CONSERVATION AND RESTORATION OF EARTHENWARE TILES IN OVAR – METHODOLOGY FOR A SUSTAINABLE INTERVENTION

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ABSTRACT

In the urban landscape of Ovar, a city in the north of Portugal, 19th-century earthenware tiles are one of the most important elements of its identity. This study addresses the current situation of this city with a view to maintaining and preserving its original tiled façades. By means of a case study, we also show the capacity of conservation and restoration to maintain cultural identity and promote touristic potential by safeguarding the collective memory of antique ceramics production.

1. INTRODUCTION

Ovar is a city in which intervention coherence is vital in order to maintain the decorative legacy contained in its 19th century earthenware tiles. Conservation and restoration are thus essential for the preservation of its cultural memory but they also serve other purposes. Research on earthenware tiles and mortars is necessary to ensure successful intervention and enables closer links to be forged between conservation and restoration interventions and the ceramics industry, to the extent that the former need the latter and complement its role in the recovery of our architectural heritage.

2. HISTORICAL NOTE

Tiled façades first appeared in Ovar during the 19th century as a result of various factors, including demographic growth, urban and industrial development at the national level and the town's proximity to the ceramic production centre of Vila Nova in Gaia/Oporto.

The mass-scale production of the ceramics factories on the banks of the Douro River, in particular the Ceramics Factory in Devesas, contributed to a reduction in costs for the consumer and an increase in the available range of options. The arrival of the railway also provided a perfect vehicle for the distribution of ceramic materials, facilitating and reducing the costs of transporting raw materials and final products and opening up a much larger market.

The history of the use of earthenware tiles in Portugal dates from the 16th century, when they were often used to decorate noble and ecclesiastical spaces, either using patterned tiles (16th century, 17th century and the end of the 18th century) or figurative panels (end of the 17th and 18th centuries). The earthenware tiles of the 19th century and the beginning of the following century used patterns based on geometrical and organic motifs, which were produced using semi-industrial processes. Some authors have defended the view that the application of earthenware tiles to the façades of Portuguese civic buildings is exclusively due to the influence of Brazil (1), while others insist that it was a parallel national change (occurring in both Portugal and Brazil). In Ovar, a region which exported emigrants to Brazil who have since returned to their homeland (2), this influence is a strong feature of the façades of its civic buildings, in particular housing developments (3), whether they are under construction or being renovated.

3. BRIEF DESCRIPTION OF OVAR'S BUILDINGS, EARTHENWARE TILES AND MORTARS

The buildings with tiled façades in Ovar may be simple, consisting of a single floor, or they may have up to three floors with wrought-iron balconies and sometimes an attic. As a rule, these residential buildings have granite stonework around any openings in their frontage. Most of the buildings were originally homes, while others housed small shops. Currently, most of the buildings conserve their initial use, while others have been adapted for different functions, such as the accommodation of private businesses, or they have been adapted for public use (museums, for example) (Fig. 1).

The tiles are predominantly smooth, but there are also examples of bevelled and embossed pieces. The majority were produced using the majolica technique, but some have bodies enriched with kaolin ("pó de pedra"). In the decoration of the former the stencilling technique has been used, sometimes with manual touches (applied using a fine brush), and the latter have been printed. Firing temperatures of around 1,050º C were employed and in the case of "pó de pedra" body a temperature of 1,120 ºC (4). For the former, which is more common, there are alkaline and alkaline earth metal fluxes, which explains why a lower temperature was used. They have a palette of different colours (a single colour or sometimes up to five or six colours), in which vegetal and geometrical motifs predominate (Fig. 2). Many examples are of unknown origin (because they have no brand name on the back), but there are pieces labelled with factory brands, such as the José Pereira Valente Factory and the Ceramics Factory in Devesas owned by Antonio Almeida Costa & Company, which is more representative.

The original fixing mortars are composed of aerial lime, silica sand and a small fraction of clay (5) and they have been laid on top of mortars applied to level the surface created by the slate brickwork.

Fig. 1 – Examples of buildings with earthenware tile façades, Ovar.

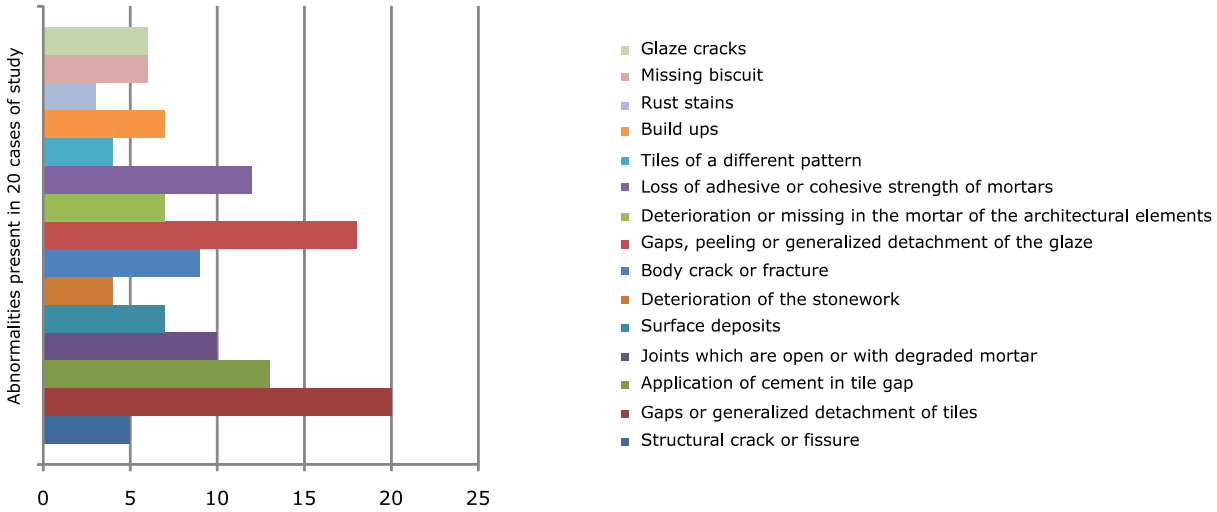
Fig. 2 – Examples of earthenware tiles form the 19th century in Ovar.

4. THE GENERAL STATE OF CONSERVATION OF THE EARTHENWARE TILES IN OVAR

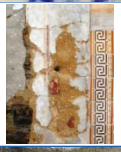
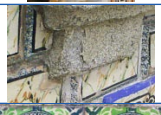
Twenty façades in the city of Ovar, with a number of functional problems which are summarized in Table 1, were analysed. The problems are related to the most common agents which cause them to deteriorate: moisture, temperature, wind, atmospheric pollutants and even human activity. All these factors determine the behaviour of façade tiles, but we would emphasize the action of underground water, moisture in walls and saline fog (owing to the proximity of the ocean). Human influence also has a role in changing materials, either directly or indirectly, a lack of maintenance currently having the most obvious impact. However, atmospheric pollutants also contribute to the development of some dysfunctions, as well as specific micro-organisms and the characteristics of certain buildings, for example the absence of systems for the drainage of rainwater or the existence of surrounding buildings that project shade. Also production defects that affect present behaviour are detected – both at the level of ceramic bodies (the use of low pressure during manufacture) and the glazes (poor bonding to the tile body as a result of insufficiently high firing temperatures) – which manifests as high porosity and high susceptibility to detachment of the glazes.

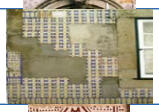
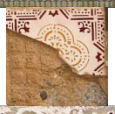
The dynamics of this system afforded by the city and the factors which impinge on it – its geographical position, the climate, urbanism, demography and industrial impact, amongst others – means that some forms of change are more pertinent than others (Table 1). Defects in the ceramic body or glaze are the main problems, not only in terms of the number of cases, but also of how extensive they are. These two problems are the most detrimental when dealing with the conserva-

tion of ceramic façades, as well as interfering with the reading and the aesthetics, as they become points of weakness in the system. In turn, these weak spots in the system promote an increase in incidents and encourage the appearance of other abnormalities (for example, microbiological development). A knowledge of these pathologies is especially relevant for combating and preventing the degradation of materials and, consequently, for designing suitable intervention methods.



Graph 1 – Abnormalities present in 20 cases of tiled façades analysed in Ovar.

Defects	Most common deterioration agents	Example
Crack (of structural origin)	Human or environmental	
Mortar crack	Human, biological, oxidation, salts or MTW[1]	
Loss of tiles: gap, displacement or detachment	Moisture, MTW, soluble salts, human intervention	
Tiles of a different pattern	Human	
Open joints or with mortar degradation	Moisture, soluble salts, human intervention	
Deterioration or defects in the mortar of the architectural elements	Moisture, MTW, atmospheric pollutants, oxidation	
Deterioration of stonework	MTW, salts	
Surface deposits and build-ups	Pollutants, wind, moisture	

Rust stains	Air, moisture	
Application of cement in tile gap	Human	
Gap, crack or fracture in the biscuit	Human intervention, moisture, salts	
Gap, peeling or bubble of the glaze	MTW, human intervention, soluble salts, micro-organisms	
Glaze cracks	Human intervention (production error), moisture	

[1] MTW – moisture, temperature and wind.

Table 1 – Most common façade abnormalities in Ovar.

5. SPECIFIC FEATURES OF THE CONSERVATION AND RESTORATION OF OVAR TILES

A conservation and restoration intervention may have two aspects to it, a preservative and a curative aspect, neither of which is always present. The former, which is primarily related to conservation, attempts to avoid the continuation or development of pathologies, by stabilizing the materials at an appropriate level, while the latter is associated with restoration and aims to recover part of the piece (structural, colour, form) which has been lost, taking into account the aesthetic principles which underpin it. In a museological context, for example, conservation is often the option that is elected, given that the aims are not functional and the intervention can be separated from its context. Restoration is necessary in situations in which the function and context of the materials continue to be how they were originally, as in the case of the historical earthenware tiles of Ovar.

The ACRA (Tile Conservation and Restoration Workshop), created by the Municipal Chamber of Ovar, has existed since 2000. Its main goal is the preservation of the city's earthenware tiles. Its activities include supporting the owners of houses with tiled façades, prevention, conservation and restoration interventions, reproductions, the creation of a tile bank and the promotion of public awareness by means of workshops, presentations in schools and media appearances (3). While preventive interventions are less incisive and are only deployed in cases where there is imminent danger (for example, tile detachment), conservation and restoration interventions inevitably go deeper but are indispensable.

There are various problems when we intervene in this type of heritage issue, given that there is a need for cooperation and funding on the part of owners and optimal weather conditions, which affect not only the state of conservation, but also the viability of an intervention.

The choice of a purely conservative intervention would have particular consequences in the conservation of each specific case and, in the long term, on the appearance of the entire city. The option of performing conservation and restoration interventions is the one that is most beneficial for this type of heritage, as can be seen from the results presented in Table 2. In most cases the pathology is not repeated or its incidence has been reduced, even several years after the intervention. Cases in which there is an increase in the percentage of abnormalities are specific and are primarily related to their geographical location and environment.

		Loss of tile		Detachment		Fractures and cracks		Surface deposits		Missing glaze	
	Total area of the ceramics (m^2)	m^2	%	m^2	%	m^2	%	m^2	%	m^2	%
08	5	0.5	10.0	-	-	0.2	4.0	0.5	10.0	0.8	16.0
		-	-	-	-	0.4	8.0	-	-	1.0	20.0
09	7	-	-	0.3	4.3	×	×	×	×	0.6	8.6
		-	-	0.1	1.4	0.3	4.3	-	-	1.5	21.4
10	3	0.6	20.0	2.0	66.7	-	-	-	-	0.7	23.3
		-	-	0.1	3.3	-	-	-	-	-	-
21	**23**	**-**	**-**	**23.0**	**100.0**	**×**	**×**	**×**	**×**	**10.8**	**47.0**
		-	**-**	**×**	**×**	**-**	**-**	**0.3**	**1.3**	**-**	**-**
54	12	6.4	53.3	0.6	5.0	-	-	0.2	1.7	×	×
		-	-	-	-	-	-	-	-	-	-
66	13	0.3	2.3	0.4	3.1	×	×	-	-	1.6	12.3
		-	-	0.6	4.6	0.8	6.2	-	-	2.7	20.8
69	14	-	-	0.5	3.6	0.7	5.0	-	-	1.4	10.0
		-	-	-	-	1.1	7.9	-	-	1.0	7.1
76	32	0.1	0.3	-	-	-	-	-	-	1.3	4.1
		0.1	0.3	-	-	-	-	-	-	1.2	3.8
79	7	0.1	1.4	0.1	1.4	0.1	1.4	-	-	0.6	8.6
		-	-	-	-	-	-	-	-	0.4	5.7
86	29	0.2	0.7	0.4	1.4	-	-	-	-	2.0	6.9
		-	-	-	-	-	-	-	-	1.1	3.8
87	7	0.1	1.4	0.6	8.6	0.2	2.9	-	-	-	-
		-	-	0.2	2.9	0.1	1.4	-	-	-	-
	7	-	-	2.2	31.4	-	-	-	-	0.9	12.9
		-	-	-	-	-	-	-	-	0.7	10.0
Average prior to intervention (%)*			7.5		11.4		1.5		1.2		13.6
Average after intervention (%)*			0.1		1.1		1.4		0.1		8.4
Reduction of defect (%)			98.7		90.3		6.7		91.7		38.2

	State of conservation prior to intervention – Intervention with a maximum duration of five years
	State of conservation prior to intervention – Intervention with a duration of over five and less than ten years
	State of conservation prior to intervention – Intervention with a duration of ten or more years
	Current state of conservation
-	Defect absent
×	Present defect unrecorded
*	Cases with the × symbol were not counted when calculating the average

Table 2 – Incidence of tile defects verified during building interventions, area (m^2) and percentage (%).

6. THE MUSEUM OF SACRED ART (THIRD ORDER OF SAINT FRANCIS OF ASSISI) – A CASE STUDY

This building, acquired in 1780 to accommodate the House of the Order, had only one floor initially. In the 19th century it was clad with earthenware tiles of a single pattern, which included the symbols of the Third Order of Saint Francis of Assisi –the cross of Christ and two crossed arms (of Jesus and the saint). The second floor was built in 1924 and was covered with reproductions of the 19th century tiles in the 1940s (6).

The Museum of Sacred Art (Number 21 in Table 2) was one of the first buildings with a tiled façade to undergo an ACRA conservation and restoration intervention, although its utilitarian function of providing services and its architectural and structural features are similar to those of the other buildings in the city, so it serves as a model.

The objectives of the intervention (Table 3), which started nearly eleven years ago, were to conserve and repair the tiles and the bonding mortars. The intervention started with the production of a photographic record and then a graphic record to indicate the order and position of the tiles on an elevation of the façade and the individually labelled elements, in order to identify their location and later enable them to be placed in their original position. The next phase was *facing*, which consists of applying gauze over the tiles in order to protect the glazing on the tiles from the vibrations they were subjected to during their removal. Their removal, which was performed manually, was necessary, owing to the degradation of the mortars as a result of loss of cohesion, once this degradation had compromised the stability of the tiling with the consequent risk of pieces falling on people and property, and to prevent possible theft (Fig. 3). The next phase was the removal of the mortars on the back of the tiles. This was done mechanically, with the intention of preparing the elements so they could be replaced on the wall. Maintaining the old mortars, with their altered properties, would make attachment difficult and prevent good adhesion. The backs of the tiles were also washed for this reason. The cleaning of the tiles, in particular of the glaze, eliminated dirt and had two purposes – to avoid the advance of the existing changes and to return their lost aesthetic value, caused, for example, by changes in colour and loss of gloss. The salinity test served to determine whether the presence of soluble salts was high and posed a risk to the tiles. As the result was negative, desalinization was not performed. The microbicide was applied with a paintbrush with the intention of eradicating microorganisms, which are deposited on the glaze-biscuit interface, this being one of the primary causes of glaze defects and, at a more advanced phase, of the deterioration of the biscuit. The consolidation of the ceramic body and the glaze served to reinforce the binding of the two materials. Some tiles tended to fragment and on some the glazing had come off so an acrylic resin was used to fill in the gaps. The collage of fragments restored structural and surface unity to the tiles, as did the volumetric reintegration which was performed immediately afterwards. After lev-

elling the shapes, chromatic reintegration was undertaken to restore colour (base colour) and the motifs were painted on in order to recover the original appearance of the tiling system as a whole. When these tasks were completed, a protective layer was applied to safeguard the restored façade from atmospheric agents. Reproductions were prepared to replace original tiles that were highly degraded and did not fulfil the requirements of wall impermeabilization. The intervention ended with the application of the original tiles and reproductions to the façade.

This intervention, which is currently in a good state (Fig. 4), was thorough and involved the removal of almost all the tiles, the reintegration of a large number of tiles and the production of 53 copies. However, some of the defects which were addressed during the intervention re-emerged, as happened in the case of superficial deposits, which are, in fact, inevitable and require more regular cleaning. Tile detachment also reoccurred so, once again, work will be carried out on the building to treat this pathology. Nevertheless, the reappearance of this disease is probably related to an incompatibility between the base and fixing mortars. This means we need to concentrate on these issues (which have occurred, even in the Azulejar project conducted by the University of Aveiro) by carrying out more research studies. In-depth research on 19th century tiles also needs to continue, although there are studies on the subject (7), as well as on conservation and restoration materials, given that studies dedicated to these issues envisage their use in controlled environments, which is not the case when we are dealing with a tiled façade exposed to weather conditions and an urban environment.

The need for a new intervention will address specific deficiencies and not such deep-seated requirements as the first intervention. On the other hand, despite the need for intervention, this cladding system has shown itself to be quite durable in comparison with others.

This intervention was costly in terms of human and financial resources and the amount of time it required, but it highlights the efficacy of conservation and restoration interventions. This efficiency will increase with each intervention, as a result of research on restoration materials, as we state above, since they will be more compatible with their original versions and resistant to the environment to which they are exposed.

This demonstrates that, in the long term, this type of intervention and methodology is sustainable, durable and favourable, both in terms of assets, and of materials and funding.

Fig. 3 – Removal of detached tiles during the intervention.

Fig. 4 – Current appearance of the façade.

Phase	Instruments/ Materials
Order record	Labels
Facing	Gauze
	Acrylic resins dissolved in organic solvents
Tile removal	Chisel
Cleaning the mortar on tile backs	Spatula and scalpel
Washing the tile backs	Running water + neutral detergent
Tile cleaning	Scalpel
	Organic solvents
Salinity test	Running water (151 µS)
Microbicide application	microbicide dissolved in water
Consolidation of the biscuit and the glaze	Acrylic resins dissolved in organic solvents
Collage of fragments	Acrylic resins dissolved in organic solvents
Volumetric reintegration	Epoxy resin + stone dust + barium sulphate + titanium oxide
Levelling of volumes	Sandpaper
Chromatic reintegration	Inorganic pigments in acrylic varnish
Application of protective layer	Acrylic varnish dissolved in aromatic organic solvents
Manufacture of reproductions	Industrial biscuits, glaze and ceramic pigments
Re-application of tiles	Lime mortar and river sand

Table 3 – Intervention performed on the building in 2001.

7. THE CONTRIBUTIONS OF A SUSTAINABLE AND DURABLE METHODOLOGY

19th century tiled façades offer cities heritage, social and historical values. They are associated with one of the great Portuguese migratory movements, which is, in turn, related to one of the great moments in the history of mankind – the abolition of slavery in Brazil. Their conservation, in particular through tiled façade preservation and restoration, is implicit to urban regeneration or recovery, but it can fulfil functions that go beyond this. The option of saving just the material and artistic memory that tiles embody, by replacing them with another type of covering, would have meant their conversion into museum exhibits after removing the objects from their context, at a cost which, in the long term, would have been higher.

A conservation and restoration intervention should meet a number of requirements. From the point of view of heritage, durability is essential to avoid successive interventions which impose stress on the materials. From the point of view of financial viability, a very long-lasting and sustainable intervention is essential, in order to create a balance which will enable façades to be recovered while bringing additional benefits.

On the one hand, the preservation of the historical quarter can make it a tourist attraction for the city. On the other, it can contribute to the recovery, in the ceramics industry, of visual solutions for antiques, as has already happened in certain companies, as well as for tiles themselves, which are a good cladding option that is effective, lasting and aesthetically pleasing. In addition, given the numbers of tiles in the city and the country as a whole, the production of replicas of historical tiles as a result of conservation and restoration interventions, even though it affects the recovery of empty buildings, cannot be merely sustainable. It must also be profitable.

8. CONCLUSION

History, restoration and ceramics join forces to ensure that interventions can be performed using a methodology designed to produce artefacts that are sustainable and long-lasting, which is as necessary to reap the benefits of these materials as it was before the current economic situation. If history justifies interventions, restoration is the option for preserving history and industry is the indispensable tool for restoration. Industry must use and serve history at the same time. Industry supports restoration in its creation of reproductions (which can at times be too big for a small shop), but it must recover the patterns, colours and decorative techniques of the past and at the same time contribute to a knowledge of them which is not lost so that they form part of the history of the present and the future.

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