on the success of these interventions.



Figure 1: Jerónimos Monastery and Torre de Belém in Cosme de Medici's Journey through Spain and Portugal (1668 - 1669) (1668-1669), Pier Maria Baldi (1637-1712). © Biblioteca Nacional de Portugal.

2 THE ORIGINAL BUILDING

The construction of the dormitory wing, sometimes also called the “annex”, started before 1514 under the supervision of the master builder Diogo Boytac who was later replaced by João de Castilho [1]. This building is represented, usually with the rest of the monastery, in a large number of paintings and engravings from the 17th and 18th centuries (see Figure 1). Several early photographs exist which present its state in the mid-19th century (see Figure 2) and surveys of the plan, front facade and cross-section dating from the same period are displayed in Figure 3.

The wing is composed of two levels: the gallery at the ground floor, a space covered by a succession of vaults, originally open to the outside by an arcade (see the plan of Figure 3), used at first as a warehouse for goods brought from India. The first floor was composed of a central corridor lined on each side by a succession of rooms (see the cross-section of Figure 3). As described by José Felicidade Alves [2], this corridor was at first intended to connect a Royal palace, placed at the west extremity of the wing, to the church and cloister for private use of the royal family. At the death of Manuel I, this idea was abandoned and the first floor assigned to house the cells of the monks, 35 on each side, as a dormitory building next to the cloister, although probably intended at first, was never constructed [2]. The facade is composed of 28 spans separated by powerful buttresses topped by ornate pinnacles, probably stylised bushes [3], and separated into five groups by higher bodies pierced with Manueline windows (see the elevation of Figure 3). The facade adopts an austere, almost unadorned architectural language, presenting the building as a service space constructed with the same rigor as the rest but subordinate to the main parts of the monastery (hence the denomination “annex”). The entrance to the building is at the west extremity and the connection to the rest of the monastery is ensured by a building named “Hall of the Kings” (see the left photograph of Figure 2) to the east [3].

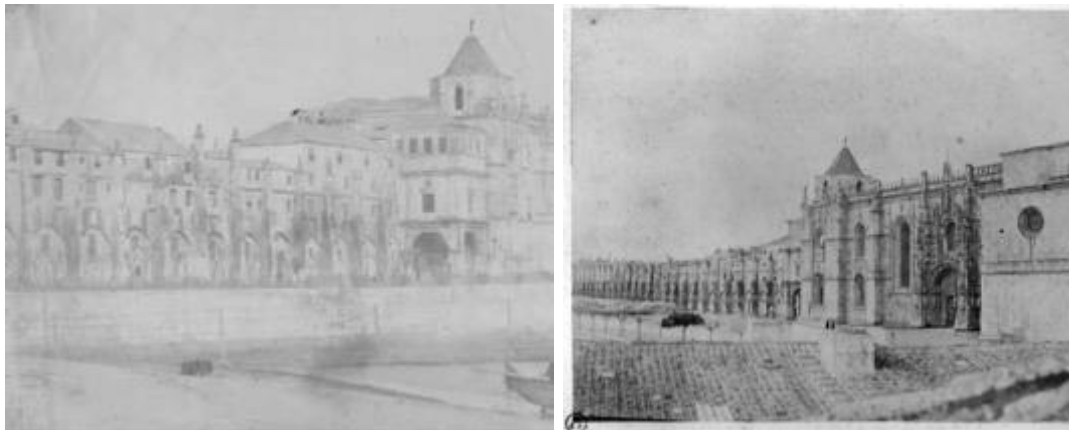


Figure 2: left: Monastery of Santa Maria de Belém, ca. 1856, salted paper, © Coleção João Edward Clode; right: South façade of the Jerónimos Monastery, Possidónio da Silva, unknown data and possession.

At the end of the 16th century, the arcade was walled up and the internal space divided into workshops and warehouses and rented out to private individuals (this is visible in the 17th century engraving of Figure 1). In 1707, the space was modified to become a dormitory for the English troops and later on to house the Customs of Lisbon [4].

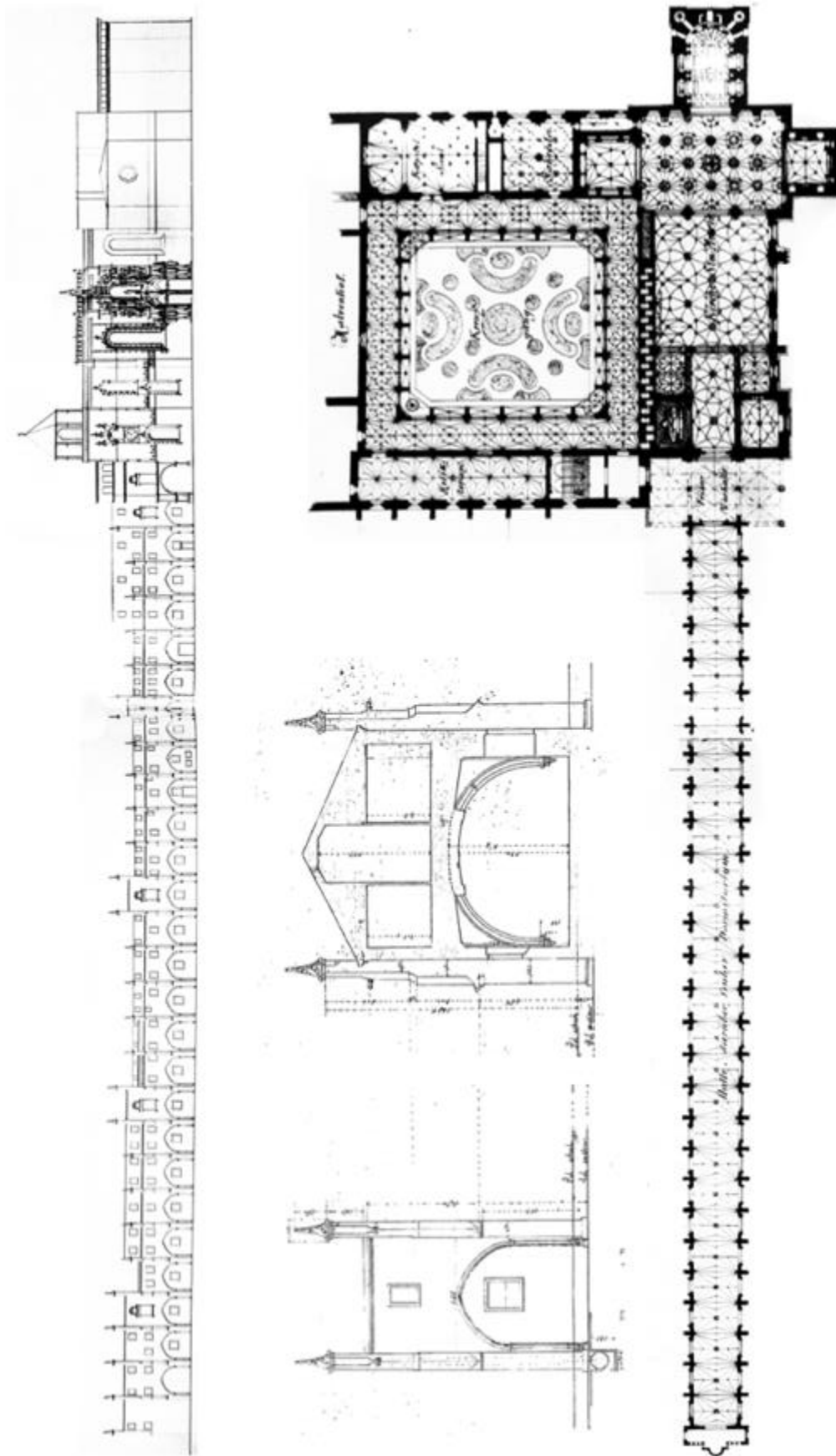


Figure 1: Survey of the dormitory wing before the 19th century interventions. Plan: Albrecht Haupt, Hannover, 1886 © TIB/UB, 32REPO-014. Elevation: Domingos Parente da Silva, 1898, copy of a drawing by Rafael da Silva Castro executed in 1860, © AHCPL, 65P1. Cross sections: unknown author and date, Des 0050379 © IHRU/SIPA.

As described by Luciano Cordeiro [3], the first floor was modified in an erratic fashion by the monks which resulted in the mid-19th century in the state visible in Figure 2. New floors were added above the roof, englobing the top of the buttresses and disrupting the elevation. There is no description of the interior counterpart but sources report that in 1834, when the monastery became national property by a decree that nationalised the possessions of the Church, there were only 13 monks left and the whole complex was in a state of particularly poor repair [4].

3 THE 19TH AND 20TH CENTURY INTERVENTIONS

After the nationalisation of the monastery, the building was handed over to Casa Pia, an institution intended for the support and education of orphans and invalids. In 1859, José Maria Eugénio de Almeida, an influential capitalist of the period, became the administrator. He immediately engaged construction works to palliate the insalubrity of the buildings and the general lack of room for the increasing number of residents (1000 orphans).

As described by Regina Anacleto [5], Almeida was in complete control of the interventions and appointed a succession of architects at the head of the works himself. The first wave of interventions was supervised by Valentim José Correia, between 1863 and 1865, who proceeded to destroy the first floor, conserving only the gallery, to reconstruct a new one that adopts the same rhythm of buttresses and pierced with neomanuelin windows of his design. The right photograph in Figure 4 shows in the background a portion of the building where the first floor was already replaced. In the foreground, the first floor is being demolished. This new first floor is taller than the former and composed of a unique room in its width (see the left photograph of Figure 4). The addition of turrets (see Figure 4) at the extremities of the wing are attributed to J. Samuel Bennet, an English architect. Between 1867 and 1878, José Cinatti and Aquiles Rambois, italian scenographers at the San Carlos theatre who had previous experiences as architects were appointed. They completed the lateral turrets and demolished the Hall of the Kings which had the effect of separating the wing from the rest of the complex. They undertook the construction of a central tower, an eclectic composition of Manueline, gothic and oriental origins that replaced the three central spans (Figure 5). This tower was flanked by two smaller bodies at the back (letter A in the current plan in Figure 6) and another body containing the staircase was constructed at the east extremity (letter B in the plan).

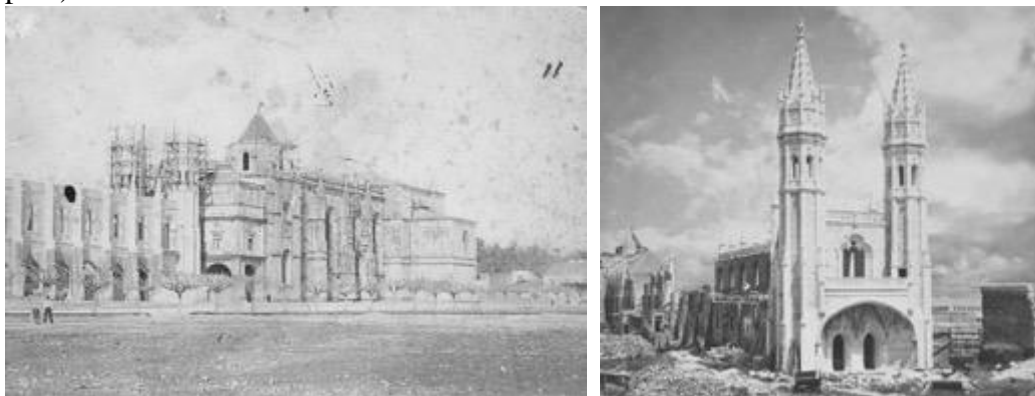


Figure 4: left: Photograph of the eastern extremity, ant. 1868, unknown author and possession; right: Photograph of the western extremity of the dormitory wing during the substitution of the first floor, Carlos Relvas, 1869, frSFP_0351im_EP_0005 © SFP.



Figure 5: left: Photograph captured during the construction of the central tower, unknown author, 1877, © Arquivo Municipal de Lisboa; right: Photograph captured after the collapse of the central tower, Henrique Nunes, 1878, © Arquivo Municipal de Lisboa.

The tower collapsed mid-construction on 18 December 1878 at 9 am. Luciano Cordeiro [3] invoked as reasons that the vaults were too depressed and the masonry of poor quality. Several photographs that document the collapse exist; one is presented in Figure 5, the others in the Appendix. The spans immediately next to the tower were partially destroyed. However, the outer walls of the two smaller bodies flanking the tower at the back remained.

In the aftermath of this dramatic collapse, the engineer Manuel Raymundo Valadas and the architect Rafael da Silva Castro were charged of completing the construction of the western side of the building [5]. The ruin was dismantled, and the openings left by it were temporarily closed. In 1894, the department for the conservation of public buildings evaluated two solutions: either the filling of the gap with a motif similar to the rest of the facade or the re-construction of a “central body” more economic than the first. At the same time, the building was assigned to house the Ethnographic Museum (now Archaeological Museum of Lisbon). A competition for the completion of the building and a new expansion for the museum is opened to Portuguese architects in 1896 and won by Henrique Parente da Silva [5].

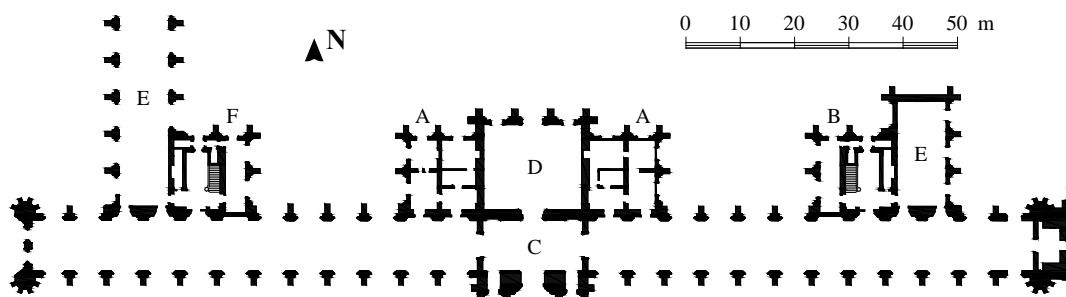


Figure 6: Current ground floor plan of the building.

Around 1903, the project was undertaken (see the completed project in the left photograph of Figure 7): a lower central body was constructed in the gap. It contains a vaulted entrance hall at the front and a large room at the back (respectively C and D in

Figure 6) with the same disposition repeated on the first floor. This body is lined with the two smaller bodies that survived the collapse that contain administrative spaces. Parente da Silva also added of two wings at the extremities of the building (E in Figure 6) that link it to another wing at the back built by Casa Pia in the mid-19th century. These wings copy the façade and disposition of internal spaces of the main building. They are respectively partially finished on the right of the aerial view of Figure 7 and unfinished on the left side. These works probably came to a stop because of a lack of funds. The construction of the new wings was temporarily abandoned and the room at the back of the central body was left unfinished to this day. The right photograph of Figure 7 shows the east wing left mid-construction.

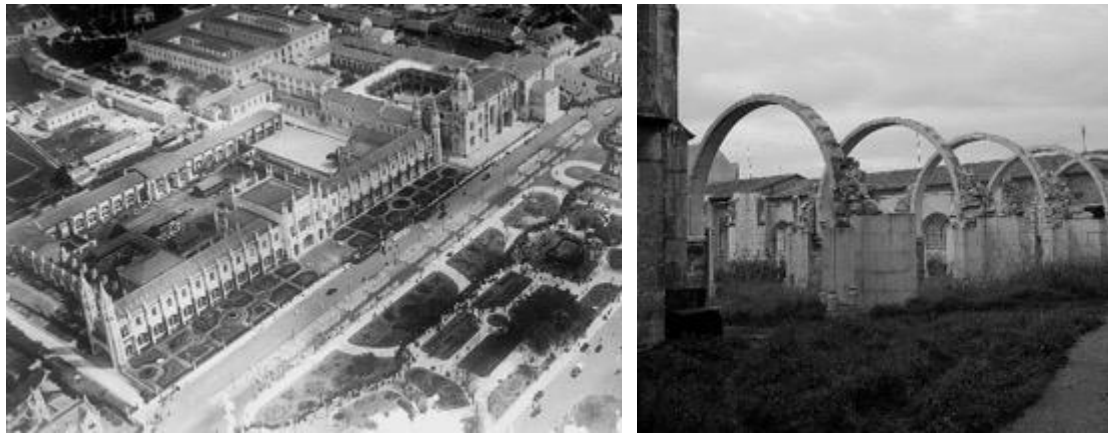


Figure 7: left: Aerial photograph of the monastery, c. 1929, Foto 00503579, © IHRU/SIPA; right: Eastern wing mid-construction, c. 1929, Foto 00504224, © IHRU/SIPA.



Figure 8: left: Photograph of the construction of the facade at the end of the aborted east wing, c. 1939, Foto 00503331, © IHRU/SIPA; right: West wing mid-construction and new staircase outbuilding, 1961, Foto 00503653, © IHRU/SIPA.

A second wave of construction works arises in 1939 in preparation for the Exhibition of the Portuguese World, organised by the regime on the square overlooked by the monastery. Various alterations of the facade were made: (i) the reduction of the upper part of the central body, (ii) the levelling of the pinnacles along the facade, and (iii) the

removal of some of the ornamentation of the central body. The aborted east wing started in the 1903 works was closed with a facade (mid-construction in the left photograph of Figure 8). The prepared piers and arches of the right photograph of Figure 7 were demolished. The west wing was later completed in the 1960s and given along with the north building to the Navy Museum inaugurated in 1962 (see the right photograph of Figure 8). A staircase body mirroring the one constructed before the collapse of the tower was added in 1961 (F in the plan of Figure 6; see the left photograph of Figure 8).

4 A COMPARISON OF THE STRUCTURAL SYSTEMS

Figure 10 shows a comparison between the authentic structure of the gallery and the structure of the new galleries erected at the beginning of the 20th century. The constitution of the walls is revealed by the photographs of the collapse (see Figure 5 and the other photographs in the Appendix). The walls of the ground floor are constituted of a typical gothic “three-leaf” system of ashlar facing stones filled with a mixture of gravels and mortar. The photograph reveals that the walls of the collapsed tower and reconstructed first floor are made of an irregular masonry of small stones, a sort of *opus caementicium* that is concealed on the façade by a thin veneer of ashlar (probably attached by metallic clamps to the masonry) and left visible inside (the walls were initially covered with wood panelling). Close inspection of the stonework indicates that the surfaces of the new buttresses are made of ashlar masonry. This shows a certain pragmatism in the design of the structure: the buttresses are made of a good quality and heavy masonry because they need to ensure the lateral resistance of the building and produce the weight necessary to retain the vaults; the walls have little role in the carrying of the loads and therefore are made of a less noble and lighter material that however intends to emulate the authentic construction technique by the use of covering.



Figure 9: left: photograph of the gallery vaults under reconstruction next to the central body, c. 1939, Foto 00502933, © IHRU/SIPA; right: photograph of the extrados of the east wing vault, c. 1939, Foto 00503336, © IHRU/SIPA.

One photograph (left Figure 9) captured during the reconstruction of the original gallery vaults close to the central body provides information on its constitution (see also the right photograph of Figure 5). The use of multiple crossed ribs that create many key stones and the curious pointed basket-handle arches are visible in many of the Manueline constructions (including in the church of Santa Maria de Belém) [6]. Their particularity

is that the triangular surfaces produced by the ribs, which are filled with the webbing, are rather small and therefore the main load-bearing role is ensured by the rib skeleton. As visible in the photograph, the ribs connected to the walls are reinforced with spandrels. This disposition is not typical in the original French gothic constructions but was observed and interpreted as a gothic anti-seismic apparatus by Pepa Cassinello in Spanish cathedrals that were built in zones of high seismicity [7]. When the ribs are loaded laterally, these spandrel walls can enter into compression by pushing against the buttresses which prevents the opening of cracks on the ribs that typically lead to the failure of a vault. As visible in Figure 10, the extrados is completely filled with earth to create a flat surface on which a timber floor was placed, later replaced by a floor of thin masonry arches as attested by photographs (see Appendix).

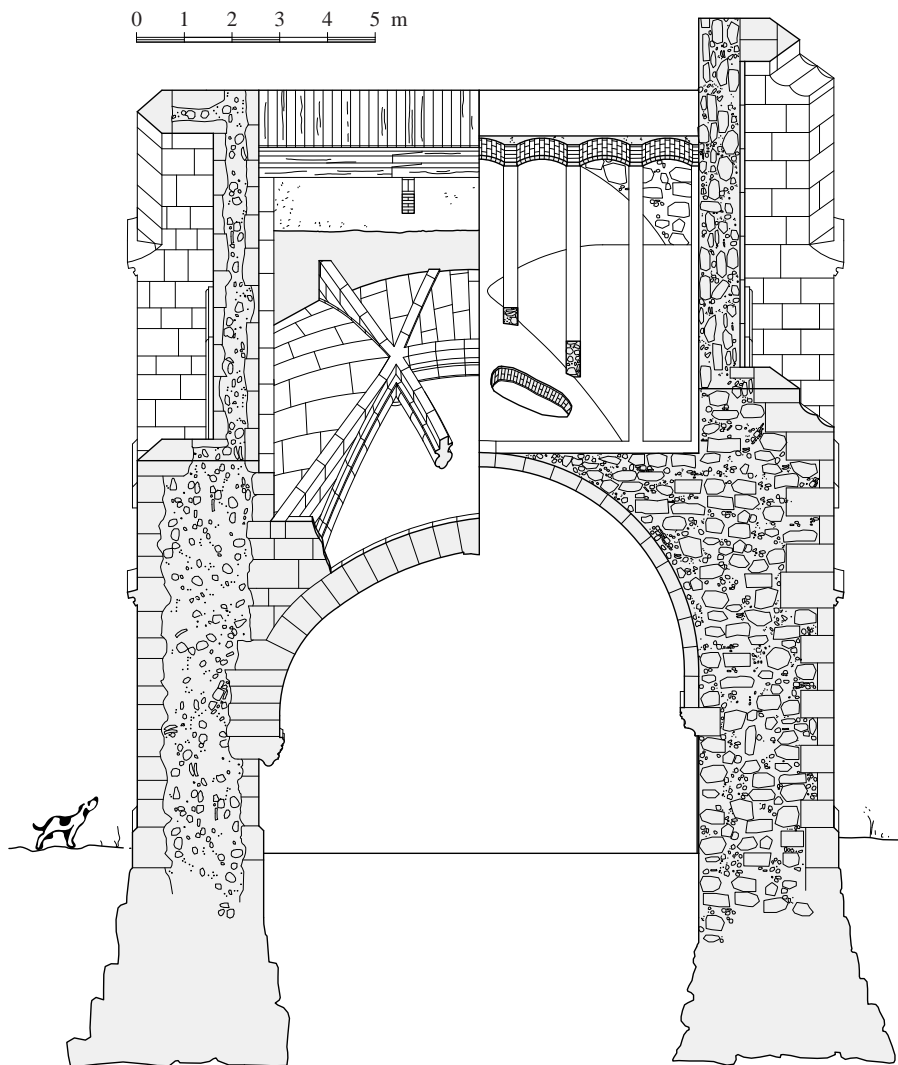


Figure 10: Constructive axonometric view of the galleries. left: 16th century; right: 20th century extension.

The new wings copy the rhythm of buttresses and façade of the original part but adopt a different vaulting system. A circular arch is positioned at each buttress and the void between two consecutive arches filled with groin vaults made of brick masonry plastered

on the intrados. The intrados is visible in the right photograph of Figure 9 and reveals the presence of spandrels above the arches. The extrados is not filled with earth but walls are mounted directly on it, acting also as ribs to the vault, and hold the floor structure that is composed of a light system of masonry vaulting covered with a cementitious material. Here the arch is nothing else than a *doubleau* without great structural role. It is mostly a device used to mark the passage of the thrust forces to the wall and that expresses the stiffening spandrel wall placed above. Here again the pragmatism of the construction is made clear by the choice of a vault of simple geometry constructed using light materials and fitted with a floor structure that is very efficient. The construction of the walls is similar to the one used fourty years before for the reconstruction of the first floor of the main building.

The floors of the administrative spaces (A, B and F in the plan of Figure 6) are in all probability a system of metallic I-shape beams connected by thin brick vaults covered with a layer of cementitious material. Metal detection tests reveal the presence of these beams and indicate of spacing of 60 cm. Additionally, the observation of some ceilings (see photograph in Appendix) indicates the characteristic curved intrados of the brick vaults and lower flange of the metallic beams. This flooring system was a very economical alternative for the covering of medium spans in this period before the advent of reinforced concrete floors.

The drawing of Figure 10 is based on the photographs shown previously and described in this section. Some additional photographs were used but their importance being inferior, they were gathered in the Appendix. The constitution of the walls is based, apart from the photographs, on a careful examination of the stone joints and completed with informations from Viollet-le-Duc's *Dictionnaire raisonné de l'architecture française du XIe au XVIe siècle* [9]. The drawing of the foundations is hypothetical.

5 A DISCUSSION ON THE INTERVENTIONS

In 1895, Luciano Cordeiro, a member of the Lisbon intelligentsia wrote a pamphlet addressed to the Commission of National Monuments [3] that addressed a sharp critique of the works carried out on the dormitory wing. He invoked two conflicting objectives at the root of the project: the need to extend the building to house a thousand orphans, and the wish to restore the monumentality of a building with a strong connection to the history of the nation. He declared that rather than insisting on the extension and renovation of the building to house the orphanage (which when Cordeiro writes reached an exorbitant cost), the latter should have been restored in a respectful manner and a new building built in the vicinity to house the orphans. Cordeiro's judgement in his writings seems close to our current vision.

At the beginning of the interventions in 1861, Eugénio de Almeida announced: "It is a work of good taste and national pride to cleanse the monument of these excrescences, bringing it into harmony with the original construction" [4]. Through this sentence we understand that Almeida was probably familiar with the contemporary restorations of French medieval monuments (the restoration of Notre-Dame by Eugène Viollet-le-Duc is almost finished at this time) and wanted to restore the monastery in the same line. Nowadays, we see that this intention was rapidly betrayed by an absence of serious understanding of the style, history and meaning of the building. The latter is restored to a state that was never meant by its designers. As noted by Cordeiro the monumentality of the building is artificially increased by making it into an autonomous body separate from the monastery and by the adjunction of high towers and invented ornamentation (the

façade still today concurrences the monumentality of the church). These additions are conjugated with liberal destructions and replacements of the original fabric (probably justified at the time by its poor state of repair) that are to deplore today. This attitude differs sensibly from that of the French school. Although the restorations of Viollet-le-Duc were characterised by the wish to recreate a pristine state at the cost of a high level of interventionism, later judged too important, these were founded on a good archaeological understanding of the building and its history coupled with a rich knowledge of medieval architecture and building techniques. These aspects are the ones precisely lacking during the works commissioned by Eugénio de Almeida.

This sequence of restoration may be understood first and foremost as a sign of the failing legislation and control of the restoration of monuments by the state. Indeed, the first commission was constituted in Portugal in 1864 but possessed little control. Without this necessary control, the project was simply left to the judgement of Almeida and his architects with regrettable results.

The second problem mentioned by Cordeiro was the need to extend the building. In the 19th century works, this extension is ensured by the use of the attics of the new first floor and by the adjunction of new bodies grafted to the back of the building (thus avoiding to disrupt the main façade) that house various spaces (see the right photograph of Figure 8). The facades of these constructions emulate that of the main building to create a coherent language. The solution of extending a building by copying the drawing of the original façade is a typical solution [8]. In this type of situations, the program and economy of the extension project are usually close to that of the original construction and the construction techniques, materials and technologies in use are relatively unchanged between the original construction and the extension. These conditions are not united here and it seems there is a conflict between the envelope and the interior. The façade announces two floors and the buttresses indicate the presence of vaults. In reality, the subdivision of floors is different and the buttresses do not counteract the thrust of any vault. Economical structural systems are used (the veneered rubble masonry and the metallic floors) which again contradicts the medieval construction announced by the facade and is in opposition with the contemporary reflections regarding the truth of the structure (theorised by Viollet-le-Duc in his *Entretiens*).



Figure 11: left: photograph of the first floor of the North wing mid-construction, c. 1984, Foto 504317, © IHRU/SIPA; right: photograph of the façade of the North wing mid-construction, c. 1984, Foto 00504325, © IHRU/SIPA.

This attitude continues when in the 20th century, extensions are needed for the museum and again the façade is emulated for the constructions of new wings. This time the program is similar to that of the main building. However, the Manueline vault is replaced with a more economical one described in the previous section. It abandons the expressiveness of the original construction, avoiding the use of ribs and relying on a white render to hide the economical materials used for the vault and the walls which results in spaces that are very different and certainly less interesting. We can also question the appropriateness of these narrow galleries, imposed by the set external shell, for the housing of exhibitions. Nowadays the designers of the exhibits had to resort to complicated dividing partitions to allow a good flow of visitors.

The interventions come to an end in the 1980s, the North wing is fitted with a first floor, for use of the Marine Museum, which again emulates the rest of the constructions. This time the use of stone is abandoned to make way to brick and reinforced concrete veneered with stone (see Figure 11). This attitude of the “pastiche”, which in the case of this complex, seems to have adopted because of the political importance of the building, has already been identified as problematic in some cases by historians (see [10] for example). Here we see that it led to the sterility of the architecture. The choice of a set external envelope is made at the cost of the quality and suitability of the internal spaces. The use of contemporary and economical construction techniques that have little to do with the ones used in the 16th century conflict with the envelope and naturally engender the use of devices to create the illusion of authenticity.

In this type of cases, an extension that clearly presents itself as contemporary but is at the same time respectful of the existing fabric should be privileged. The external shell is left free to adapt to the necessities of the museum and the use of visible contemporary materials perfectly acceptable. Particularly effective examples of these types of interventions are the extension of the Tate Gallery in London and the Staatsgalerie in Stuttgart designed by James Stirling.

6 CONCLUSIONS

This paper presents the result of an analysis of the history of the construction of the dormitory wing of the Jerónimos Monastery. In this case like in others, the historical survey is a tool that is strictly necessary for the design of an intervention both for the architect and for the engineer. The aspects it allowed us to understand in this case are listed below.

1. An historical building is an accumulation of constructions from different periods that can become very complex. The different parts are sometimes difficult to distinguish especially when some elements were designed to emulate older parts (as demonstrated in this case study). The sources allow the dating of the interventions and the different elements.
2. The precited dating of the different parts allows an evaluation of the culturally valuable parts of the building that should be preserved in future interventions.
3. An understanding of the context and attitude of the designers when the construction and interventions took place is necessary to understand the reasons behind the design and constructive choices (e.g. the choice of a certain structural system).

This understanding is important because it allows the research of other sources that allow the completing of the missing information.

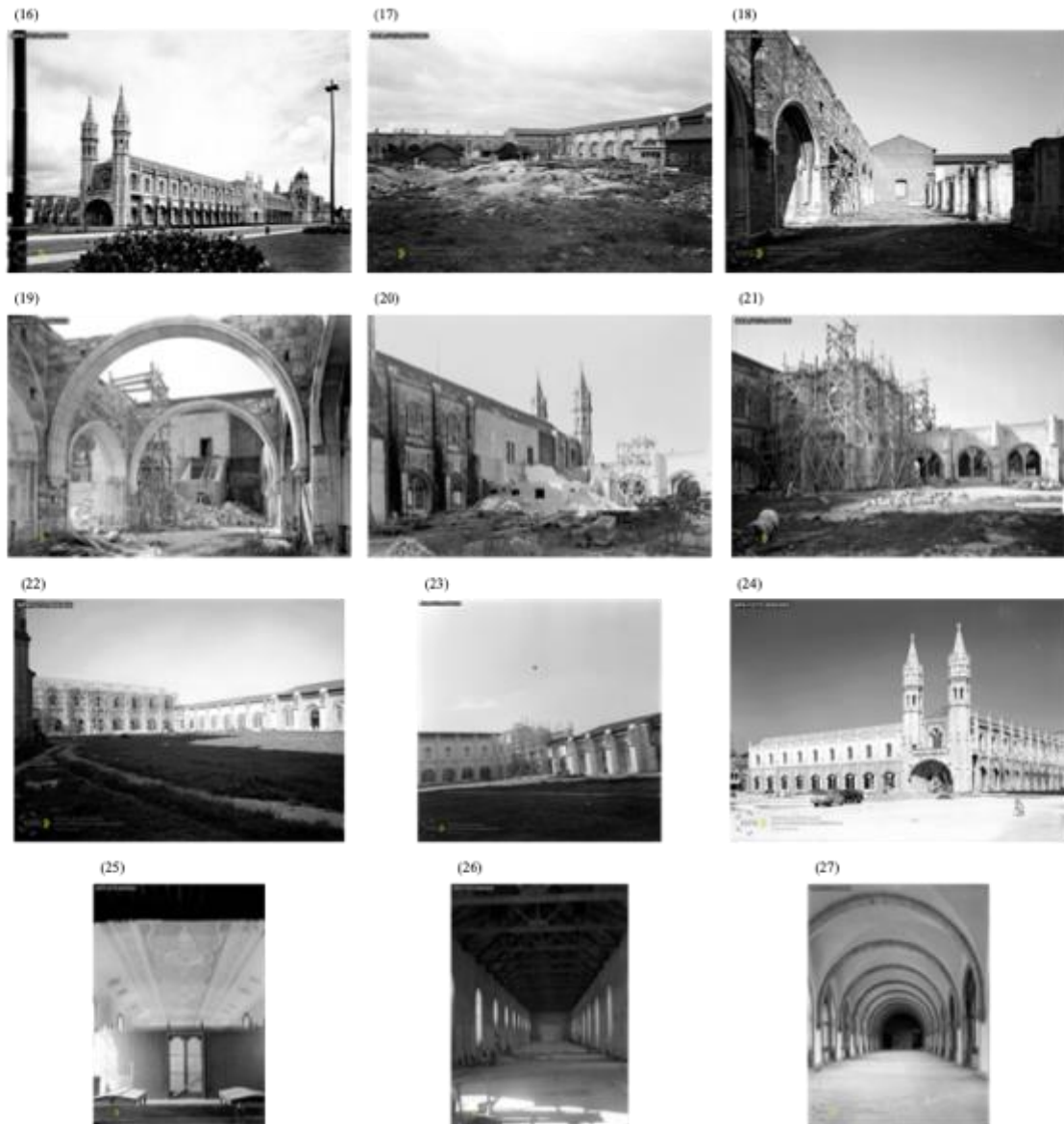
4. Photographs and drawings issuing from the survey allow an understanding of the composition of the elements, details and techniques that are necessary to understand the behaviour of the structure and build realistic models. This prevents the use of non-destructive tests whose results are sometimes hard to interpret for the understanding of the structure but rather for the validation of assumptions already formulated.

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APPENDIX: ADDITIONAL PHOTOGRAPHS





(1) General view of the building during the construction of the central tower, ant. 1878, Foto 00503165 © IHRU/SIPA. (2), (3), (4) and (5) Views of the ruins of the central tower, c.1879, Eduardo Portugal © AMLSB. (6) Central gap after the removal of the ruins, c. 1888, © AMLSB. (7) Front façade of the new central body, c. 1920, Foto 00503069. (8) Back façade of the central body, c. 1940, PB-IV-0821 © DGPC|MNA. (9) Rear room of the central body, 1941, Foto 00503345 © IHRU/SIPA. (10) Entrance hall, 1974, PB-IV-0897 © DGPC|MNA. (11) General view of the back façade, c.1940, Foto 00503095 © IHRU/SIPA. (12) Demolishing of the temporary façade of the East wing, c. 1940, Foto 00503547 © IHRU/SIPA. (13) Timber floor over the original gallery, 1941, Foto 00503274 © IHRU/SIPA. (14) Replacement with a masonry vaulting system, c. 1940, Foto 0328075 © IHRU/SIPA. (15) First floor of one outbuilding, 1975, PB-IV-0995 © DGPC|MNA. (16) General view from the West, 1958, Foto 00503608 © IHRU/SIPA. (17) and (18) West wing before the beginning of the completion works, ant. 1960, Foto 00503093 and 00503283, © IHRU/SIPA. (19), (20), (21), (22) and (23) During the works, c. 1961, Foto 00503528, 00503527, 00503626, 00503652 and 00504191, © IHRU/SIPA. (24) Finished external façade, 1962, Foto 00503955, © IHRU/SIPA. (25) Wood panelling of the first floor of the main building, c. 1940, Foto 00503262, © IHRU/SIPA. (26) First floor of the West wing, c. 1962, Foto 00503656, © IHRU/SIPA. (27) Ground floor gallery of the West wing, c. 1962, Foto 00503658, © IHRU/SIPA.