MODERNIST BUILDINGS IN LISBON, 1925-1940

BUILDING CHARACTERIZATION AND PATHOLOGY

Vera Lúcia Nobre Higino

Extended abstract

Jury

President: Professor Doutor António Heleno Domingues Moret Rodrigues

Supervisor: Professor Doutor João Paulo Janeiro Gomes Ferreira

Supervisor: Eng.º João Augusto da Silva Appleton

Vowel: Professor Doutor Jorge Manuel Caliço Lopes de Brito

Vowel: Professor Doutor António Candeias de Sousa Gago

Outubro 2013
1 INTRODUCTION

This dissertation intends to characterize and analyze the construction and major anomalies in residential buildings, built in Lisbon in the 20’s and 30’s of the XX century within a Modernist architectural style.

The advanced state of degradation identified in many of these buildings, associated with the rich architectural value of Modernism style, demands a definition of methods and strategies for intervention hoping to safeguard its cultural value, prolonging its service life.

The architectural influences of the early modern movement match the transitional period of the construction type "galoleiro" for the introduction of reinforced concrete, a material that would modernize the buildings and renovate the architectural expression.

The hybrid condition of the buildings at this time needs analysis and documentation techniques to assess the best intervention solutions.

2 MODERNIST ARCHITECTURE

The Modern Movement is the most significant style that characterized the architectonic production of the twentieth century.

This movement sought building standards in a unique way, rational and logical, based on a permanent search for new features, which ended the styles that had dominated the nineteenth-century.

Works like the AEG turbine factory by Peter Behrens, the Franklin Street building by Auguste Perret, and so many others built in the European axis, between Berlin and Paris, alongside with the works of Adolf Loos in Vienna, the experiments performed in the New World with the Chicago school and the pioneering spirit of Frank Lloyd Wright - will mark the intense debate of the first decades of the century.

2.1 NATIONAL CONTEXT

On the national scene, Modernist architecture was part of a particularly active phase of urbanism in Lisbon, initiated by progressive urbanism of Eng.º Ressano Garcia along with the turning point of the crisis context of post-war.

The actors in this process would be a new bourgeois class, building contractor, promoters, and a variant, too frequently; the building contractor / owner / promoter whose aim was primarily profit.

The "income building" for the real estate business was a modality that characterized the functional program for residential buildings in this period.
These buildings will occupy expropriated land or allotted old suburban farms. On the other hand the more consolidated areas of the city still have vacant lots and blocks to urbanize, with urbanization based on lots and streets with closed back, keeping an occupation that was previously used.

The Modernist architecture developed in Portugal starting from the 20s, with particular intensity in the years 1928 to 1930, a period that follows the beginning of a political and institutional stability, achieved by the Estado Novo.

Between the years 25 and 40, the Modernist style presented two different stylistic tendencies. The first was Art Déco, by French influence; had the tendency to geometrize the facades towards simplified forms, by flattening decorative elements in the surface of the façade, helping to smooth the shapes and volumes, and to highlight straight strength lines and textures (figure 02), diverging from the Art Nouveau decoration, from the previous decade (figure 01).

Later and slowly a more rational and purist architecture gradually emerges, diverging from the Art Deco stylistic practice, with a strong link to a more technical building statement, resulting from the introduction of reinforced concrete in housing buildings, with new structural and volumetric possibilities, it was later known as Radical Modernism (figure 03).

3 IDENTIFICATION OF STUDY OBJECT

The survey developed, which aimed the identification, location and characterization of Lisbon’s modernist buildings was based on a survey from 1988, work done for the Lisbon City Hall by architects José Manuel Fernandes and Maria de Lurdes Janeiro. With this document in hand,
several city incursions were maid, visiting the specific districts, blocks and buildings, in order to know it's general current state of conservation and preservation.

In survey carried out was considered the city of Lisbon divided into six zones, urbanistically more homogeneous, according to the 1988 survey (Fernandes, 1988).

1- West Zone (centered in São Mamede, Santa Isabel, Alto do Parque)
2- Avenidas (centered in Av. da Liberdade / Av. da República axis)
3- S. Sebastião da Pedreira Benfica (Estrada de Benfica/ Laranjeiras)
4- Eastern Zone (centered in Av. Almirante Reis, desde a Graça ao Areeiro)
5- Center and East Coast (centered in Madredeus/Xabregas)
6- West Coast (centered in Junqueira)

18 buildings were analyzed, built in different zones and phases of Modernism, and currently in different stages of preservation. It was possible to know the constructive character from the analysis of projects of these buildings in the Municipal Archive of Lisbon, and local visits, together with the bibliography. In these buildings, architectural style and construction were closely linked and continuous process of evolution.

Table 1 Identification of 18 buildings in study

<table>
<thead>
<tr>
<th>CONSTRUCTION TYPE</th>
<th>LOCATION</th>
<th>ZONE</th>
<th>YEAR OF PROJECT / CONSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>“GAIOLEIRO”</strong></td>
<td>Avenida Elias Garcia, 69 a 75</td>
<td>2</td>
<td>1917/1919</td>
</tr>
<tr>
<td></td>
<td>Avenida da Republica, 49A-49D</td>
<td>2</td>
<td>1920/1923</td>
</tr>
<tr>
<td></td>
<td>Avenida Almirante Reis, 197 e 197A</td>
<td>4</td>
<td>1932/1934</td>
</tr>
<tr>
<td><strong>MIXED</strong></td>
<td>Rua Rodrigo da Fonseca, 131</td>
<td>1</td>
<td>1935/1936</td>
</tr>
<tr>
<td></td>
<td>Rua Alexandre Braga, 4/6</td>
<td>2</td>
<td>1932/1933</td>
</tr>
<tr>
<td></td>
<td>Avenida da Republica, 91</td>
<td>2</td>
<td>1931/1932</td>
</tr>
<tr>
<td></td>
<td>Avenida Elias Garcia, 63 a 67A</td>
<td>2</td>
<td>1929/1931</td>
</tr>
<tr>
<td></td>
<td>Rua Eduardo Brasão,2</td>
<td>4</td>
<td>1934/1935</td>
</tr>
<tr>
<td></td>
<td>Rua Damasceno Monteiro, 21d</td>
<td>4</td>
<td>1936/1937</td>
</tr>
<tr>
<td></td>
<td>Rua Lopes, 91</td>
<td>4</td>
<td>1934/1936</td>
</tr>
<tr>
<td></td>
<td>Avenida Ressano Garcia, 25</td>
<td>3</td>
<td>1936/1937</td>
</tr>
<tr>
<td></td>
<td>Rua Filipe da Mata, 91 a 99</td>
<td>3</td>
<td>1932/1933</td>
</tr>
<tr>
<td><strong>1ª REINFORCED CONCRETE</strong></td>
<td>Rua Artilharia Um, 47/48</td>
<td>1</td>
<td>1938/1939</td>
</tr>
<tr>
<td></td>
<td>Rua Rodrigo da Fonseca, 192</td>
<td>1</td>
<td>1936/1937</td>
</tr>
<tr>
<td></td>
<td>Rua Rodrigo da Fonseca, 204</td>
<td>1</td>
<td>Process not available</td>
</tr>
<tr>
<td></td>
<td>Rua Nova de São Mamede, 74</td>
<td>1</td>
<td>1936/1937</td>
</tr>
<tr>
<td></td>
<td>Rua Alexandre Braga, 9</td>
<td>2</td>
<td>1937/1938</td>
</tr>
<tr>
<td></td>
<td>Avenida Ressano Garcia, 5</td>
<td>3</td>
<td>1934/1935</td>
</tr>
</tbody>
</table>
4 REGULATIONS AND CONSTRUCTION CODES

The urban Plan of Avenidas Novas, by Eng.º Ressano Garcia reported no normative principles in construction and aesthetics of buildings, factor that marked with ephemerality this buildings. Each promoter was building for himself, for sale or lease; the choice was between residential building or villa typology, for occupying the entire front of the lot or not, by the isolation of the building or the provision aligned.

In a time of eclectic architecture, marked by several revivals, exoticism and rurality, this excessive freedom will result in the absence of quality and homogeneity.

However the process of urban transformation in the decades 20-40 will follow a period of technical progress in the construction and functional program, with the publication of the following regulations:

- Regulation of wholesomeness of urban buildings (RSEU) - Decree dated February 14, 1903;
- Regulations for the use of reinforced concrete - Decree. 4036 to April 3, 1918;
- Reform of property tax - Decree No. 15289 of March 30, 1928 and Decree No. 18738 of August 9, 1930;
- General regulation of urban construction for the city of Lisbon (RGCU) - December 6, 1930;
- Regulation of reinforced concrete (REBA) - Decree 25948 of 16 October 1935;

5 CHARACTERIZATION OF MODERNIST BUILDINGS

5.1 BUILDING CHARACTERIZATION – MODERNIST BUILDINGS BUILT BETWEEN 1925 AND 1935 - ART DÉCO.

The first buildings, built between 1925 and 1935, were “gaioleiro” type, with the predominant materials such as ordinary masonry mortared with chalk and sand, hardwood floors and metallic structures. The crisis of the 20s, and the rising price of building materials, has led to an adaptation of the style is based on simplification of the facades and the predominance of economic materials.

The name of “gaioleiro” want to translate the simplification of building systems and structural period that proceeded the 1755 earthquake through the following changes:

- Increase the height of the buildings to 5 or 6 floors high;
- Distortion of “gaiola Pombalina”, in which some elements have horizontal solidarization in master walls lost, making deficient dimensional interconnection of the building structure;
- Less resistance of the interior walls;
- Lower quality in construction;
- Use of materials of inferior quality.

In 1930 the publication of RGCU (General Regulation of Urban construction for the city of Lisbon) and its provisions recommended the use of reinforced concrete in buildings. Here begins a phase of constructive integration of new technology, keeping, however, the application of traditional and eclectic materials. This hybrid construction is a mixed type.

This mixed type corresponds to the transition between the end of building construction type “gaioleiro” to the beginning of the introduction of the concrete construction. This period is characterized by the composite structures of masonry and concrete, wood and maintaining traditional iron balconies and stairs at the rear facade of the building. It is particularly frequent replacement of wood for concrete floors in kitchens and toilets areas.

The changes in each functional element of the buildings, are relate mainly to the provisions of RGCU (1930); regularization of wall thicknesses; minimum sections of woodwork in floors high; the application of the concrete slabs of the kitchen areas and toilets, and in braces off on the spans, supported by sturdy walls.

Reinforced concrete (first generation) is introduced in residential construction in a fragmented and experimentalist with some freedom of calculation and execution, permitted by Regulation for use of reinforced concrete in 1918, a period that extends until the entry into force of the Regulation of Concrete armed (RBA, 1935).

5.2 BUILDING CHARACTERIZATION - MODERNIST BUILDINGS BUILT BETWEEN 1930 AND 1940 - RADICAL MODERNISM

In the 30s, developed in parallel with the influence of the Art Deco, began a renovation of style and construction process, leading to a new architectural expression.

This phase of the rationalist movement is characterized by a modern style with formal simplification and geometrization. With use of horizontal elements mainly where the volumetric treatment of the facade and space plays a key role. This development style is directly related to the definitive introduction of reinforced concrete in construction.
In 1935 starts the 1st period of the reinforced concrete, used in foundations, beams, columns and slabs in full, in executing bodies protruding from the facade plane and flat roofs not accessible. Also the service stairs and balconies in iron structure begin to be replaced by reinforced concrete.

The application of new material in buildings is generalized with an explicit concern with the implementation of ideas hygienists and fire safety, neglecting, however, the earthquake resistance of buildings.

5.3 PHYSICAL AND SPATIAL CHARACTERISTICS

The evolution of constructive processes, are not reflected in the physical-spatial solutions adopted in residential buildings, particularly in the spatial organization of the interior. This is evident in the buildings built in the 30 on the new constructive solution, resulting from the application of the concrete, which was not followed by changes in the spatial organization of the domestic interior.

Despite the introduction of concrete in the construction of floors increase greater freedom in organizing in inside spaces in house, such possibility was not significantly utilized. Indeed, it was not taken advantage of the ability to increase the areas of space, because of reduced thickness of the slabs constructed, permitted by RGCU (1930) with 0,08 m minimum.

6 PATHOLOGY OF MODERNIST BUILDINGS

With exception of the buildings that suffered conservation and rehabilitation works, the building complex subject of study has several constructive pathologies.

For analysis and characterization of the state of degradation of Modernist buildings, was used a sample of 12 from the 18 residential buildings studied.

In the analysis of the condition of this buildings were considered mixed typologies and 1st period of concrete, the "gaioleiro" typology was excluded because of the low representation of that type in the set.

6.1 METHOD OF EVALUATION

To structure the analysis we used the following criteria parameters:

1. EFM (element source of maintenance). Constructive elements that may develop problems giving rise to rehabilitation work or specific maintenance;
2. Anomalies identified in constructive elements.
6.1.1 GENERAL CRITERIA

To determine the level of severity of the abnormality in each construction element was combined the following two criteria:

a) Consequence of failure to satisfy the functional requirements;

b) Importance of the construction element affected.

It was estimated the importance of each criterion by comparing anomalies, based on the calculation method developed by Pereira (2012), assigned a weighting factor to each type of anomaly - 1, 0.7 or 0.3 of the anomalies of greater importance to minor; well as assigned a weighting factor to each construction element - 1, 0.7 or 0.3, whichever is considered of more or less importance to the construction.

6.2 GRAVITY OF THE ANOMALY

The severity of the anomaly is related to the intensity and type/extent of work required for their correction. Synthesized in three levels of severity for the preliminary anomaly of the same type:

- Level 1 (mild anomaly) - Anomaly that affect the appearance of the EFM and require work, easy to perform.
- Level 2 (mean anomaly) - Anomaly that impair the appearance of the EFM, which require hard work execution; Anomaly that impair the operation of the EFM, and jobs that require easy carrying.
- Level 3 (severe anomaly) - Anomaly that impair the operation of the EFM, which require hard work execution; Anomaly that endanger the health and safety, can motivate serious or very serious accident.

By calculating the product of the weighting factors and the levels of severity preliminary set and sorted based on the result obtained by the three levels of severity 1,2 and 3.

6.3 LOCATION ON THE MAIN PROBLEMS IN BUILDING

Anomalies are registered in a differentiated way, in the outside and inside of buildings, either in the mixed type, or in the 1st reinforced concrete period. In buildings with mixed typology we can conclude that the inside of the building has a higher percentage of anomalies (65%) than in the housing outer (35%), contrary to what was observed in buildings in 1st stage of the concrete with a higher incidence of anomalies in the housing outer (60%) than in the interior (40%).
6.4 DETERIORATION OF MAIN CONSTRUCTIVE ELEMENTS

There was 122 anomalies, identified in 7 buildings of mixed type, in 14 groups of EFM (element source of maintenance). In the 5 buildings of the 1st phase of concrete there were identified 45 anomalies in 9 groups of EFM (element source of maintenance). In figure 04 and 05 is compared the relative frequency of failures by including in types under analysis, it is concluded that the mixed typology is more affected and bearing more different types of anomalies.

Figure 04 Frequency of anomalies registered in the exterior of the building.

It was noted that along the construction evolution, specially with the introduction of the reinforced concrete at a larger scale, it reflected a shift in the common anomalies found, and in the most affected elements.

Figure 05 Frequency of anomalies registered in the interior of the building.
The wall coverings are EFM group with the largest number of occurrences in the two types of buildings, mainly because of water action, causing the breakdown of the walls when exposed to wind and rain. The humidity infiltrated when they encounter cracks and voids in the mortar, form a network of preferential paths within the elements, usually by mortar joints between the bricks or stones. In this way they do on the inside of the wall carries salts, which, after dissolved, crystallized through evaporation of water reaching the wall surface.

Figure 08 Frequency of anomalies registered in each EFM in the outside.

Following in buildings mixed type, corrosion of metallic structural elements occurs mainly at the back of these buildings at the balconies and stairs, but can also verify other elements or parts of the building. This anomaly is mainly because the lack of any kind of finish / protection that prevents the oxidation of metallic elements. At the buildings in the 1st period of concrete the salient elements in concrete, projected from the facade of the building have pieces at risk of falling, flaking, blistered, with biological attack, crumbling. Often related to design and execution failures.

Figure 07 Frequency of anomalies registered in each EFM in the inside.
These buildings reveal a unique architectural value in its capacity for renewal and creation of a new form of expression. His practice was primarily dominated by engineers and builders, occasionally by architects, stands out the authors Cassiano Branco, North Junior, Pardal Monteiro and Cristino da Silva. Although misfit of the concerns and objectives of the international movement, Modernism in Portugal was able to resist the prevailing circumstances of a composition revivalist with a century of tradition, introducing a new language in response to social and technological changes of the period.

The traditional construction system, mediated by a transition time, also suffers, in this period, progressive changes. Mostly from 1935 with the slowly introduction, of reinforced concrete in foundations, beams, columns and slabs in full, and not accessible flat roofs. But it was especially in terms of the composition of the facades in Radical Modernism style that biggest change takes place, buildings earn higher tridimensionality by projecting concrete elements protruding from the plan facade, repeatedly on traditional principles of symmetry, with innovative design. Showing a partial understanding (limited to the form) of what constitutes a comprehensive proposal of what could be a new mode of architecture production.

When analyzed the degradation state of the buildings it appears that there is greater susceptibility of constructive elements in mixed type between 1925 and 1935, with an incidence of most types of anomalies. With particular emphasis on corrosion anomaly recorded while abroad, associated with metallic elements, later replaced in the 1st phase of the concrete for reinforced concrete. These buildings reveal an evolution of the ability to withstand the weather, ensuring a better performance against functional requirements.

The introduction of reinforced concrete in construction - a new material and construction technique - even if applied with some hesitation, fragmented in the early twentieth century, revolutionized architectural expression in Portugal. His main contribution to the genesis of modern architecture, are those related to the role of physical support structure as an active element of the composition.

The knowledge of the architectural heritage built in this period is critical to understanding the evolution of the building constructive Lisbon, as well as the intrinsic relationship between the technological developments in construction and architecture in performing its function.
8 REFERENCES


GENERAL REGULATIONS OF URBAN CONSTRUCTION FOR THE CITY OF LISBON, approved by the City Council of Lisbon on 28 August de1930.

REGULATION OF WHOLESOMENESS OF URBAN BUILDINGS, approved by Decree of February 14, 1903.

REGULATIONS FOR THE USE OF ARMED BETON, approved by Decree n. º 4036 of April 3, 1918.

REGULATION OF CONCRETE, approved by Decree n. º 25948 of 16 October 1935.

CONTRIBUTION OF LAND REFORM, approved by Decree n. º 15289, of March 30, 1928 and Decree n. º 18738 of August 9, 1930.