

# SOCIAL HOUSING: THE ABSENCE OF LCC

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## ABSTRACT

To face qualitative and quantitative lack of dwelling, important public investments were made in social housing. Providing adequate shelter to low income families was a major focus of this public investment in the last quarter of the twentieth century in Portugal. However, most social dwellings haven't been built in compliance with essential sustainability principles, therefore compromising their present value. This has been confirmed with a recent field survey conducted by the authors to a set of social dwellings in Aveiro district, in the centre of the country.

The early deterioration of the buildings, the deficient thermal and acoustic insulation, contributes to its lack of quality. Its degradation level is consequence of low durability design solutions and deficient construction processes control, increased by the absence of maintenance actions. The restricted budgets and the absence of Life Cycle Costs (LCC) studies, also contribute to the above scenario. The public Portuguese entities responsible for this building stock never made LCC analysis to support their decisions. Nowadays to face the buildings deterioration problems, reactive actions are taken.

The aim of this paper is to present the results of the most relevant problems detected in a sample of rental social dwellings, and the consequences of the inexistence of the LCC. This will be used in the scope of a research project being carried which aim is prioritize refurbishment interventions in the Portuguese social housing stock.

**Keywords:** Social housing, sustainability, LCC

## 1. INTRODUCTION

Social housing promotion major aim is to provide houses at lower prices than the current market, to be purchased or hired by low incomes families, assuring them habitation with minimum quality conditions [1]. This promotion can be done by public or private initiative. The Portuguese State investment to support the construction of public rental housings, from 1992 to 2001, was 87 830 millions of Euros. During this period has been passed from the construction of 1 283 houses in 1992 to 6 343 in 2002. This increase permitted to give a house to 40 104 families [2]. The State Housing Secretariat study recognizes that the quality and durability of these housings hasn't been the desirable, existing nowadays a greater worry with these aspects [2]. The number of houses constructed and the financial amounts involved in these projects, must result in constructions with higher quality, most efficient and durable. By other side during its occupancy the majority of these buildings weren't accomplished with preventive maintenance [3].

Buildings have as principal objective full fill its occupants essential needs of weather cover. So its envelope must establish a frontier between the interior and the exterior environment, with safety, habitability and comfort high performance. It is also important to establish performance objectives related with economical issues along the service live of the buildings, related with its energetic efficiency, with its durability and sustainability. A short durability implies the precocious appearing of pathologies, the no compliance with the estimated service live of the entire building or of its parts, the need of extraordinary rehabilitation actions, the major waste and consumption of resources and the need of more frequent repair and rehabilitation works.

Analysing the principal pathologies identified in buildings, it can be verified a great incidence in its envelope. This incidence implies a minor performance level of the elements were they appear, and the appearance of interior pathologies. This lack of quality and the related pathologies are caused by technical and administrative causes [4]. The Portuguese public procurement only covers the construction works in these projects. The contractors only gave the global price to the construction work and stay responsible to repair any

constructive problem that appear during the next five years after the construction. Any economical studies about operating and maintenance costs are made during the design and planning phase. The absence of the LCC studies and the public management restricted budgets, associated with the lack of quality during the construction, implicate a precocious building degradation. It is urgent that innovative public procurement be implemented, that covers not only construction of works but also long term contracts for maintenance and management of the existing facilities. By this way all of the intervenient must be worried with the efficiency, quality, durability and cost of the solutions, since the first moment of the project. It is urgent to take into account the life-cycle cost analysis, for assessing the total cost of facility ownership.

The building set considered was constructed, between 1981 and 2004. The buildings are implanted in 8 different local regions of a same district, in the centre of the country. This study was initialized with the consult of the respective project. After that it was carried out the building's external and interior visual survey, accomplished with inhabitant's interviews.

## **2. BUILDINGS LIFE-CYCLE COST**

Buildings deterioration implicates the necessity of maintenance and extraordinary rehabilitation actions. These management problems generated some years ago, the concern with the buildings life cycle optimization.

ISO 15686:1 defines life-cycle cost as the "economic assessment considering all agreed projected significant and relevant cost flows relevant to the constructed asset over a period of analysis expressed in monetary value. The projected costs are those needed to achieve defined levels of performance, including reliability, safety and availability". The total cost of a building or its parts throughout its life include the costs of planning, design, acquisition, operations, maintenance and disposal, less any residual value [5],[6]. Adopt LCC studies is particularly important to clients who have a long term interest in the property concerned. Often such clients come from the public sector and own a large portfolio of property. It is a tool, to assist in making decisions between different options, and to decide which one result in dramatically reduced operating and maintenance costs.

In Portugal, the public sector that makes financial investments in social housing hasn't yet adopted this tool. The only concern they have is whit the initial cost.

LCC can be applied to new construction projects and to existent facilities, being relevant when comparing alternative investment scenarios such as: retain and refurbish or sell, alternative rehabilitation designs, alternative specifications [6].

Nowadays the United Kingdom Government demands that "all public sector procurement must be made solely on the basis of value for money, in terms of Whole Life Costs. This means that there is a duty on suppliers to deliver services to clear standards which cover both cost and quality by the most effective, most efficient, and most economic means available". So public procurement covers not only construction works but also long term contracts for maintenance and management established specially through BOOT contracts - build-own-operate-transfer: private finance contracts which involve the private sector Building, Owning, Operating and (at the end of the concession) Transferring the project back to government. The contractors have to do the maintenance and management of the facilities during at least 7 years [7].

As construction sector is a great natural resources and energy consumer, the lack of durability, the precocious appearing of pathologies, the need of extraordinary rehabilitation actions implicate major waste and consumption of resources. So the performance building prevision is essential to minimize all these losses. The LCC analysis can contribute to these, with great advantages in the public sector, through the costs analysis across the years, to be supported by the facilities owner [8].

## **3. CASE STUDY**

The aim of this study was the visual survey of the social housing park, constructed and hired by eight local city councils. These city councils are situated in the Aveiro district in the centre of Portugal. The visual survey included the external envelope assessment accomplished by internal surveys in 10% of the apartments. The result of the survey is to obtain a global graduation to each one of the buildings – Degradation Level.

The requirements defined to be measured are the:

- envelope waterproofing (roof, external walls and frameworks);
- external visual aspect (coating cracks, detachment, spread of vegetable and micro organisms, glazing frameworks, roof and rain water drainage facilities degradation);
- durability.

### 3.1 SAMPLE CHARACTERISTICS

The building set considered was constructed, between 1981 and 2004. The buildings are implanted in 8 different local regions of the Aveiro district, in the centre of the country.

- Elements number – the sample have 27 buildings groups, 52 buildings, 138 blocs and 1276 apartments.
- Age of buildings – building's age range from 26 to 3 years old.
- Number of storeys - 3 or 4 housing storeys including the ground level.
- Constructive characteristics - external brick cavity walls, external finishing in single-coat render mortar and in some cases ceramic tiles, metal frameworks with simple glazing, flat and pitched roofs.

### 3.2 METHODOLOGY

It has been created a visual survey methodology to the external envelope. Its aim is to identify the external pathologies and its level of severity trough an evaluation scale. To apply this evaluation scales it was established the deterioration parameters to be considered in each level, associating a visual scale with a physical scale similarly to the scale of Shohet et Paciuk, 2006 [9].

The evaluation scale implemented, with eight levels, was based in the Hermione scale, table1. The assessment in each level is given attending the pathologies intensity, its location and extension.

Table 1 - Evaluation scale

	Level		Description/Action	DL
G	Good without reserves (10 a 8)	G+	Exceptional without any intervention need. Keep and plan maintenance actions to keep the conservation level.	10
		G <sup>o</sup>	Good without reserves. Current clean and maintenance actions must be taken.	9
		G-	Good with some minor reserves. Clean and maintenance actions must be taken in the elements with deterioration symptoms.	8
Y	Acceptable with reserves (7 a 5)	Y+	Acceptable with necessity of low rehabilitation actions.	7
		Y <sup>o</sup>	Acceptable with necessity of moderate rehabilitation actions.	6
		Y-	Acceptable with necessity of deep rehabilitation actions.	5
R	Unacceptable (4 a 3)	R <sup>o</sup>	Unacceptable. Priority intervention. Exceptional rehabilitation.	4
		R-	Unacceptable. Without rehabilitation possibility. Demolish/substitute	3

DL– Degradation Level

The visual survey results were aggregated by a model developed from the Hermione model.

### 3.3 DATA ANALISYS

The majority of the buildings surveyed were constructed after 1996, figure 1.

During the contact with the cities council's technicians it was verified that there is neither LCC studies nor preventive planed maintenance actions. In the sample 41,5% of the buildings never has submitted to any maintenance action and 24,5 % only to punctual reactive repair actions, table 2.

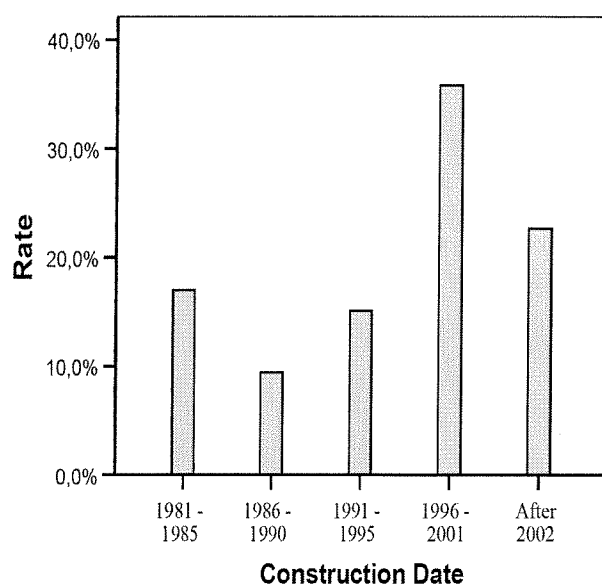


Figure 1 – Buildings rate by construction date

Table 2 – Last maintenance/repair action by construction date

Construction date				Last maintenance/repair action					Total
				Never	Less than a year	1 to 5 years	6 a 11 anos	Only punctual reactive repair actions	
After 2002	Age	0-5 anos	Count	10				2	12
			% within age	83,3%				16,7%	100,0%
1996 - 2001	Age	6-11 anos	Count	9				10	19
			% within age	47,4%				52,6%	100,0%
1991 - 1995	Age	12-16 anos	Count		1		7		8
			% within age		12,5%		87,5%		100,0%
1986 - 1990	Age	17-21 anos	Count				4	1	5
			% within age				80,0%	20,0%	100,0%
1981 - 1985	Age	22-26 anos	Count	3		2	4		9
			% within age	33,3%		22,2%	44,4%		100,0%

In the following figures it is represented the graduation level obtained to some of the requirements assessed during the survey, expressed in number of cases registered.

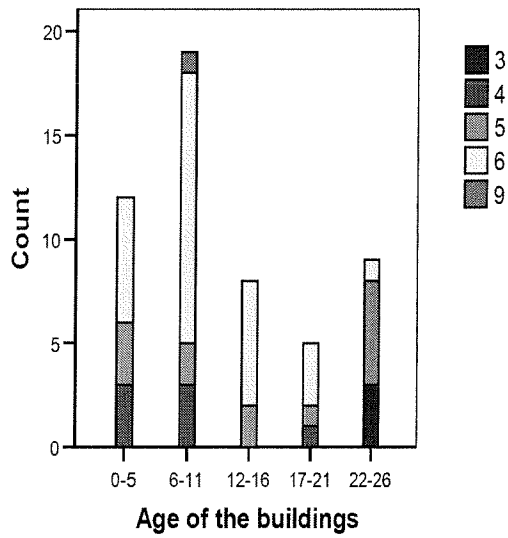


Fig. 2 – Façades coating cracks degradation level

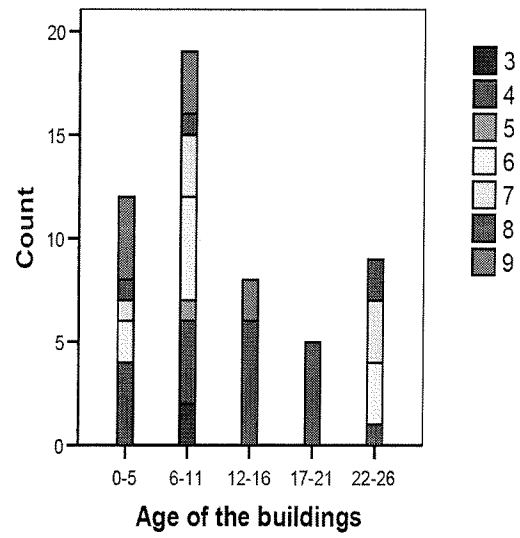


Fig.3 – Façades discolour coating degradation level

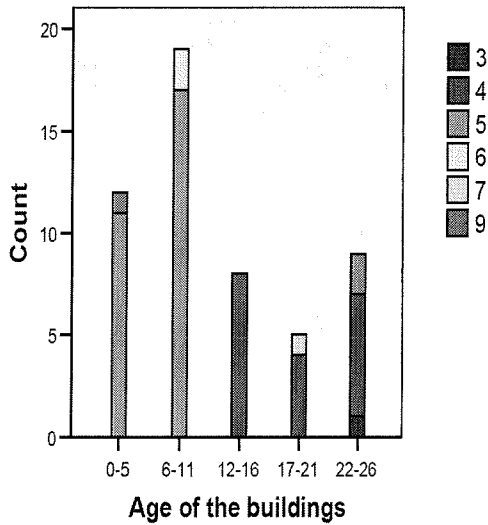


Fig.4 – Windows degradation level

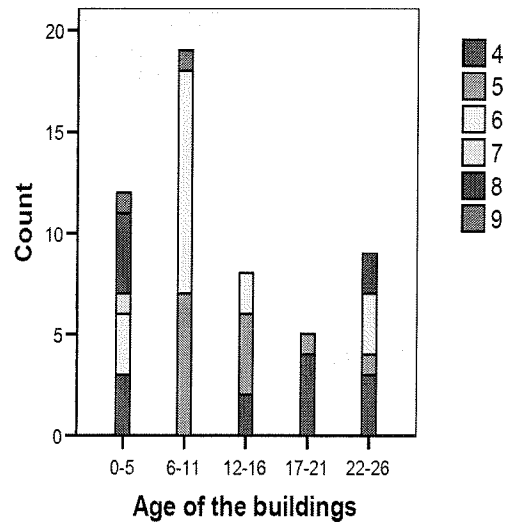


Fig.5– Roof degradation level

The graduation level presented in figures 2 to 6 permits to verify that the façade coating cracks and the discoloration are the pathologies with the worst assessment. The deterioration, the bad watertightness and high air permeability of the windows contribute to its low assessment. The roof and rain water drainage systems degradation level is more relevant in the eldest buildings, with one exception in a recent building that present great problems in its roof caused by construction deficiencies. In general the global degradation level is lower than eight and worst in the buildings with more than twelve years. The eldest case with a DL=8 has been subjected to rehabilitation actions in its envelope, figure 7.

It can be verified that recent constructions present significant degradation in its envelope that contribute to the appearance of pathologies in the interior of the houses with the consequent reduction of its performance.

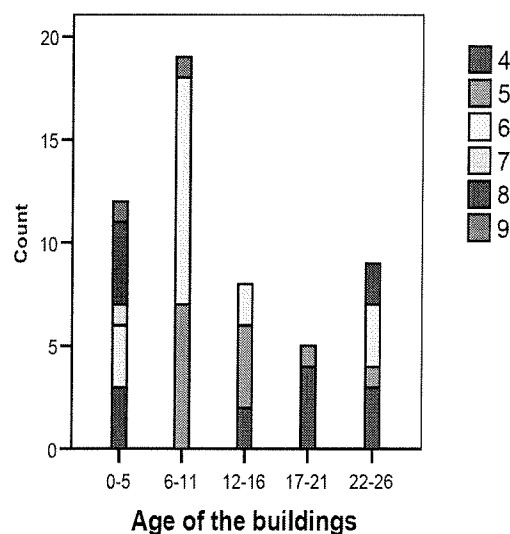
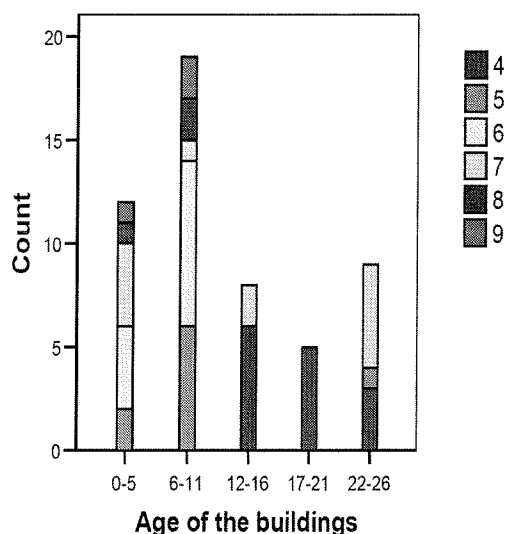


Fig. 6 -Rain water drainage facilities degradation level

Fig.7 – Global degradation level of the building

#### 4. Conclusions

It can be concluded about the low performance level of this set of social rental. The precocious appearances of pathologies in the constructed buildings represent a greater financial effort due to the need of extraordinary rehabilitation actions. To eliminate this waste of money and avoid the low quality of the buildings, the public owner must implement innovative procurement which has to include:

- Contract specification to ensure the quality of the work that will be carried out.
- Tenders can't be evaluated with an only criterion – the cost. There will also be considerations about the quality and durability of the product and minimum quality standards have to be required during its service life.
- LCC analyses have to be contained in the tenders.
- Contracts must have included the responsibility of the contractors by the maintenance of the facilities during at least 10 years, accomplished with effective inspections by the owner technicians.

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