

CHARACTERISATION OF HISTORICAL LIGHTHOUSES AS INDUSTRIAL HERITAGE ELEMENTS: APPLICATION TO THE LIGHTHOUSE OF THE ISLAND OF SANTA CLARA, SPAIN

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ABSTRACT

Lighthouses are a symbiosis of architecture and technology, combining a tower, an adjacent building with living quarters and stores, and technology that produces signals for sailors. They must be permanently in operation and they must be unmistakably distinguished from other nearby lighthouses. They are extremely versatile elements that satisfy several functions in addition to the light signals. The authors consider that traditional lighthouses, commissioned in the mid-19th century, are genuine signalling factories, and that they must be studied as such, based on the concepts defined by the UNESCO documents, among others, for industrial heritage. Recently, the Institute of Cultural Heritage of Spain (IPCE), dependent upon the Government of Spain, has considered lighthouses with a historical value as industrial heritage elements. The authors accept this consideration and as such, in 2017, the drafting of the Catalogue of Lighthouses with heritage value in Spain was commissioned by the IPCE. A large number of projects are being activated today to include tourist uses in the lighthouses. However, it has been detected that these projects eliminate tangible and intangible materials that irreversibly distort the lighthouse as an example of our industrial heritage. The paper aims to detect the characteristics that must be assessed to establish the heritage value of historical lighthouses and propose a procedure for their evaluation. By way of an example, the value of the lighthouse of the Island of Santa Clara in Donostia-San Sebastian (Spain) is analysed from the viewpoint of its pertinence to the industrial heritage. To characterise a lighthouse, its architecture, location, the technology implemented in the lamp that tops the tower, and its spatial distribution must be analysed.

Keywords: historical lighthouses, industrial heritage, historical architecture and technology, Santa Clara Island.

1 INTRODUCTION

As a result of current technological advances, lighthouses built in the mid-19th century have lost part of the functions assigned to them. Originally, these elements indicated orographic milestones on the coast, they guided navigation, they emitted acoustic signals in foggy weather, they were able to guide air traffic during the first half of the 20th century, they warned of smuggling and fishing grounds, and they even acted as watchtowers carrying out defensive tasks. They are a combination of architecture and technology, forming genuine “signalling factories”. The optics (mainly Fresnel lenses) and their rotation mechanisms, that can reach up to 2,000 kg in weight, were placed on the cusp of a tower measuring several metres high and located in practically inaccessible places, forming genuine construction feats.

With the exception of the sound coming from acoustic fog signals, the lighthouse is probably the only piece of machinery built by man in the 19th century that does not produce noise. The optics rotation or obscuration screen mechanism was generated by a weight that fell by force of gravity through the tower. The light generated by the lamp was guided by means of some metal plates that worked by reflection (catoptric optics) or by means of Fresnel lenses (dioptric optics), working by refraction or by means of a combination of both technologies (catadioptric optics). The aim is to generate a beam of light at regular time



intervals that unmistakably identifies each lighthouse [1]. All of this was in permanent operation all the hours of the year. In the slang used among maritime navigation professionals, the term “lighting of the lighthouse” is used to identify the date when it came into operation. The luminous signal and the construction element that contains it (the tower) are especially important.

Another relevant factor is the building of living quarters for the lighthouse or tower keepers. These professionals had to permanently live in the lighthouse accompanied by their families, creating a peculiar building organisation. The lighthouse keeper had to write every day in the Order Log, the Communications Log and the Service Log, mentioning any contingencies observed and even a brief weather report. The distribution of spaces and their organisation responds to a necessary plan. One part was used by the main lighthouse or tower keeper, which was differentiated from the area designated for the assistant (more than one in some cases). The workplaces and the living quarters are two and the same. Operating the lighthouse requires a small office, some small workshops to carry out maintenance and repairs, and stores for fuel and spare parts. In many lighthouses, the living quarters were accessed the service area. They all had a cistern, a market garden and premises to stable subsistence animals. Electrification began during the last decade of the 19th century.

The lighthouse is an elusive construction. During the day, the architecture is observed, with the tower, the living quarters of the lighthouse or tower keepers, and other adjacent buildings used as workshops or stores, but the light emitted is not seen. At night, the lighting system, produced by rotations or flashes, stands out, and the construction system is not seen. Only at dawn and during the final minutes of nightfall is it possible to appreciate both architecture and light.

Lighthouses were built in Spain as a result of four national plans designed by the Lighthouse Commission in 1842, 1902, 1967 and 1989/1995. In the first plan, approximately 100 out of the 190 lighthouses in operation today were built [2]. Their historical value is identified with the state of technology and of construction at their “lighting” period. All of them have an intrinsic value based on their location. In mid-19th century more than 4,000 lighthouses were constructed worldwide, using a technology specifically developed for this [3]. The Fresnel lenses went from the laboratory to be used in industry, while the towers were erected in masonry by master stonemasons who participated in Spain in the construction of the 19th century neo-Gothic cathedrals. It was an emerging market that brought considerable profits for French, English and German companies. Today, lighthouses preserve their value as signalling elements by integrating in them the modern positioning and guidance systems. However, the majority are “remotely” managed so the continuous presence of the tower or lighthouse keeper, a profession that is gradually disappearing, is not necessary.

A large number of projects are being activated today to include tourist uses in the lighthouses. In all cases, in agreement with the Spanish legislation, it is compulsory to maintain the use of the lighthouse as an element of aid to maritime navigation. However, it has been detected that these projects eliminate tangible and intangible materials that irreversibly distort the lighthouse as an example of our industrial heritage. The article aims to draw attention to this problem.

Therefore, the objective of the article is to establish the bases to detect the heritage values of historical lighthouses and to show the way to characterise this type of constructions based on industrial heritage parameters. The analysis methodology carried out can be applied to any historical lighthouse.

As an example of the analysis of the characteristics of Spanish lighthouses in mid-19th century, the lighthouse of the Island of Santa Clara in Donostia-San Sebastian (Spain) is described in this article (Fig. 1). It is small in size when compared with the large Spanish

lighthouses (e.g. Chipiona, Cape Palos, Tower of Hercules and Maspalomas). This lighthouse complies with the connotations mentioned in the previous paragraph, with the peculiarity of being located on an island contributing to its original integrity.

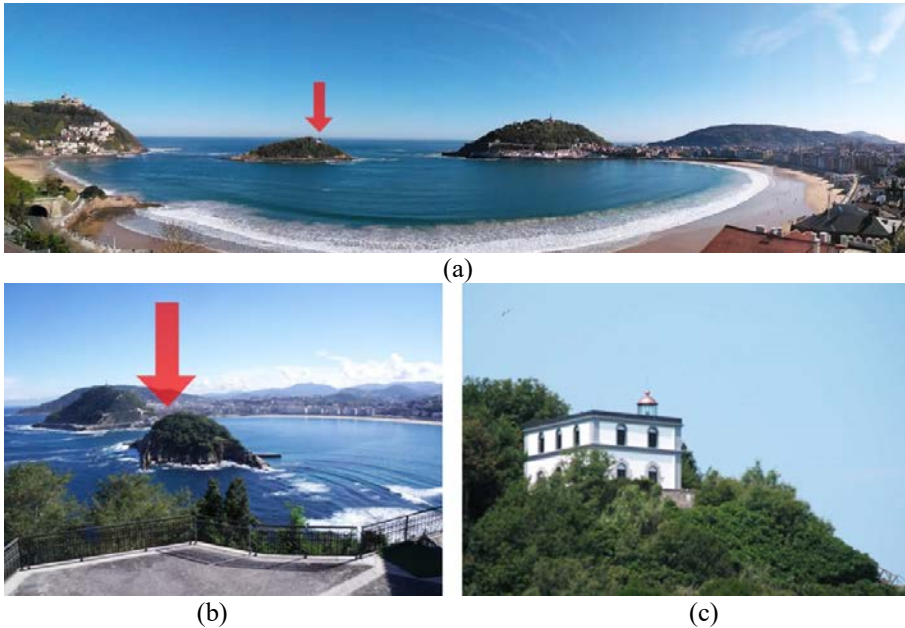


Figure 1: (a) General view of La Concha Bay in Donostia-San Sebastian (Spain); (b) The Island of Santa Clara; and (c) The lighthouse of the Island of Santa Clara.

2 CONCEPTS REQUIRED TO IDENTIFY AND CHARACTERISE INDUSTRIAL HERITAGE ELEMENTS

Recently, the Institute of Cultural Heritage of Spain (IPCE), dependent upon the Government of Spain, has considered lighthouses with a historical value as industrial heritage elements. The authors accept this consideration and as such, in 2017, the drafting of the Catalogue of Lighthouses with heritage value in Spain was commissioned by the IPCE [4]–[7]. The lighthouse of the Island of Santa Clara forms part of this catalogue.

The National Plan for Industrial Heritage [8], [9] of the IPCE defines what is understood by industrial heritage and which components form part of an element considered as such. Special emphasis is placed on them being elements whose origins lie in the Industrial Revolution that started in England at the end of the 18th century and that, in Spain, was consolidated from the third decade of the 19th century on. Industrial heritage is associated with an industrial era and includes “tangible and intangible contents associated with the working memory work and the place”. It also mentions that “Probably, one of the most important criticisms in heritage-related interventions of recent years has been that some of the projects have left the original elements devoid of content, provoking the absence of references and the loss of the working memory. Not all restored buildings can be adapted to any new functionality. Industrial heritage is the result of a certain relatedness, of capitalism, and with a specific technological system: mechanisation. Consequently, their elements were erected between mid-18th century and the last third of the 20th century”.

The analysis of an industrial heritage element with historical value must include both its tangible and intangible elements. The former can easily be identified. The latter can be defined as “entities of industrial memory” [8], [9] which are the testimonies that represent a comprehensive part of the historical memory associated with a working system.

3 METHODOLOGY

In addition to the concepts reflected in the National Plan for Industrial Heritage [8], [9], the following documents have been followed to establish the heritage value of historical lighthouses: Recommendation of the Council of Europe no. R (87) 24 [10] and no. R (90) 20 [11]; The Nizhny Tagil Charter for Industrial Heritage [12]; Principles of Dublin (2011) drafted jointly by ICOMOS-UNESCO [13]; and Resolution 1924 (2013) of the Council of Europe entitled Industrial Heritage in Europe [14].

The lighthouse of the Island of Santa Clara has been investigated through historical-documentary analysis and historical-constructive analysis, in order to determine its original architectural elements, spatial distribution and technology.

In the historical-documentary analysis, most of the documents were obtained from the Historical Archive of Ports of the State. Specifically, folders 77/7, 53/5, 78/1, 77/8 and 78/2 of the Historical Archive of Ports of the State have been analysed. Other archives have also been consulted, such as the Archive of the Port Authority of Pasajes, the Municipal Archive of San Sebastian, the Historical Provincial Archive of Gipuzkoa, the General Archive of Gipuzkoa and the National Historical Archive of Spain.

In the historical-constructive analysis, a detailed study of the walls was performed indicating different materials, building periods and alterations. The study of the drawings of the original project has been essential, which have been compared with the current state of the building.

4 THE LIGHTHOUSE OF THE ISLAND OF SANTA CLARA

4.1 Location

The lighthouse is located on the Island of Santa Clara at the entrance to La Concha Bay in Donostia-San Sebastian (Fig. 1). The lighthouse indicated the position of the Island of Santa Clara, the only navigable entrance to the bay to the port of Donostia-San Sebastian. The coordinates of the lighthouse of the Island of Santa Clara are Latitude: 43°19.315 N and Longitude: 1°59.896 W. The city has a geostrategic situation of interest as it is located in the far north of the Iberian Peninsula, 20 km from France in one of the corners of the Bay of Biscay.

4.2 Original architectural project

The “lighting” of the lighthouse of the Island of Santa Clara took place in September 1864. The original architectural project [15] can be seen in Figs 2 and 3. Probably, as justified below, the available planimetry is what today is called a “draft project” or “project ideas”, as neither the type of structure nor the materials used in the tower and in the living quarters building are indicated.

The lighthouse was planned to be used by a lighthouse or tower keeper. The spatial distribution and location of the tower correspond to Typology B-2 according to the classification defined by the first author for lighthouses with heritage value of Spain [4], [5], [7]. The entrance hall to the tower is the connecting axis between three areas: living quarters, offices and small workshop, and the tower that emits the light of the lighthouse.



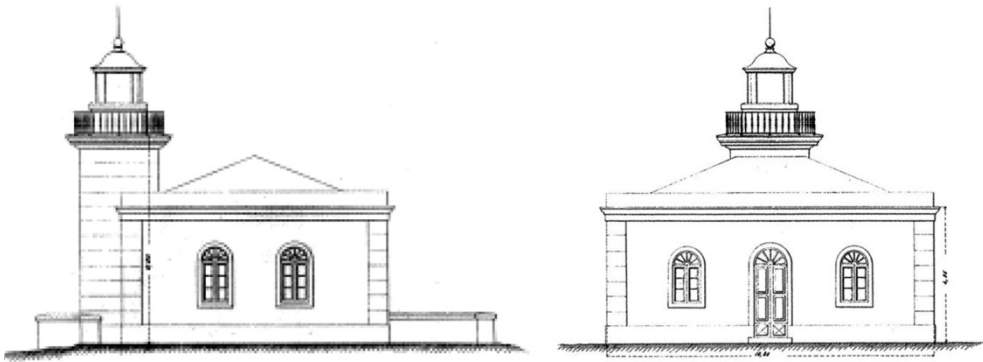


Figure 2: Elevation of the façades in the original project, 1864.

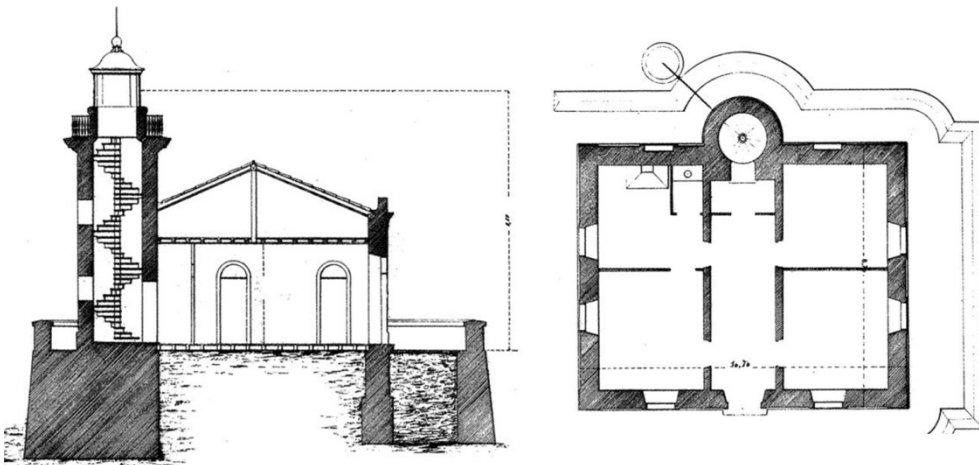


Figure 3: Longitudinal section and ground plan in the original project, 1864.

From the lighting viewpoint, it was initially proposed for it to have fixed white light with flashes every minute and a dioptric lens system from the firm Henry Lépaute with headquarters in Paris. The reach of the light had to be 9 nautical miles (16,668 km).

4.3 Evolution and current state of architectural elements, spatial distribution and technology

The written documentation dates back to 1911 so there is a total lack of documentation between this year and the year of lighting (1864). Forty-seven years during which it has been impossible to attest the changes that took place in the lighthouse, changes that are obvious but very small in number. From the constructive viewpoint, it is only detected, with respect to the current situation, that the under-roof floor is consolidated as a second floor with flat roof (Fig. 4). The authors consider that this modification was carried out immediately after the construction of the lighthouse for several reasons. It is even possible that originally, the

definite aspect was as observed today, and that the drawing shown in Fig. 6 is an indicative preliminary project. This fact has been observed in hundreds of documentary collections of other lighthouses analysed (e.g., the Lighthouse of Oropesa), where the original projects were changed as the definite construction date approached. The modification to include two storeys and a transitable flat roof simplified the work related to the exterior upkeep and maintenance of the tower. On the other hand, it increased the working area of the building of living quarters, office and small workshop. The spatial distribution of the new floor is identical to the lower floor without having to overburden the structure. In the case of the Lighthouse of the Island of Santa Clara, this new floor, accessed from the tower staircase (Fig. 5(a)), contained three bedrooms and a full bathroom, leaving the ground floor for dining room, kitchen, toilet, office and small workshop. The water tank is located on the new flat roof, which was filled from the cistern using manual operating pumps.



Figure 4: (a) General aspect of the building today; and (b) Current flat roof.

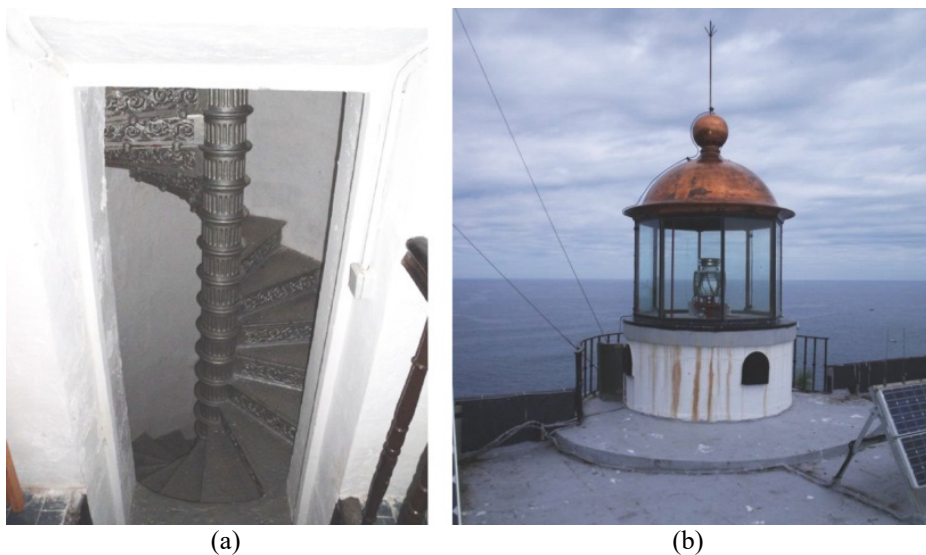


Figure 5: (a) Access to the second floor from the tower staircase; and (b) Lamp and dome.



Figure 6: (a) Access to the tower from the main entrance hall; and (b) Second-floor bedroom.

It can be stated that the construction has reached our days with a similar internal organisation to the original (Fig. 6). The current height measurements, ground plan, door and window openings, dimensions of the tower and rooms, are identical to those that are described in the original drawing. A similar morphology of carpentry is even detected. The lighthouse has been uninhabited for the last 30 years so no modifications have been made to the spatial distribution throughout this period, helping to reinforce the idea of its original integrity.

A similar consideration can be made regarding the dimensions of the lamp and dome. During the presentation of the lighthouse by the Department of Public Works to the Management of the Group of Ports, in 1957 [16], it is mentioned that the lamp is octagonal with a dome installed in 1864 by the firm, Henry Lépaute, indicating its dimensions. This information already appeared in the original project so by verifying the current dimensions, it can be said that the lamp and dome are the original ones from 1864 (Fig. 5(b)).

Regarding the optics, and consulting available documentary sources, they have undergone two modifications as a result of the service needs. In 1911, the Lighthouse Commission decided to modify the appearance of the lighthouse light for sailors (Royal Order of 23 February 1911). This appearance must be a white light with groups of three obscuration's that must be achieved with metal screens. The optics remain intact and immobile, coupling a rotation system with two outer screens, with a speed of one turn every 30 seconds. The screens are placed floating in a tank of mercury, connected to a cable and a 30 kg weight that descends by force of gravity down the lighthouse tower (8 m run), according to 1911 project (Fig. 7(a)). The down chute of the weight can be seen today (Fig. 7(b)). The great advance represented by the design of mercury floats in O-ring vats to facilitate the rotation process must be pointed out.

This system was ordered in 1911 from the French firm, Barbier, Benard and Turenne, increasing the reach of the light to 12 nautical miles (22,224 km). The lamp was incandescent powered by gasoline. The complete replacement process ended on 25 August 1916. The long construction and installation period reflect the difficulty of taking any material to the lighthouse of the Island of Santa Clara. Probably the onset of the First World War in 1914 contributed to the delay of the work.

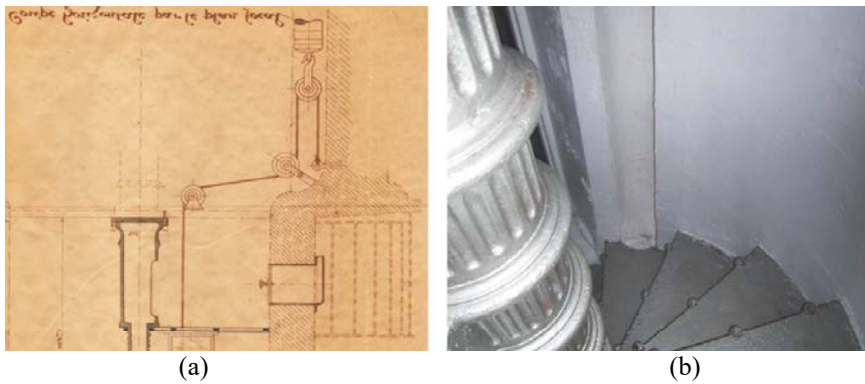


Figure 7: (a) Weight system of the rotation system according to the 1911 project; and (b) Down chute of the weight of the rotation system of the optics screens today.

The original 1864 optics are perfectly preserved today and can be found at the headquarters of the Ports of the Basque Government organisation in the port of Donostia-San Sebastian. The new optics introduced according to the 1943 project, working with a lamp of compressed acetylene dissolved in acetone, is still kept in the lighthouse today as reserve optics to those implemented in 2008. The latter, of acrylic material, works with LED lamps, generating flashes with no rotation mechanism. In other words, throughout the history of the lighthouse, three optics have been implemented; the initial 1864 optics that are preserved as a “museum piece”, the 1943 optics that are preserved in their entirety in the lighthouse as reserve optics, and the current 2008 optics (Fig. 8(a)). The electrification of the lighthouse was carried out in 1942 based on a project of 1932.

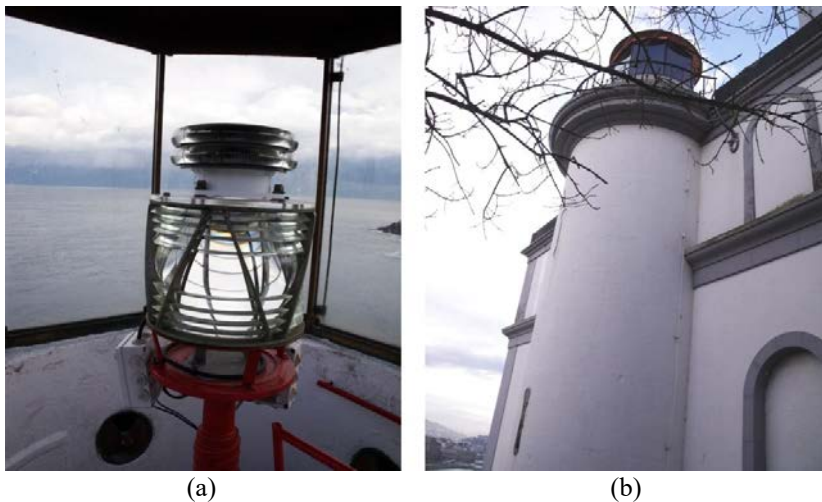


Figure 8: (a) Acrylic optics of 2008 on white-coloured base placed on the optics implemented in 1943, with inclined struts (both work with flashes of the lamp with no rotation mechanism); and (b) Detail of the semi-embedded tower in the living quarters, office and store building.

Finally, we must mention that improvements were made to the lighthouse esplanade in 1930. In 1945 some repairs were made to the path going from the wharf to the lighthouse and the floor planks of the living quarters building were replaced with ceramic tiles.

5 DISCUSSION AND CONCLUSIONS

This paper is a contribution towards understanding the heritage values of historical lighthouses. The methodology was appropriate to determine the original architectural elements, spatial distribution and technology of the lighthouse of the Island of Santa Clara.

The lighthouse of the Island of Santa Clara has remained practically intact since the time of its “lighting”. Both the architecture, technology and its organisation clearly represent an example of lighthouses constructed in Europe in mid-19th century. In the authors’ opinion, it must unquestionably pertain to a catalogue of elements considered as industrial heritage.

It is deemed to be confirmed that the “lighting” of the lighthouse of the Island of Santa Clara took place in September 1864. The elements of the tower (staircase and masonry), the lamp and the optics, except for the 1943 replacement, remain unchanged in time. This quality is associated with the tangible value of the lighthouse as pertaining to the industrial heritage. These are key elements that “produce” signalling for sailors.

It has been possible to detect the original distribution of the house of the lighthouse keeper. The use of the under-roof floor of the original project as a second floor of the living quarters building, permitted improving the quality of life of the lighthouse keeper. The living quarters and the working place necessarily cohabited: the spatial distribution responded to a programme that was consciously executed. They formed part of another intangible symbol of the working culture of the construction era. The cistern, market garden and small pavilion for subsistence animals were necessary due to the confinement of the family during long periods of time. It was a combination of tangible and intangible values.

The viewpoints of the analysis conducted can be repeated for any other historical lighthouse. Only by performing an exhaustive analysis of the values of the lighthouse based on the tenets of the industrial heritage, is it possible to guide a restoration project of these magnificent constructions.

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