

**PATHOLOGIES IN OLD BUILDINGS OF THE HISTORIC  
CITY CENTER OF VILA REAL**

Andreia Queirós<sup>1,a</sup>, Anabela Paiva<sup>2,b</sup> and Jorge Pinto<sup>3,c</sup>

<sup>1</sup> Universidade de Trás-os-Montes e Alto Douro, Quinta de Prados, 5000-801 Vila Real, Portugal

<sup>2</sup> Universidade de Trás-os-Montes e Alto Douro, Quinta de Prados, 5000-801 Vila Real, Portugal. C MADE – Centre of Materials and Building Technologies

<sup>3</sup> Universidade de Trás-os-Montes e Alto Douro, Quinta de Prados, 5000-801 Vila Real, Portugal. C MADE – Centre of Materials and Building Technologies

<sup>a</sup>andreaqueiros30@hotmail.com, <sup>b</sup>apaiva@utad.pt, <sup>c</sup>tiago@utad.pt

**Keywords:** pathologies, old buildings, historic city center, Vila Real.

**Abstract**

In the 80's people tended to move out from the city centers to live in peripheral areas, in more modern buildings, with larger spaces and higher levels of comfort. Due to the abandonment, the city centers became unsafe, degraded and devalued.

The historic city centers are strongly linked to the cultural heritage of cities, so they should be preserved. However, they should evolve accompanying the needs of the users, in order to be attractive, while preserving their cultural, architectural and construction characteristics.

In Vila Real, a city located in the northeast of Portugal, this happens too. Some years ago, with the help of European, National and Municipal incentives, the historic city center began to be rehabilitated. Even so, there are still a lot of buildings in need of attention.

In this context, a set of eighteen buildings, representative of the historic city center of Vila Real, was selected for the purpose of this work. A survey of the construction characteristics and associated pathologies of these buildings has been carried out. We analyzed the most frequent pathologies in the various construction elements of the external and internal envelope, namely cracking, humidity, degradation of the painting in walls and timber frames, and parasite vegetation on the roofs.

**Introduction**

The increase of construction of new buildings led to the desertification of city centers, so their historic buildings have been abandoned and degraded, resulting in the need to rehabilitate them. As they represent the history, the culture and the identity of the city and of the people, they should be rehabilitated in a way that preserves their characteristics [1].

Nowadays, in Portugal, the population tends to go back to the historic city centers and consequently, there is an interesting dynamic of rehabilitation of these areas and the historic center of Vila Real, in the region of Trás-os-Montes e Alto Douro (TMAD), has also been following this dynamic.

In this context, this research work is within the scope of the Construction Observatory of TMAD [2] that intends to disseminate the characteristics and the dynamics of new construction and rehabilitation in this region.

In order to contribute to the regeneration and rehabilitation of the historic centre of Vila Real, a survey of the characteristics and pathologies of 18 buildings was carried out.

In this article the adopted methodology to develop this work is presented, as well as the characteristics and the more frequent pathologies of the studied buildings.

### Methodology

The characterization and survey of the pathologies of the buildings of the historic city center of Vila Real was done through a case study. So, a representative number of buildings were selected. and a datasheet was adapted from the datasheet prepared by Mouraz [3] and used in the Freeze Viseu project [4]. This datasheet is divided into different topics related to the external characteristics, design and organization of the buildings, roofs, walls, spans and window frames and characteristics of the internal elements, such as partition walls, walls in contact with other buildings, floors, ceilings, equipment, as well as their pathologies.

Using the datasheet a field work was carried out in which several visits and meetings with the owners or users were held. A vast set of photographs was also taken to document the existing features and pathologies of the buildings.

After, the collected data was analyzed and conclusions were drawn.

### Case Study

The city of Vila Real, in the northern interior of Portugal has a population of around 52,000 inhabitants, an area of 370 km<sup>2</sup> and an altitude of 450 m [5].

The case study consists of 18 buildings located in the historical center of Vila Real. In Figure 1 a partial view of the historic city center of Vila Real and the location of the 18 buildings (from A to R) are shown.



Figure 1 - Location of the studied buildings of the historic center of Vila Real [Source: <https://www.360cities.net/image/vila-real-historic-center>]

### Construction Characteristics

In this section the construction characteristics of the buildings studied will be presented.

These buildings were built before 1900 and are a two or three storey buildings, Figure 2. Usually the ground floor is used for commercial or catering activities and the other floors for housing. They are terraced houses with only a facade to the street. The facade is made of granite and have a natural smooth finishing or is plastered and painted. The plaster was made with sand and lime in the buildings that have never been rehabilitated. All these buildings have pitched roofs with two or more slopes and timber structure. 14 of them are coated with Marseille ceramic tiles Figure 3 and some of them have eaves and skylights. The buildings shown in Figure 2 can be considered

representative of the buildings of the historic centre of Vila Real.



Figure 2 - Building I and E of the historic center of Vila Real.



Figure 3 - Pitched roof with Marseille ceramic tiles and skylight

The partition walls are *Tabique* walls (Fig. 4a)) in 11 cases, which are made of vertical timber boards with horizontal slats and filled and plastered with an earth and lime based mortar. In 9 cases these walls are made of hollow brick and in 3 cases of concrete block. The existence of these construction solutions leads to the conclusion that these buildings have already been rehabilitated. The interior doors are made of timber, Figure 4b).



a) Tabique wall

b) Timber ceiling and door

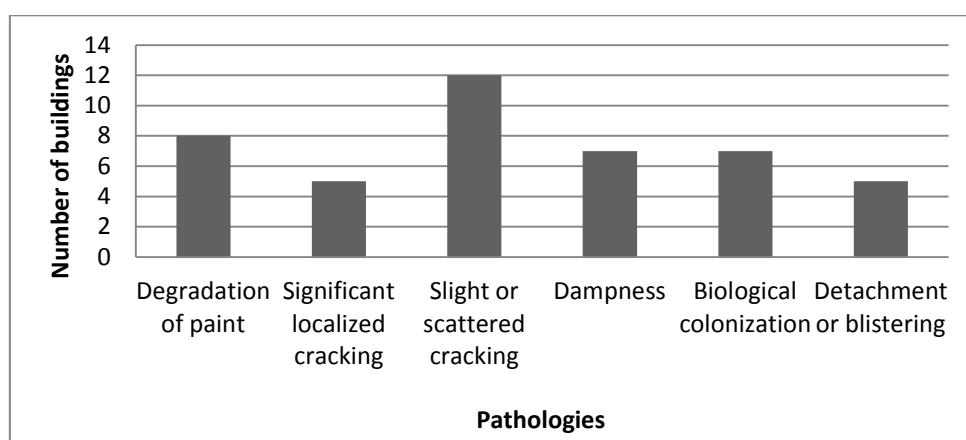
Figure 4 - Construction solutions for partition walls and ceilings.

The floors and ceilings in 9 cases are made of timber and the common finishing is paint or varnish. In 11 buildings the floors are made of concrete slabs and in 9 buildings the ceilings are also made of concrete slabs. These slabs are used in buildings that were already rehabilitated.

The windows frames in 12 buildings are also made of timber and in the remaining buildings they are made of aluminum (8 cases) or PVC (7 cases). The types of windows presented in these buildings are casement and hung windows. The window sills are mainly made of granite (12 cases) and timber (10 cases).

### Buildings Pathologies

Most of the buildings of the historic center of Vila Real need to be rehabilitated, as already referred to, so a survey of major pathologies was carried out. The results of this survey, in what concerns the facades, showed that there is slight or scattered cracking in 12 of the studied buildings, degradation of the paint in 8 of them and dampness and biological colonization in 7 others, Figure 5.



.Figure 5 - Pathologies in facades

In Figure 6 the facades of two buildings are presented. On the left photo the facade of the building presents dampness, mould and peeling paint. On the right photo the granite is cracked, and there is dampness under the window sill.



Figure 6 - Facades with dampness, mould, peeled paint and cracks.

The access of the exterior of the pitched roofs, in most of the buildings was difficult, even so it was found the presence of parasitic vegetation in the ceramic tiles in 6 cases and deterioration of the drainage system in 5 cases. A damaged roof is shown in Figure 7.



Figure 7 - Parasitic vegetation in Marseille tiles

The most frequent pathologies found in window frames are the degradation of the paint, in 12 buildings and the degradation of the wood in 9 of them. 4 buildings have broken glasses, Figure 8.

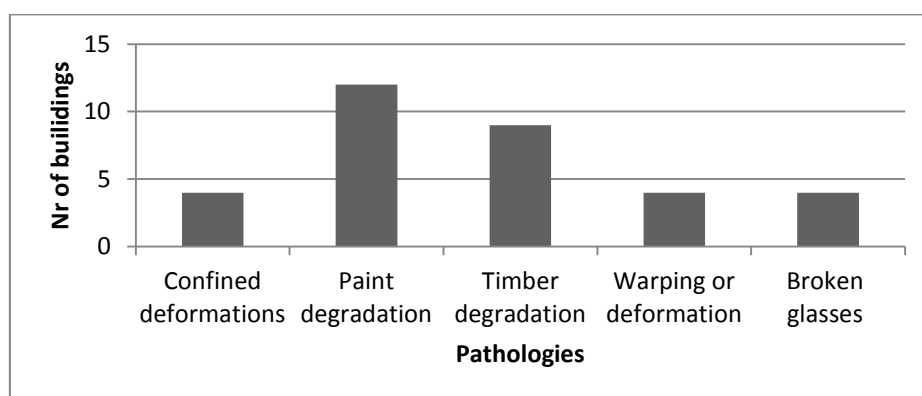


Figure 8 - Pathologies in windows

Several pathologies in a window can be observed in Figure 9, such as degradation of the paint and of the timber frame, broken glass and window sill.



Figure 9 - Pathologies in window.

The more frequent pathologies in interior walls are crack, in 15 of the studied buildings and dampness in 10 of them. In the example presented in Figure 10, the main cause of these pathologies

can be water infiltration, due to roof or drainage problems. The dampness leads to the appearance of mould and possibly to the cracking and blistering of the mortar.



Figure 10 - Dampness, cracks and mould in an interior wall

The floors, as well as the doors and their frames are made of wood. In Figure 11 the pathologies in floors are presented. The main problems are the floor wear in 10 of the buildings (Figure 12) and cracking in 9 of them. Deformations and degradation of the baseboard is also present. These pathologies are due to the use and the lack of maintenance.

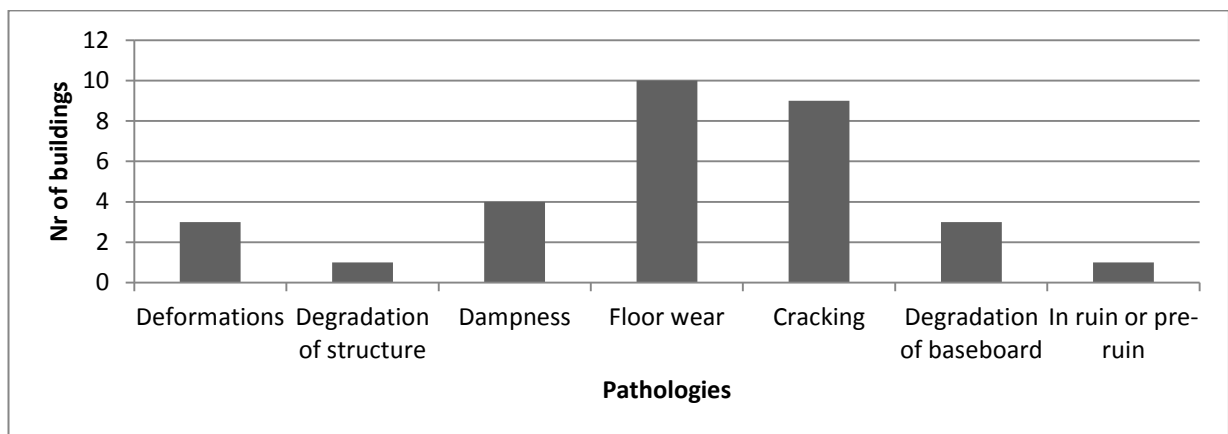


Figure 11 - Pathologies in floors

The stairs have as main pathology the wood wear in 14 of the buildings. Cracking and degradation of the wood are others pathologies shown. Also the use and the lack of maintenance are responsible for their degradation.



Figure 12 - Wood wear on stairs

The more frequent pathologies that affect the ceilings are the cracking and dampness that appear in 9 of the studied buildings, as can be seen in Figure 13. The ceilings in 3 buildings are in ruin or pre-ruin and 2 of them are deformed or have the structure degraded or have mould.

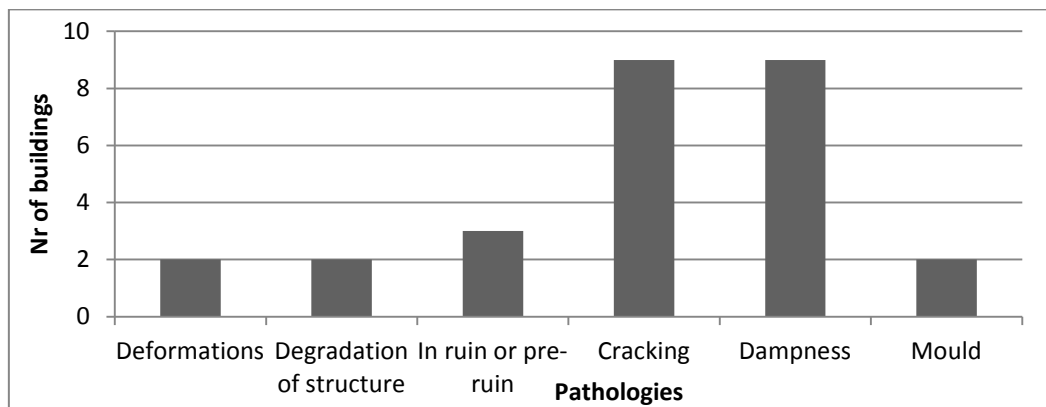


Figure - 13: Pathologies in ceilings

The pathologies in ceilings are mainly due to problems in the roof or condensations, Figure 14.



Figure 14 - Consequences of dampness in ceiling

Although, the buildings pathologies identified, none of the buildings are in ruin or pre-ruin. This leads to the conclusion that the construction solutions used have great potential for rehabilitation. So, instead of replacing wood floors and ceilings with reinforced concrete lightened slabs with prestressed beams or the earth and lime based plaster of *tabique* walls with cement and lime based plaster or plasterboard or the windows wooden frames with aluminum or PVC frames, the ancient construction solutions could be preserved. Some of the buildings already rehabilitated are shown in Figure 15 and 16. The old wooden floors, ceilings, stairs, handrail, baseboard and door were restored. The facade was maintained, as well as windows frames and the balconies guardrails.



Figure 15 - Rehabilitated building



Figure 15 - Rehabilitated building - facade and interior

### Conclusions

The historic city center of Vila Real is in a revitalization process, but there is still a lot rehabilitation work to be done. The eighteen buildings that were studied are representative of this situation.

The pathologies that have been identified are related to the aging of the materials and the presence of water, due to cracking, drainage systems damage and cracking or absence of ceramic tiles on the roofs, that could have been drastically reduced with a regular maintenance.

As no situation of ruin or irreversible damage was found in the studied buildings, it can be concluded that the rehabilitation of this patrimony seems to be a promising option and that the rehabilitation process must be considered in order to preserve the original construction solutions.

### Acknowledgements

This research was partially funded by the Foundation for Science and Technology (FCT), PEst-OE / ECI / UI4082 / 2013 (C-MADE).

To the students of the Course Conservation and Rehabilitation of Buildings, of the Master in Civil Engineering of UTAD, of the 2016/2017 school year.

### References

- [1] AIRES, B. A., Estratégias de reabilitação urbana caso de estudo: Bairro dos Ferreiros, Dissertação de mestrado em Engenharia Civil da UTAD, Vila Real, Portugal, 2009
- [2] Paiva, A., Paiva-Rodrigues, E., Faustino, J., Barbosa-Vieira, J., Ramos, L. (2000), Observatório da Construção em Trás-os-Montes e Alto Douro: um Instrumento de Apoio à Intervenção dos Agentes Regionais do Setor Imobiliário Habitacional, 3rd International Congress of Real Estate, Construction and Company Evaluation, Lisbon, Portugal.
- [3] MOURAZ, C. P., A (2016) Importância da Caracterização Construtiva e do Estado de Conservação na Sustentabilidade ds Acções de Reabilitação: Um caso de estudo no Centro Histórico de Viseu, Master's Dissertation in Civil Engineering, FCTUC, Coimbra, Portugal,.
- [4] County of Viseu, Projeto Freeze Viseu, <http://viseupatrimonio.pt/projeto-enquadramento-objectivos.php>. Accessed in March of 2018.
- [5] County of Vila Real, <http://www.cm-vilareal.pt/index.php/municipio/caraterizacao>. Accessed in March of 2018.