Rehabilitation of the interior structures of the Pombaline Buildings

An architectural perspective

Francisco Taquenho de Matos Fernandes

Extended Abstract

Master Dissertation in Architecture

October 2016

1. REHABILITATION OF THE INTERIOR STRUCTURES OF THE POMBALINE BUILDINGS

"The preservation of the architectural heritage is an essential part of memory itself that man builds and bequeathing. Its conservation and rehabilitation is the art of combining the desirable and the possible, gathering the necessary knowledge to good sense which is key ingredient for success."

João Augusto da Silva Appleton (2013)

Rehabilitation is one of the ways in which the need to ensure the longevity of the architectural heritage is addressed, because if not recovered and modernized it will tumble into oblivion and move towards ruin. The value of the heritage does not result only in its material value, but rather in its ability to tell the story of the city and its historical evolution.

The demand of people to live in the city center has been reflected in the growing number of vacant buildings rehabilitation works in the Pombaline quarter over the past few years. Although who now passes through this area of the city is not indifferent to the number of building that are in an advanced state of degradation, it is still comforting to note the efforts that have been made to rehabilitate these same buildings.

It was this observation that led to the theme of this dissertation. The curiosity to see what has been done and how, in recent years, in terms of rehabilitation in the Pombaline quarter. The type of program addressed throughout the dissertation focuses on buildings rehabilitated for rental or hotel units because of the growth of the tourism sector in Portugal, particularly in the city of Lisbon. The increase in tourists visiting the city and the revolution that occurred in recent years with the introduction of the concept of short term rental has led to the growth in the number of rehabilitated buildings in the city.

The aim of this work is, through the analysis of rehabilitation projects carried out over the past five years in Lisbon's downtown, to understand the influence that the original structure has in the adaptability to the new proposed program, as well as realize the difficulty, respecting if possible the existing structure, to create spaces that suit contemporary needs the following excerpt that sets the tone for the purpose of work (APPLETON, 2013):

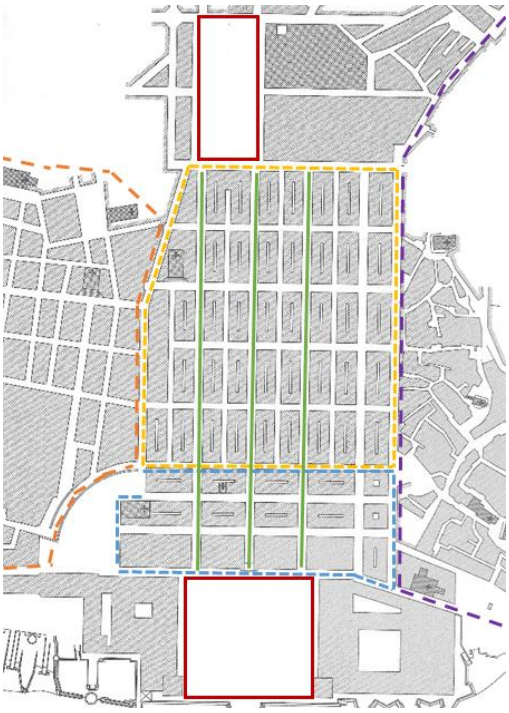
> Even in the current architectural heritage, consisted of buildings that alone can be considered trivial, but which together assume an historical and cultural importance of greater value, approach rules should be adopted and design methodologies and construction should be assumed to achieve the most important goals : recover with economically sustainable basis the existing building, causing it to gain or resume functional capabilities compatible with contemporary needs, while maintaining the substance of the body and spirit operated of the intervened object, through an intervention that ensures all these components, the creation of a new unit necessarily distinct from the original.

The focus of the dissertation doesn't aim to unclear about the best techniques of rehabilitation of the building structure, or know the wood as a structural material at all levels. These and other points were research target and integrate chapters of the thesis, but it is not the technical side that this is levied.

2. HISTORICAL AND CONSTRUCTIVE BACKGROUND

After the 1755 earthquake in Lisbon, the reconstruction plan for the downtown area was initiated, developed by Manuel da Maia. Of the six plants presented, it was the plant 5th designed by Captain Eugénio dos Santos Carvalho that was approved, from which in the detailed reconstruction plan was developed.

Looking to the plan's characteristics there are noticeable reasons for the choice of this route (grid) for base the plan, the following are the most important: it allows complete freedom in solving problems regarding lack of health and fluidity circulation; has the same proportion of private and public space; regular design allows thinking in advance the possibilities of construction of a sewage system, water supply and waste collection.



The Quarter is the generator part for the whole route because its dimensions and its use as an element that fills the void, creates all the track.

In the West area were kept convents and ancient streets that make the transition to the hill of Carmel and San Francisco. At East a new street was created (Madalena street) parallel to the new streets, but with the distinction of not being leveled, following the unevenness of Castle Hill.

It is observed in Figure 1 two distinct zones, the North where the blocks develop in northwest-southeast direction, while the South they develop in the perpendicular direction.

Structural axis
Main squares
South zone
North zone
East border
West border

Figure 1. Downtown Lisbon Reconstructoin Plan (1756) - SANTOS, 2005: Drawing IV

Although the focus of this work is Pombalino building, it is needed to frame it in relation to the other types of structural typologies. The seven construction periods are divided in figure 2, as the construction period and the type of structure, where the building that this work is related to is nº 4.

Figure 2. Evolution of the building construction process in Lisbon - COIAS, 2007: 42

3. ADAPTATION OF THE POMBALINE SPATIALITY TO THE CONTEMPORARY NEEDS

The *Pombalino* building starts with two objectives: to quickly accommodate a large number of people and to promote the reconstruction of downtown Lisbon in the minimum possible time. For these reasons, it was imperative to stablish the following concepts: economy, stability, regularity and simplicity.

The Spatial characteristics of the building, visible in Figure 3, reflect these concepts. The ground floor spatiality, with essentially commercial function is an unobstructed space, with visible support pillars, as well as the ceiling domed or on timber. The spatial characteristics of the upper floors are: regular compartmentalization, resulting in continuous small spaces, with the circulation between spaces being made through open gaps in the front walls. Weak spatial qualities on the rooftop arise due to low ceilings and few living conditions resulting from greater exposure to the outside elements, the smaller number of openings and the geometry of the cover does not allow the use of the entire area.

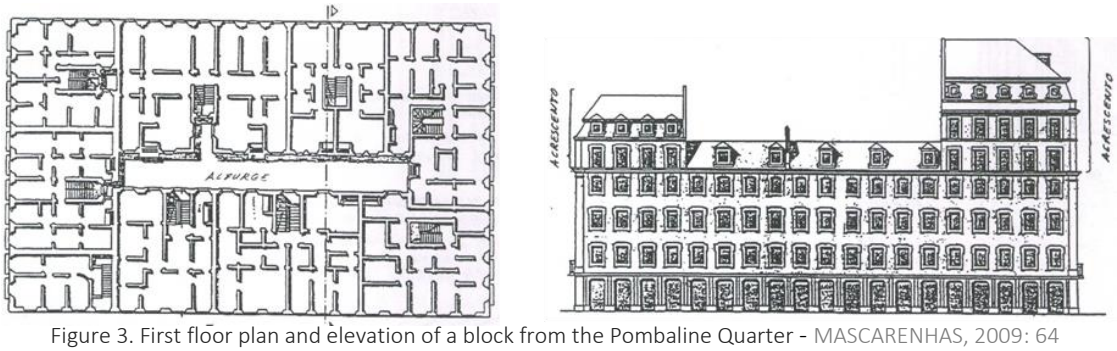


Figure 3. First floor plan and elevation of a block from the Pombaline Quarter - MASCARENHAS, 2009: 64

Across time the culture and the way of living in inhabiting spaces has evolved, there were important changes in terms of the functional program, which is necessarily linked to the way of life of the space users. The buildings are no longer exclusively for residential use, currently the most relevant activities in addition to housing are the activities of services such as banks, offices, hotels and hostels.

Presently it is mandatory that all public buildings have toilets on every floor, in particular for the access to people with reduced mobility. This leads to a structural adjustment of the building including the introduction of infrastructure and greater partitioning of private spaces.

In multi-storey buildings, which is the case of Pombaline building, there is the need to transport goods and people to upper floors, it is now possible to do it by mechanical means. The structures of these systems do not follow the same construction method that the building under study, so it is necessary to restrict the original structure to incorporate this element.

As opposed to compartmentalization, mentioned as typical spatial characteristic of *Pombalino* building, ample space (open space) is a spatial concept increasingly appreciated by those who want to use an office space, certain like social areas of hotels or hostels. This recent trend turns more difficult the task of adapting programs of this nature to the original structure of Pombaline buildings or adapt the structure to this space need.

4. POMBALINE QUARTER REHABILITATION

After analyzing the construction process from Pombaline area, as well as the intentions and purposes of those who thought about it 250 years ago, it is time to look to the present and realize which way has been taken to respect the heritage that has been left by Manuel da Maia.

Looking at the last four years, in Lisbon, we can see a change in the legal framework of cultural heritage and spatial planning. The main examples of this change has been the reclassification of *Lisboa Pombalina* as Joint Public Interest and the publication of Safeguard Plan Detail of *Baixa*. Two instruments that ensure the control and management of what is done in terms of urban operations in the area.

So it can be understood the current built conservation status in *Baixa* it is referred to the conclusions achieved in MORAIS 2015, it is the most recent study on this subject. This is a dissertation developed by an Architecture student, in *IST,* where he conducted a survey of all the buildings of *Baixa* according to some issues, one being the state of conservation of buildings. Table 1 presents the results on the total amounts of gross floor area.

Nível de Conservação	EXCELENTE	BOM	MÉDIO	MAU	PÉSSIMO	OBRAS[23]
Totais de área bruta de construção (m^2)	8 929	244 239	564 511	134 928	4 696	33 397
Totais de área bruta de construção (%)	0,9%	24,7%	57,0%	13,6%	0,5%	3,4%

Table 1. Evaluation of the state of conservation of the Baixa buildings in 2014- MORAIS, 2015: 48

When analyzing the table above is possible to conclude that almost 75% of building need to be intervened, and 17% of which is in a high state of degradation.

The *Baixa* is not about a building that is in an advanced state of degradation, but an urban area that needs criteria and accuracy in regard to its rehabilitation, as is infected by the daily congestion and the nightly emptying centered on the lack of solutions able to return to this area its residential function. There are four current points being analyzed, justifying the Rehabilitation of *Baixa*: market analysis of rehabilitation at national level, municipal incentives at the city of Lisbon, environmental advantages of rehabilitation and also the heritage value of the buildings in *Baixa*.

According to *INE, 2013* data, there are 1 million buildings, in 2011, in need of intervention in Portugal. There are several opportunities that the rehabilitation market has to respond to the needs presented: increased product quality associated with a higher value; new opportunities for specifics in the area: energy rehabilitation of buildings, investment in renewable energy and provision of maintenance services.

5. REHABILITATION OF ANCIENT BUILDINGS WITH WOODEN STRUCTURE

Is the aim of this work to realize today's situation of the rehabilitation of buildings in downtown Lisbon, the main reason for the intervention in these buildings is their advanced state of degradation. The aim is to identify the causes of the degradation, the resulting pathologies in structural elements and construction techniques that should be chosen.

It aims to make a synthesis of the anomalies that occur in buildings with wooden structure because its correct identification enables a rehabilitation project tailored to the structural needs of the building being attended.

Those that relate to effects on building foundations are, foundation soil amendments and increased loads. Changes and movements foundation soil that occur are due to any changes resulting from human activity or that arise naturally. The crushing timber occurs mainly due to excessive loads, its appearance is typical in areas of contact between the wooden beams and masonry. Water is the main causative agent of the breakdown of the walls and roof structures. The infiltrated moisture due to water rises by capillary in foundation walls by changing the wall structure and the presence of rain water mainly in troughs zones. The thermal discomfort is, in the case of structure under study, caused by the absence of thermal insulation on the outside walls, partition walls, floors and roofs. Related to the floor structures are anomalies resulting from faulty construction of the structure.

They are now mentioned constructive techniques to ensure proper rehabilitation of timber structures of *Pombalino* buildings. With regard to structural reinforcement that is closely linked to the security of persons and goods it should be that more time should be devoted to the process of rehabilitation of old buildings, however there are several factors to prevent this from happening.

In COIAS, 2007 the engineer Vítor Coias mentions that for rehabilitation purposes it can act in three areas: structural components of masonry, structural components of wood and the structure of the building as a whole. For the purposes of this study, solutions will be focused only in the second area, bearing in mind one of two concepts: increased resistance of the element to be rehabilitated through enhanced with new materials; reconstituting of the section being rehabilitated using the same material, with or without coupling elements.

- Reinforcement of structural elements with steel parts;

- Application of fiber glass composite material in structural elements;

- Adding new elements to floors and roof structures, using the same material;

- Replacement of portions of structural elements of wood with prosthesis with connecting elements;

- Replacement of portions of structural elements with prostheses with reinforcing parts;

6. CASE STUDY ANALYSIS

Looking to the main factors of attractiveness of Lisbon, in conjunction with the buildings that have been rehabilitated over the past years, it was noted that much of this was intended to hotels or short and long term apartments. In terms of time frame, it was decided to cover projects that had been completed between 2010 and the current year (2016), or are still in the construction phase in order to collect truly current information.

The project selection process was not immediate, it was needed to filter the projects with some criteria: the project is found in the design stage or competition; it was not possible to find information concerning the authorship of the project; projects undertaken by foreign entities; projects situated outside the zone under study.

Figure 5 presents the six case studies analyzed, as well as information about each and its location.

A1. Baixa House
Fanqueiros street, nº 38
Apartaments
2007 (project)
2011 (construction)
José Adrião Arquitetos

A2. Rua da Assunção 88
Assunção street, nº 88
Apartaments
2012
MLeP

A5. 3 Apartamentos Pombalinos
São Julião street, nº 30
Apartaments
2013 (project)
2016
Aurora Arquitetos

A11. Madalena Residence
Madalena street, nº 56-60
Apartaments
2013 (project)
2015
Fragmentos de Arquitetura

A12. Madalena 129 - 137
Madalena steert, nº 129 - 137
Apartaments
2015(project)
2016 (in construction)
Francisco Simões Arquitetos

H5. Hotel Lis Baixa
Douradores street, nº 146
Hotel
2015
mE Arquitetos

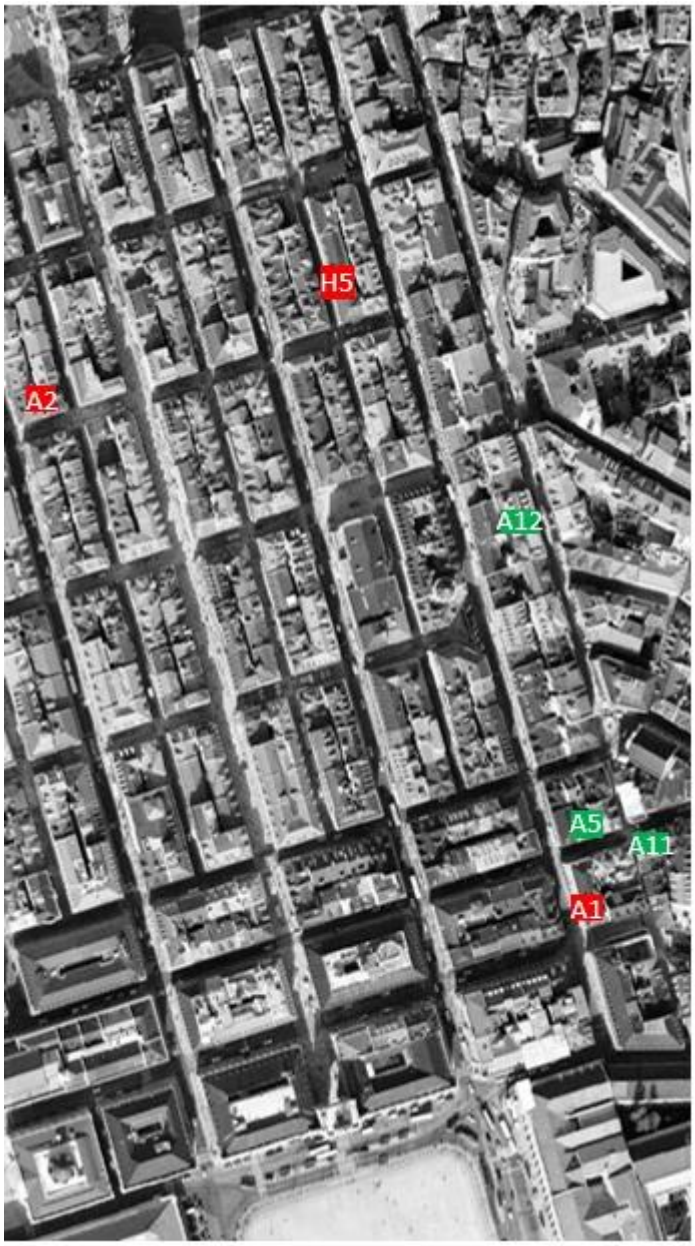


Figure 5. Location of the case studies in *Baixa Pombalina* – ONLINE RESEARCH

There were asked to architectural firms responsible for the projects to lend the design elements of the yellow and red drawings and the descriptive memory. The analysis of the projects is based on three criteria:

1st - The initial condition of the building, if possible, the state of conservation of the structure;

2nd - Adaptability of the design program to the building structure in question;

3rd - Understanding the constructive solutions and verify if they respect the pre-existing structure;

A1. BAIXA HOUSE

The principle assumed by the designer reflects a lack of concern with the preservation of the original building structure, reflected especially on the top floor, because almost all of the existing walls were removed. Through the reading of the drawings it is apparent that in the intermediate floors the construction of the new walls do not follow the *Pombalino* model, they exist mainly in new toilets and kitchens, because of the need to restore all the infrastructure networks of the building. As regards spatiality it is perceptible the designer's concern to maintain the identity of the original space, but it has not been conserved in total its original structure. It is also observed that they decided to maintain the structure of the cover visible, giving a new spatial amplitude to the top floor and thus ensure good quality housing, which was not achieved before.

A2. RUA DA ASSUNÇÃO 88

As regards the adaptability of the program to the existing structure, there was a desire of designer to keep part of the existing structure, dividing the larger spaces with the main bearing walls. This project is a clear will, when possible, to adopt construction techniques similar to the original time of the building, in particular the strengthening of the front walls and the reconstruction of the roof. It is noticed that the constructive intentions do not always correspond to the proper level of the final space quality. In this project there is only a cosmetic use of the structure, not seeking to reconcile its structural function with the plastic component. The space of the ladder area, associated with the levels of floors, loses its vertical reading of a big gap, because of the simple addition of the false ceiling. On the top floor it is observed a vented space which seeks to reveal the structure, with intention to increase the quality of space.

A5. 3 APARTAMENTOS POMBALINOS

The option not to remove the screed does not seem to be the best solution, although it has implications in the disturbance and dirt to the bottom floor. Hidden behind false ceilings are decorative plaster work, the solution to bring view to these elements is the more correct option and it is valued the finishing as an artistic element. The solution of the construction of partition walls in light steel structure with plasterboard does not respect the original structure and should not be justified by the overload of the structure, because if it did, this would be a motivation to remove the screed in the structure of pavements. As to the spatial level is noticeable the intention to return some intimacy to original space, since it is was totally lost when the building was adapted for industrial use. Both in the room with fresh ceiling, and in the succession of rooms divided by concertina doors, it can be understood the achievement of the intention mentioned above.

A11. MADALENA RESIDENCE

The project needs as regards the placement of an elevator and to solve the weak roof housing conditions lead to the major changes in structure, with the use of techniques and different materials of the P*ombalino* model. Oldest parts of expanded rooms are used for new room areas, or old canopy areas, kitchen and sanitary facilities are reorganized for better functionality and spaciousness. The rehabilitation of the existing structure is made of little unobtrusively. Examples include the strengthening of St Andrew's crosses and the stabilization of the pavement structure by placing steel beams. It can be seen the intention to design comfortable and ample spaces for the social areas of the apartments, and more intimate spaces in the private areas, which goes accordingly the analysis of the drawings. This spatiality is a response to current needs, revealing the little adaptability of the original spaces, more compartmentalized, for social areas. But being possible to observe the designer's effort to integrate part of the structure (front wall) in the separation of spaces, playing with their plasticity.

A12. MADALENA 129 – 137

The adjustment of the intermediate floors is far less intrusive with regard to the number of walls to tear, using essentially the advantage of those in longitudinal continuity with the stairs and other two perpendicular to the stair, thereby ensuring robustness in the preexisting structure. With exception of the roof, the floor pavement in level 5 and the reconstruction of the stairs on the upper floors, which use the same materials, the other new parts of the building do not follow the P*ombalino* model. In particular the new walls, where it is used light metal structures covered with plasterboard. In the intermediate floors the partitioning of the original space means that with just a few changes in the opening and closing of openings in front walls, it is possible to obtain control required in the circulations. Illustrative images of the interior spaces allow to read the new spatiality proposal. The breadth and depth of the larger social spaces is achieved by removing the partition walls, which once compartmented space. But the smaller social space reflects the current demand for mixed areas, where is observed the integrated kitchen area in the living area, something unthinkable at the time of construction of the original building.

H5. HOTEL LIS BAIXA

Although the intentions of designers were to keep the identity of the building, for legal reasons of accessibility, they have changed much of the interior walls, which makes it unreliable achieving this goal. And there are no references to the construction methods of the new walls and based on previous projects, it would appear that the construction of the new partition walls, does not follow the P*ombalino* model. Although with different materiality than the original, there is an intention to maintain and respect the original structure of the building in the ground floor level, allowing the existence of comfortable spaces of reception and free movement of people. By observing the new ladder it is realized the desire of the designer to redo its structure, although not following the P*ombalino* model, in order to maintain the spaciousness and original design.

7. CONCLUSIONS AND RECOMMENDATIONS

Completing the analysis of rehabilitation projects of *Pombaline* buildings to apartments is possible, for the reasons described above, to conclude, that the rehabilitation of these buildings for residential use is useful for a good reuse of the same and that it can take advantage of spatial and structural virtues of the original buildings. It is sometimes necessary to make some changes in the structure, and although it cannot in all cases use construction techniques similar to those of the building construction period, it is possible to respect it. Although this intention is not verified in all the analyzed projects.

Regarding rehabilitated projects for hotel units, it is strengthened firstly, the high number of projects that have chosen to completely demolish the internal structure of the building. The original subdivision of *Pombaline* building allows easy adaptation to the residential floors of the Hotels. The spaces have characteristics that meet the need to place a large number of divisions with use of facades, in order to ensure a higher quality of housing spaces.

The spatial qualities of the top floor are always very poor due to the low-ceilinged associated with little or no thermal resistance of the roof. It is therefore a constructive process observed in almost all designs the removal and reconstruction of the cover. The use of sanitary facilities and cultural change from the use of kitchen space, combined with the need for infrastructure networks installation, it is natural that occurs a conflict of interest with regard to the pre-existing structure. This is one reason why the construction process of the new walls in these areas do not follow the *Pombaline* model, instead are introduced lightweight steel structures covered with plasterboard panels. Finally it should be noted the need for introduction of elevators in these buildings and their structural consequences, as these are more relevant than space. The structure of the elevators box in reinforced-concrete, which leads to the conflict between two types of structure.

Although the sample studied does not represent all of the renovations carried out in *Baixa*, it is a concern the number of projects that chose and followed the option of demolishing the inside structure, a third of the selected cases. The recommendation is, through legal mechanisms, control the quality of the projects and point in the direction of greater respect for the constructive heritage. Carrying out regular inspections to vacant buildings and the implementation of minimum values for the percentage of the original structure of the building to be kept in the rehabilitation projects.

As a recommendation it is proposed a greater focus on promotion of wood construction: form labor, skilled labor, train engineers, bringing experts from other countries to convey their knowledge, arouse interest for a constructive method that deserves more attention.

There are several areas of interest associated with the rehabilitation of old buildings mentioned and explained throughout the work, joint efforts and alignment towards a common purpose in all these areas, as well as others, such as the use of the national forest park can bring great advantages to these and other sectors connected or not to the construction sector.

BIBLIOGRAPHY

APPLETON, João Augusto da Silva; *Património Urbano: boas práticas de Conservação e Reabilitação de Edifícios.* Revista Património, Nº 1. (2013)

COIAS, Vítor. *Reabilitação Estrutural de Edifícios Antigos – Técnicas pouco Intrusivas.* Lisboa: Argumentum (2007)

INE; *O Parque habitacional e a sua reabilitação – análise e evolução 2001-2011.* Lisboa: INE, LNEC (2013)

MASCARENHAS, Jorge; *Sistemas de Construção, vol. V – O Edifício de Rendimento da Baixa Pombalina de Lisboa, Processo evolutivo dos edifícios; inovações técnicas; sistema construtivo - 3ª edição.* Lisboa: Livros Horizonte (2009)

MORAIS, Luís F. L.; *Revitalização da Baixa Pombalina: Proposta de Humanização.* Dissertação para obtenção do grau de Mestre em Arquitetura, apresentada ao Departamento de Engenharia Civil, Georrecursos e Arquitetura no Instituto Superior Técnico (2015)

INE; *O Parque habitacional e a sua reabilitação – análise e evolução 2001-2011.* Lisboa: INE, LNEC (2013)

SANTOS, Maria Helena R. dos; *A baixa pombalina: Passado e Futuro – 2ª edição*. Lisboa: Livros Horizonte (2005)

SILVA, Vítor Coias e; *Opções intrusivas de Reabilitação Estrutural dos Edifícios Antigos.* Portefólio, Nº 1. (2005)