# THE RE-USE(S) OF A CISTERCIAN MONASTERY IN LISBON

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Abstract

**The Monastery of Our Lady of Nazareth of Mocambo in Lisbon, usually known as Bernardas' Convent, was a Cistercian foundation. After the extinction of the religious orders, in 1834, the Monastery had several uses. In order to understand the Bernardas' Convent (or Monastery of Our Lady of Nazaré of Mocambo) we must keep in mind that the monastic space can become a territorial organism which appropriates the territory, modelling and altering it according to its needs. A city consists of complex relationships between both material and immaterial elements. These relationships give life and existence to the city, sometimes through submission and sometimes as a result of reactions because the city is coexistence.**

Streszczenie

**Klasztor Matki Bożej z Nazaretu (Mocambo) w Lizbonie, znany jako klasztor Bernardynów został ufundowany przez Cystersów. Po zakończeniu działalności zakonów w 1834 roku budynek klasztoru pełnił różne funkcje. W celu zrozumienia historii budynku klasztoru musimy należy pamiętać, że przestrzeń klasztoru może się zmieniać w zależności od swoich potrzeb. Miasto składa się z złożonych relacji między elementami materialnymi i niematerialnymi. Te relacje są istotą życia i istnienia miasta, często wzajemnie nakładając się i oddziaływując na siebie.**

Keywords: **Heritage; Cistercian Architecture; Monastery; Rehabilitation; Thermal Comfort.**

## 1. INTRODUCTION

The first Cistercian monasteries appear in Portugal, in the 12$^{th}$ century, far from the urban context. It must be taken into account that the transformation and development of the territory has been responsible for isolated buildings and settlements which have gradually been absorbed by the expansion of the urban fabric [1]. The Municipalities invested in the rehabilitation of the Cistercian architectures as is the case of the City Council of Lisbon with the Monastery of Our Lady of Nazaré do Mocambo, better known as Bernardas' Convent which is located in Madragoa neighbourhood. (Fig. 1)

The Monastery of Our Lady of Nazareth of Mocambo (Fig. 2) was a Cistercian foundation of 1653 over pre-existences but in fact this is a much more recent foundation because it was initially a place of gathering of penitent and devoted women and then later became a convent. The name "Bernardas' Convent" was adopted because the nuns who inhabited it belonged to the Cistercian order as well as St Bernard, who had a major role in the dissemination of the Order across Europe [1].

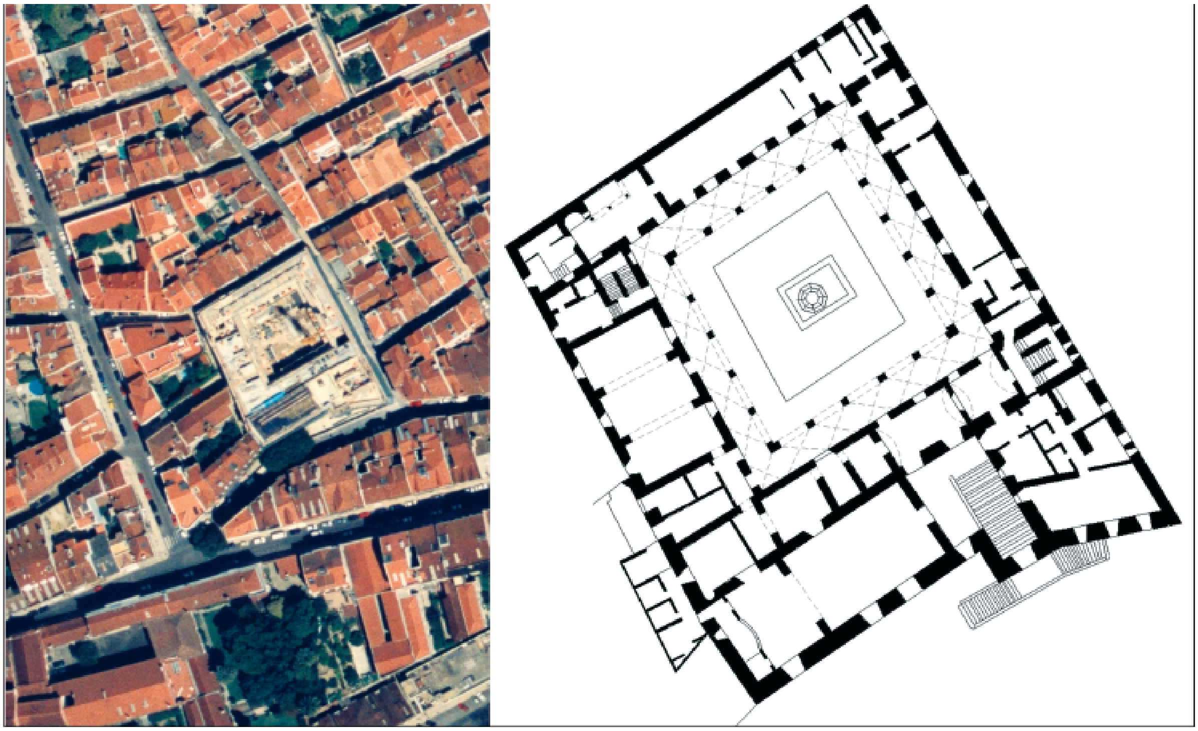

**Figure 1.**
**Localization in Madragoa (during the rehabilitation works) and general plan**

**Figure 2.**
**Exterior views**

## 2. HISTORICAL AND ARCHITECTONIC APPROACH

Madragoa was a fishing village which from the 16th century was integrated into a riverside path of expansion, towards the occidental part of Lisbon [2]. In fact, until this time, Madragoa was an area prolific with monasteries and convents located outside the city walls. Over the time, around the convent, the city was being built.

In 1755 the Monastery was destroyed during the earthquake and then was reconstructed by Giacomo Azzolini. After the extinction of the religious Orders, in 1834, it was preserved until the death of the last nun and then was sold. The Monastery has had several different schools inside the historical building. In June 1924, the Convent's church (Fig. 3) was used as a cinema and a theatre (the apse was even replaced by a stage). In addition, this space was used by an orchestra and later transformed into a furniture shop and storage. A significant population lived, in precarious conditions, in the monastic building. On the

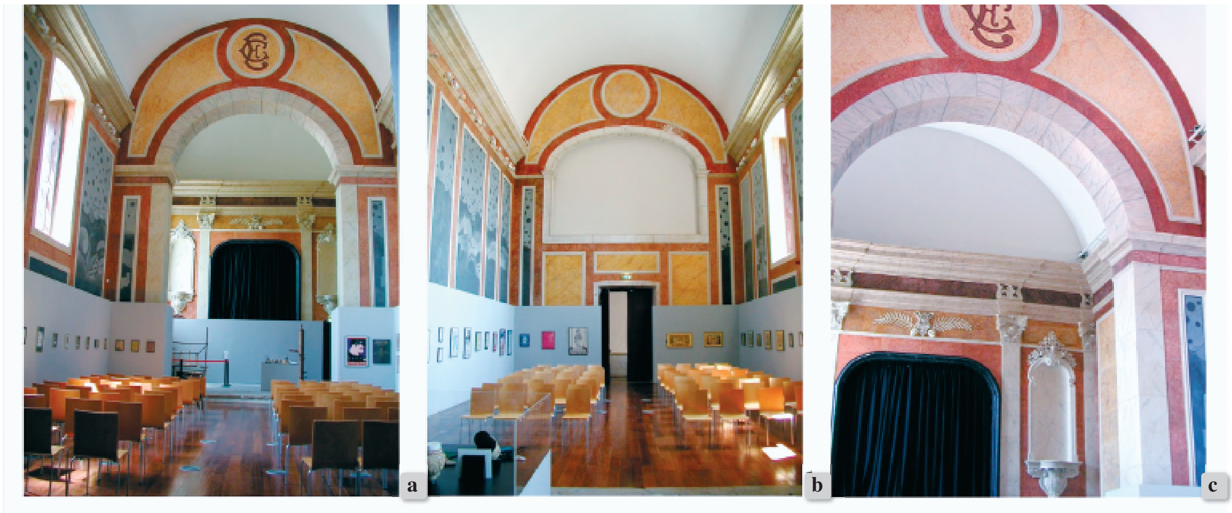

**Figure 3.**
**Multi-purpose room corresponding to the former church: a – apse / stage; b – former choir / auditorium; c – detail**

**Figure 4.**
**Interior detail and Monastic Cloister**

ground floor there were taverns and coal storages. The Monastery was used as a "Vila Operária" a kind of labour dwellings inside a pre-existing building.

In 1996, there was an architectural competition promoted by the City Council regarding the rehabilitation of this historic building. The awarded project included the rehabilitation of the convent's space distributed in residences (Fig. 4), restaurant, shops, elderly centre, social club and the Puppet Museum, as well as a multi-purpose room, originally the Church which was connected with the Museum. The works of retrofitting and rehabilitation of the convent were initiated in 1999 and they were finished between 2001 and 2002. Nowadays, the monastic building serves as a small condominium, a restaurant and Puppet Museum. (Fig. 5)

With the age of the great expansion of the cities, and at a time in which the periphery begins to reach significance comes the time of reorder. This is, a time to allow a new development with a new emerging perspective, a culture of retrofitting and rehabilitation, in short, of the transformation of the existing built historic buildings and heritage.

**Figure 5.**
**Interior details**

The continuity, or figurative discontinuity, between the new and the old loses its most superficial interpretation to become a diverse compositional tool. The opposition declared between the old and new, between conservation and innovation, is the very nature of the intervention, its constant and renewed historic condition [3]. The defining aspect of the protection of the architectural heritage is currently considering this as a unit or group of buildings, perfectly integrated and linked with the urban organism where they participate and, likewise, with the multitude of elements which are part of the whole of the territory surrounding them [4].

These are spaces which can be adapted into new situations, into new uses, in sum spaces which are updated to include and integrate the values of the present in its history. The transformation of historic buildings and its consequent adaptation to contemporary living needs are today one of the major concerns in the field of the construction of the contemporary city.

## 3. THE THERMAL (DIS)COMFORT ASPECTS

The Monastery is made of unchanged solid masonry walls, single glazed wooden windows and wooden roof structure covered with clay tiles. Exterior walls of 1 m thick limestone stone (and thicker) with plaster on both sides, were replaced by new ones of identical design and components, some clay tiles were replaced and an insulation was added to the attic. The thermal performance of any building and its correspondent heat transfer influences thermal comfort. ISO [5] standard define a comfort zone for the body based on overall heat balance that expresses a condition of mind that expresses satisfaction with the thermal environment. However, one may experience discomfort if interior surface temperature is not between specified limits of indoor air temperature. The total heat flux of the interior surface, $q_i$ in W/m$^2$ is found by:

$$q_i = h_i(\theta_i - \theta_{in}) \tag{1}$$

where hi, is the interior surface heat transfer coefficient (W/m$^2$°C), $\theta_i$, $\theta_{in}$ are the interior surface temperature and the indoor air temperature, respectively (°C). Due to random weather the window surface temperature often fluctuate more than other surfaces in a room, due to its lower thermal resistance and also lower heat capacity. On the other hand, the highest thermal mass of the wall slows down the response to the swinging of the outdoor temperature, as Tavil [6] has found. The slower response time tends to moderate indoor temperature fluctuations under outdoor temperature swings, it reduces energy consumption in comparison to that for a similar low-mass building and it moves building energy demand to off-peak periods. The time it takes for the heat wave to propagate from the outer surface to the inner surface is named as "time lag" and the decreasing ratio of its amplitude is named "decrement factor". The time lag (Φ, in h) and decrement factor ($f$) are defined by the following equations.

$$\Phi = \tau_{qi}, \max - \tau_{qe}, \max \tag{2}$$

Where $\tau_{qi}$,max, $\tau_{qe}$,max are the time that the interior surface heat flux and the exterior surface heat flux of the wall are being maximum, respectively (h) and

$$f = \frac{A_i}{A_o} = \frac{q_i, \max - q_i, \min}{q_e, \max - q_e, \min} \tag{3}$$

where $A_i$ and $A_o$ are the amplitudes of the wave in the inner and outer surfaces of the wall, respectively, $q_i$,max, $q_i$,min, $q_e$,max, $q_e$,min are the maximum and the minimum heat flux of the interior and the exterior surface of the wall, respectively (W/m$^2$). Since time lag and decrement factor are dependent on only physical properties of the element, not on the climate, the equation of the solar-air temperature is taken as follows [7]:

$$\theta_{sa}(\tau) = \frac{\theta_{\max} - \theta_{\min}}{2} \sin\left(\frac{2\pi\tau}{p} - \frac{\pi}{2}\right) + \frac{\theta_{\max} - \theta_{\min}}{2} + \theta_{\min} \tag{4}$$

where P is period, $\theta_{sa}$, $\theta_{max}$ and $\theta_{min}$ are the maximum and minimum outdoor temperature, respectively (°C). The sol-air temperature includes the effects of the solar radiation combined with outside air temperature and changes periodically. This temperature is assumed to be sinusoidal variations during a 24-h period as shown in Fig. 6 where the room temperature is assumed to be constant.

The building is located in Lisbon, 38.7 latitude north the southern and Mediterranean climatic zone [8], being temperate and moderately cold in the winter with sunshine during most of the year. Mean temperatures may range between 8°C and 30°C during the year, but seldom above 36°C in summer and below 4°C in winter. As a guideline, ISO 7730 [5] states that vertical surfaces radiant asymmetry should be kept to less than 10°C from air temperature. The unchanged exterior's physical properties are the walls and windows with an estimated U value of 1.14 W/m$^2$°C and 5.1 W/m$^2$°C, respectively.

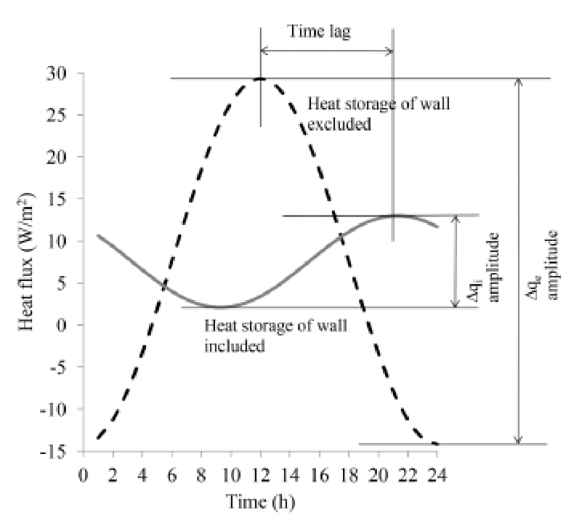


**Figure 6.**
**Schematic heat flux, time lag and decrement factor**

During the summer was not expected any local discomfort being all the surfaces temperature within the comfort zone. During the winter time the biggest difference between the indoor air temperature and the surfaces of the wall is about 4.9°C of thinner wall. With a time lag of 9 h and the temperature decrement factor is about 0.26 this may won't be achieved once the always changing outdoor air temperature becomes the predominant factor on the surfaces temperature. In winter, radiant heat loss toward a cold window surface can make an occupant feel uncomfortable, particularly on a sedentary activity. Window surface temperatures often fluctuate more than other surfaces in a room, due to lower thermal resistance and lower heat capacity. With a time lag almost null the surface temperature of the window may be of 12.5°C below the indoor air temperature. Improving window performance reduces thermal discomfort on facades particularly where there is no direct solar radiation.

## 4. CONCLUSIONS

The monasteries have provided the contemporary city, especially from the $19^{th}$ and $20^{th}$ centuries, expectant spaces or new fields of experimentation. These are new spaces which adapt to new situations and uses, in short, they update themselves integrating, in its history, the values of the present.

This is an example of multiple and successive adaptations. The extinction of the religious Orders and the successive owners adapted the building to their own needs. However, the original image of it still stands. All the functions stayed almost the same, with the exception of the church and the chapter house, now integrated into the Pupet Museum. The cells, when the monastery was converted into "Villa Operaria", gave place to minimum dwellings and currently apartments more adequate and modernized for today's needs of comfort. An exposed heavy wall, when compared to a lighter window, is significantly warmer during the winter time and provides significant cooling in summer.

The knowledge and the use of heritage are essential elements for safeguarding, sustainability and evaluation as well as factors of progress in various aspects of development in particular underlining the interdependence between culture and the qualification of community life. In fact this Cistercian Monastery, which is the Bernardas' Convent, is a piece of the Cistercian legacy in Portugal.

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