

ARCHITECTURAL ENGINEERING IN REHABILITATION AT SOCIAL HOUSING QUARTERS

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The rehabilitation of social housing quarters is done with the purpose to answer three central questions: (1) to solve the existing anomalies that are often caused by rain water infiltrations through the vertical's building envelope and also through roof, condensation caused by the lack of insulation and poor existent ventilation and existing cracks in building's facades; (2) to improve thermal comfort and increase energy efficiency of the buildings; (3) to increase the satisfaction and self-esteem of the residents promoting a modern and also high quality architectural intervention at social housing quarters. This study will describe the executed solutions for the rehabilitation of this three social housing quarters, three of the biggest social quarters of the Oporto region, each one with a different intervention in the building envelope.

Keywords: Urban requalification, Urban integration, Architecture and urban design, Self-esteem of the residents.

1 INTRODUCTION

This paper attempts to put in evidence the architectural engineering interventions in rehabilitation at social housing quarters implemented to solve the crucial problems, condensation and humidity (Thomson and Sian 2015). Social housing in Portugal represents a very significant portion of housing (50 % of inhabitants of Portugal).

In the 50's, more examples of construction of multifamily housing appeared, primarily through direct state intervention in social housing: "What we see is a spatially monetization of land available and the need for more comprehensive solutions to problems of ordering of metropolitan life" (Baptista 1999).

Around the two important metropolitan areas (Lisbon and Porto) it was verified that over than 20 % of people lives in social housing. A large number of these buildings have an intensive residential use and they need a systematic maintenance that is often ignored for economic reasons and also for insufficient planning.

With the Revolution of April 1974, other initiatives with the same goal of fighting the shortage of housing for people of lower social classes were promoted. Remarkable is the SAAL - Outpatient Services Local Support (1974-1976), created as the Housing Development Fund (FFH) Specialized Technical Corps. This service advocated "a radical model of the city and planning: a city where the poor are also entitled to the historic center" (Costa 1998).

Thus, the rehabilitation of social housing quarters is done with the purpose of answering three central questions:

- To solve the existing anomalies that are often caused by rain water infiltrations through the vertical's building envelope of the building and also through roof, condensation caused by the lack of insulation and poor existent ventilation and existing cracks in building's facades.
- To improve thermal comfort and increase energy efficiency of the buildings.
- To increase the satisfaction and self-esteem of the residents promoting a modern and also high quality architectural at social quarters.

The executed solutions for the rehabilitation of this three social housing quarters, in three of the biggest social quarters of the Oporto region, each one with a different intervention in the building envelope will be described in the present study case. These neighborhoods constitute an experience of the adoption of affordable housing in the modernist principles enunciated in the Charter of Athens (1931) excellent multifamily blocks the object of an extremely well-detailed design, “(...) in intimate relationship with the urban green, (...) with a very strong human scale” (Coelho 2006). The Plan of Improvements (Plano de Melhoramentos) (Câmara Municipal do Porto 1966) is responsible for the emergence of a new urban typology in Porto through new housing estates.

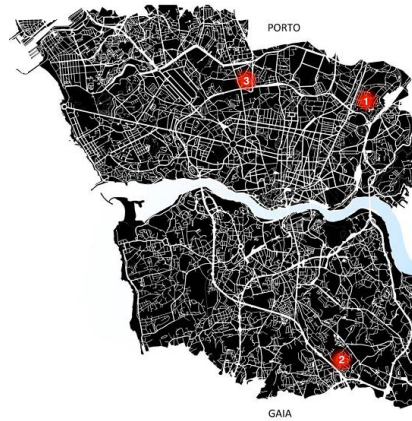


Figure 1. Neighborhood of Contumil①, of Vila D'Este, ② and of Santa Luzia ③.

2 CONDENSATION

Condensation comes from water vapour within the buildings - people, cooking, bathing ... Buildings with poorly insulated walls are very prone to this problem. Due to the lack of thermal resistance, condensation occurs, which leads to water damage in the indoor environment. These results in condensation and risk for mold growth. It will exist condensation if both Eq. (1) and Eq. (2) are true.

$$tsi < tpo \quad (1)$$

$$tsi = ti - \frac{U}{hi} (ti - te) \quad (2)$$

Where, tsi = Interior surface temperature; tpo = Dew point temperature given by the humidity chart. ti = Interior temperature; te = Exterior temperature; U = Thermal coefficient of transmission; and, hi = Thermal interior conductivity.



Figure 2. Examples of observed anomalies (condensation, humidity).

To solve the problem, heat and ventilation should be increased, but in social housing this is not possible. So, it's necessary to improve the insulation of external roofs and walls.

3 ENERGY EFFICIENCY

EU Countries have drawn up strategies to show how they plan to foster investment in the renovation of residential buildings.

One of these strategies is provide an estimate of the expected energy saving that will result from renovations. Most of the social housing has a poor level of efficiency.

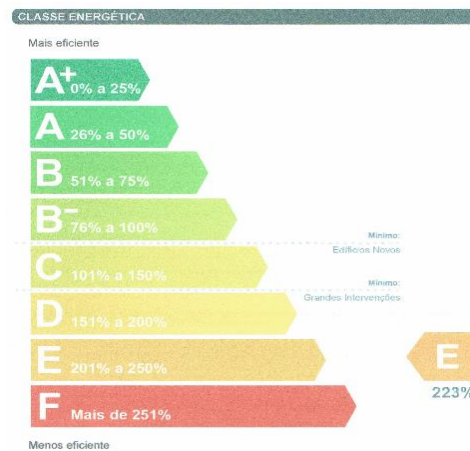


Figure 3. Example of a result of an energy efficiency evaluation (classification E).

The EU program of investment forces that the housing after the rehabilitation reach more two levels.

4 STUDY CASE

4.1 Santa Luzia, Porto

The analysis of the neighborhood of Santa Luzia, at the present time and its redevelopment project, allowed to study the factors that compromise the urban integration and how the requalification met such conditions. The project seeks to understand the relationships between

the different spatial components in shaping the urban neighborhood form and the contribution of each of these components to the overall quality of the intervention.



a) Before the architectural engineering in rehabilitation



b) After the architectural engineering in rehabilitation

Figure 4. Neighborhood of Santa Luzia, Porto (640 Dwellings).

Each component of the urban space tries to be designed so that the assembly formed by reclassified zones in the shown design, can be understood as a unit - and not the current sum of road sections more or less dispersed buildings and voids between both building an urban fabric.



Figure 5. Project of rehabilitation of Santa Luzia, Porto.

4.2 Vila d'Este, Vila Nova de Gaia

The analysis of morphological characteristics of the Vila d'Este urbanization in two stages, before and after the physical rehabilitation - allowed us to study the factors that compromised the urban integration, architectural quality and residential satisfaction of residents.



a) Before the architectural engineering in rehabilitation



b) After the architectural engineering in rehabilitation

Figure 6. Neighborhood of Vila d'Este, Vila Nova de Gaia (2085 Dwellings).

The redevelopment meets the full range of objectives, which must meet the physical rehabilitation of public space in affordable housing sets. Like in the previous case, each element of the urban space was designed together with all other elements, so that all the parts reformulated in the rehabilitation work can be seen as a unit. Before upgrading, urban set was only a sum of empty spaces between buildings scattered and fairly disjointed road sections, buildings without quality.



Figure 7. Details of project of rehabilitation of Vila d'Este, Vila Nova de Gaia.

4.3 Contumil, Porto

The intervention in Contumil neighborhood responds to the most critical issues of its urban space and meets the full range of objectives which must meet the physical rehabilitation of public space in the social housing context. Our first goal was to understand the relationships between the different spatial components in the design of the urban form of the whole and the contribution of each part to the overall quality of the intervention.



a) Before the architectural engineering in rehabilitation



b) After the architectural engineering in rehabilitation

Figure 8. Neighborhood of Contumil, Porto (248 Dwellings).

Each part of the urban space is designed so that the whole can be understood as a unit and not as a sum of distinct elements or empty spaces between them; buildings that does not assure continuity if it doesn't benefit from the complementarity between them and the adjacent spaces. Recasting of accessibility plays a very important role.

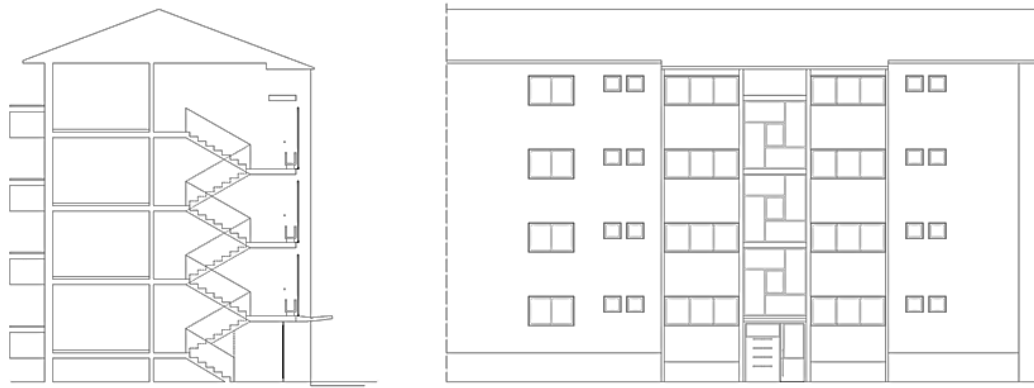


Figure 9. Details. Project of rehabilitation of Contumil, Porto.

The restructuring of the redesigned road network with orthogonal paths and new links that regulate the mesh of the remaining spaces can resolve the gaps in accessibility and proximity of parking.

5 CONCLUSIONS

These three interventions of rehabilitation at social housing quarters show that we can solve the main problems – condensation and lack of energy efficiency - through technical engineering solutions. These solutions combined with architectural interventions and the redesign of the buildings will increase the satisfaction and self-esteem of the residents, qualifying these quarters (ceasing to be considered ghettos) and integrating it in the city.

It is important to refer that the introduction of the architectural component in rehabilitation must be considered as a major and significant value in the image and functionality final result of the rehabilitated buildings (Abrantes 2009).

It is to expect that the architectural valorization work component will be the key for the acceptance of inhabitants and users of the buildings and therefore it induces auto-esteem in people to reinforce their bound with their surroundings.

This point is a value that must be assured for all social habitation.

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