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3.

SUSTAINABILITY AND TRADITION

Sustainability through traditional knowledge

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THE KNOWLEDGE OF TRADITIONAL CONSTRUCTIVE SYSTEMS AND ITS CONTRIBUTION FOR A SUSTAINABLE PRACTICE IN ARCHITECTURE
THE EXAMPLE OF THE BOURGEOIS HOUSE OF PORTO

Introduction

The practice of conservation, very common in the pre-industrial construction, constitutes an environmentally sustainable and friendly attitude, allowing to reduce the consumption of natural resources and energy and the production of construction residues, besides contributing to a balanced occupation of the territory.
Along the XX century this balance was deeply altered by the industrialization process, resulting in serious environmental impacts, along with the exhaustion of natural resources.
Fortunately, in the last decades of the past century, movements centred in the environmental cause have appeared, which, through their contribution for the denunciation of the modern society harms, are gaining more and more supports.
Nowadays, it is possible to affirm that we are living a time of transition to a new paradigm focused on the environmental cause that will certainly refocus our relationship with the planet.
In the Architecture disciplinary field, the promotion of a sustainable attitude should elect as a prime goal the intervention in ancient buildings, either considering simple actions of conservation, increasing their service life, either in more complex rehabilitation interventions, devoted to improve their overall performance and energetic efficiency. Consequently, only the extension of the service lifetime of buildings, through his maintenance and rehabilitation, will be able to reduce the environmental impact produced by the current activity of the construction field.
In this sense, we believe that in a short-term, consolidation of a process already in course - where building rehabilitation is having a major role - will occur, leading to an inversion of the prevailing architectonic practice.

The study on the Porto bourgeois houses constructive system

The study of the constructive system of the bourgeois houses of Porto has been initiated at several years ago with the realization of academic works concerning survey and interpretation (fig. 1), which counts on some hundreds of analysed buildings, largely located in the Historic Centre of the city. The first systematization presented from this material, was based on main literature about the subject and on the consultation of architecture licensing processes, existing in the Municipal Historic Archive of Porto. The accomplished research turn out evident that the available specific literature is scarce and dispersed, and includes, mainly, the studies conducted by Ernesto Veiga de Oliveira and Fernando Galhano, complemented by small monographic essays on applied materials or architectonic elements of the buildings. For this reason, the study was extended to treaties and, in particular, to manuals, that have had great national spreading during the XVIII and XIX centuries, with emphasis for the works of Oliveira, Leitão and Segurado.
The referred systematization, which has been updated with data resulting from the most recent research, also includes an extensive and complementary graphic documentation of the constructive system of these buildings.

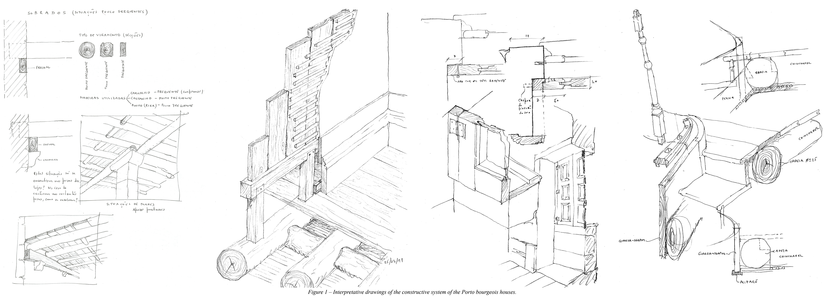

Figure 1 – Interpretative drawings of the constructive system of the Porto bourgeois houses.

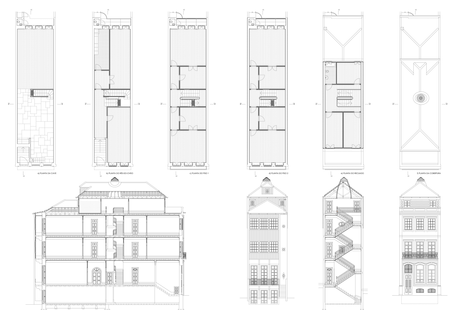

Figure 4 – Constructive model: plans, sections and elevations, scale 1/50.

Figure 2 – Overview through part of the historical centre, showing the diversity and the cohesion of the built ensemble.

Figure 3 – Overview of a street, showing the systematization of the buildings' facade composition, materials and constructive system).

The definition of a constructive model

The accomplishment of hundreds of building surveys, coupled with the deepening of the study on its constructive system, made evident a strong systematization of procedures, techniques and application of materials, that reached its greater fullness of refinement from the second half of the XIX century, when the processes of industrialization, along with the exportation of new products, takes greater importance (figg. 2, 3). However, the intention to systematize the urban development of the city has been initiated a century before, influenced not only by the illuminist ideals, but also by the process of reconstruction of Lisbon, following the 1755 earthquake.
This systematization, expressed, first of all, through a disciplined urban design, has resulted, in the building scale, in a standardization process of constructive elements, such as balconies, cornices, parapets, etc. On the other hand, the domain of the constructive techniques very centred in a corporative knowledge, also contributed, effectively, to this constructive systematization.
In the case of the city of Porto, it was possible to identify the existence of several standards related to the construction of the houses, with respect to its several components, such as the facades, floors, roofs, window frames, etc.
This context has motivated the conception of a constructive model of Porto bourgeois houses, based on the degree of occurrence of the different constructive solutions identified in the studied buildings. For this purpose, the building model was divided in ten main components of its construction: foundations; buried walls; exterior walls; floors; roofs; interior walls; vertical accesses; exterior window frames; interior door frames; and installations.
The constructive model, elaborated from the dominant constructive solutions taken from the studied sampling, resulted in an abstract building, readily associable to any bourgeois house of Porto of the second half of the XIX century (fig. 4). The association of the model to this period does not result surprising, since the most recent buildings were the ones that had not suffered deep modifications, thus maintaining the presence of many traces of its original form.
The building model is not limited, however, to this particular building, being multiplied, for each of its ten previously identified components, in a number of constructive variants, as many as was possible to identify (figg. 5-8).
In summary, the main purpose of the constructive model is to speed up the intervention processes for safeguarding and upgrading of the buildings, taken advantage of all the information contained in the drawings of different scales, from 1/50 to 1/1, and ensuring its application along the various stages that constitute the intervention process.

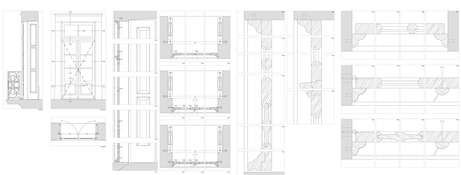

Figure 6 – Example of a balcony window in various scales of detail.

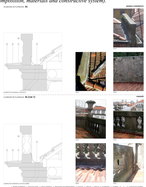

Figure 8 – Types and details of balustrade rainwater gutters.

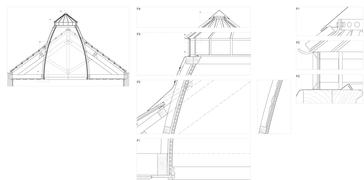

Figure 5 - Prominent skylight in various scales of detail

The application of the constructive model in the architectural design

The intervention in older buildings is a very complex operation, since the traditional materials and building systems, their behaviour and the vast phenomenology associated with damage, are not of easy domain for people with general training, which implies the intervention of several experts. For this reason, it must be considered a multidisciplinary activity par excellence.
Since the Amsterdam Declaration, it became consensual that the knowledge and the techniques applied in the interventions in exceptional buildings should also be applied to the current buildings; however, this transposition cannot be achieved in all cases, since the required technical support is frequently impracticable for economic reasons, at least with the desired amplitude.
In fact, if in the case of monuments or other exceptional buildings, it is possible to fulfil the necessary economic conditions to the establishment of multidisciplinary teams, for the current buildings it is impossible, in general, to achieve the same conditions. For this reason, it must be established methodologies that make possible, through the systematization of procedures, qualify and expedite the intervention in these type of buildings.
Therefore, in a first phase, the information contained in the constructive model has to provide a support to the geometric and constructive survey of the existing building, thus speeding its elaboration, always subjected to some constraints, in particular when the building is occupied.
Consequently, through the establishment of analogies between the constructive model and each case, it will be possible to estimate the measurements in situations of difficult determination, as well as interpret the constructive system of the diverse architectonic elements of the building.
Through the constructive model it is still possible to define the framework of the elements of cultural value of the building, reflected in the quality of the used materials and relevance of the craftsman work (such as stucco, tiles, elements of carpentry, ironwork, stonework, etc.), thus contributing to its easy identification and subsequent preservation.
Similarly, the constructive model makes also possible to define the context of modifications introduced in the houses, contributing to the identification and discussion of its value, particularly regarding the building identity, and thus justifying its preservation or demolition.
As in previous examples, it is considered that the constructive model is also suitable to the definition of the pathological condition of the houses, when in the presence of little or moderately severe anomalies, thus allowing, during the inspection, their identification and the establishment of the corresponding corrective measures. In practice, the reliability of these procedures will depend, naturally, of the expertise of the technicians involved, however, it must be stressed out that, whenever the situation demands it, the execution of more detailed inspections should always be considered.
Being a holistic process, every aspect of the approach on the condition of the existing building must consider the importance of each part (element) within the overall framework of the building. Similarly, the final diagnostic report must cross all the pertinent information, relating them in order to establish a sound and coherent evaluation.
Finally, through the constructive model several intervention solutions in the building are considered, adapted from the scientific and technical literature available on the subject and following the recommendations of international documents. This base solution, aims to establish itself as a repository of best practices, supporting the development of the intervention design phase.
Therefore, it is believed that, especially regarding the design constructive aspects, it may be achieved considerable advantages through a more systematic knowledge of the buildings characterization and condition, which will result in a typification of intervention procedures, in line, furthermore, with the typical constructive standardization of the buildings that were the subject of the present study.
With other authors it is shared the conviction that typifying constructive solutions, it will be possible to obtain a reduction of the duration of the intervention and of the mobilized resources, lowering, consequently, the final costs.
It is also important to note that, despite the aforementioned, the proposed methodology is not intended to replace the participation of the technicians or minimize the importance of their role. On the contrary, the presence of the different experts it is essential to avoid the uncritical application of typified solutions and to ensure the qualification of the interventions.

Figure 9 – Street elevation indicating value elements.

Figure 11 – Roof plan with frequent anomalies survey.

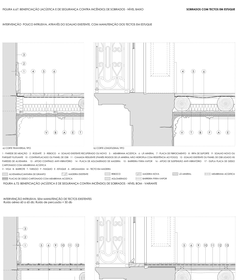

Figure 12 - Intervention in diferent types of pavements.

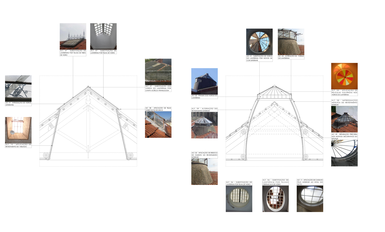

Figure 10 – Skylight sections with current alterations.