

The decay of portuguese facade azulejos: a comparaiso between south Brazil and Lisbon

Renata Barbosa Ferrari Curval¹, Grace Tibério Cardoso², Alcindo Neckel³,
Caliane Christie Oliveira de Almeida Silva⁴

^{1,2,3,4.} (Stricto Sensu Post-Graduation Program in Architecture and Urbanism, Architecture and Urbanism - PPGARQ-IMED, NEPMOUR, Meridional Faculty, IMED, RS, Brazil.)

ABSTRACT

The wealth of tiles in Portugal is made of more than the early patterned and the blue on white pictorial panels that cover the interior walls of churches, monasteries and palaces throughout the country and its former possessions. In the first half of the 19th century azulejo workshops found a new market in the owners of recent urban constructions, producing facade tiles widely used subsequently not only in many Portuguese towns but also in Brazil, to where they were exported in large numbers. The new urban look was not unanimously liked at its heyday but as time goes by, the old streets with shiny and often lively coloured facade walls are slowly gaining their place in the lists of municipal heritage worth preserving. However, many of those facades are showing clear signs of degradation. Whenever tiles are falling off from the facade, the overall state of disrepair can be noticed from a distance and totally detracts the aesthetic value of the site. These cases are evident. In many other instances, however, decay is only apparent on closer inspection and these are the cases that will be addressed by this communication. We present a comparative study of the most frequent types of physical decay found in 19th century facade walls in towns of the Rio Grande in southern Brazil and the district of Lisbon, in Portugal, taking in consideration the similar weather conditions in both regions.

Keywords: Azulejos, glazed tiles, facades, decay, Brazil, Lisbon.

I. INTRODUCTION

The aim of this paper is to make a comparison between the main kinds of physical degradation present on tiles of the Portuguese facades in some cities in the south of Brazil, such as RG, POA and Jaguarão, both in the state of RS, and in Lisbon, Portugal, because all these cities have file collections of the same period and were included in similar weather conditions and different from other Brazilian climate zones.

The tiles started to be applied in urban facades, in Portugal, in expansion zones, at the Portuguese liberalism period and had the bourgeoisie owners as prevailing its usage, once the lower class couldn't afford tiles and the rich ones didn't like them, because painting a house was regularly a sign of social abundance [1].

Porto and Lisbon were pioneer cities in the process of using tiles, but it was Lisbon that adopted particularly tiles of facades in the 1850's and started to decay its usage in the 20th century with the plan Ressano Garcia [2].

At the same time of its internal usage, Portugal exported tiles of facades to several countries, among them Brazil, that received pieces traveled in the basement of cargo ships. For its strategic localization, some cities, especially the coastal ones,

received great quantities of facade tiles in a variety of patterns from Porto and Lisbon. According to a research carried out by the author, at the National Library of Lisbon in 2012, in the period between 1830 and 1860, in the newspapers of Porto and Lisbon, Belém and São Luiz do Maranhão, both in the north region of Brazil, were the cities that received more facade tile loads [3].

Some cities in RS, for being coastal regions or near to these coastal regions, also used Portuguese tiles, and nowadays it is still possible to visualize some of them from the 19th century.

The geographical position of RS, in the southern limit of Brazil, associated to a more recent period of foundation than the other Brazilian Federal units, are certainly factors that contribute to hold a lower number of copies than other Brazilian regions.

The tiles of facades in the cities found in a number of Brazilian regions showed marks of degradation, since weather or human action had their influences. Likewise, the situation in Portugal it is not different: The tile heritage is degraded and partially abandoned and, incorporated to the routine of big cities, or in the quiet smaller cities, the tiles of facades are mixed up with further constructions and are, this way, unnoticed by the eyes of the residents. Thus, faced to this situation, there is a need of action to minimize the degradation of these pieces in order to preserve them for future generations. The present

comparative study between the kinds of the found physical degradation on tiles of the Portuguese facades in the city of Lisbon, Portugal and in Rio Grande, Porto Alegre and Jaguarão, all south cities in RS, intend to be a contribution to this goal.

II. METHODOLOGICAL PROCEDURES

Southern Brazilian cities and Lisbon, in Portugal, are the aim of this study in function of some determined factors, such as, the fact that Brazil was found by the Portuguese and inherited a significant part of its culture, this way, embodied in the tile heritage, and also by the fact that Brazilian the facade of tile collection was, in part very meaningful, imported from Portugal (Lisbon and Porto), including to RS, since the period that Brazil belonged to Portugal and taking in consideration the similar weather conditions that all the studied cities are placed: all of them have the four well defined seasons of the year, winters with lower temperatures reaching 0°C and summers with higher temperatures reaching around 40°C. Such data were obtained along with IM/MCTES from Pordada in Portugal and the Meteorology Institute of Pelotas University, in Brazil.

After choosing the cities, the local selection was performed in the presence of tiles from a period in facades, so that a visual survey could be accomplished, filling an analyzing form. The examined type of tiles were up to the present only identified in facades in the cities Porto Alegre, Jaguarão and Rio Grande.

Yet, in Lisbon there is are significant examples of tile collections in diverse facades, the sites of São Mamede Mercês, Santa Catarina, Bairro Alto, Santos O Velho, Lapa, São Vicente de Fora, Graça, Santa Justa and Santa Engrácia were chosen to be the aim of this study.

The selected places in Brazil and in Portugal were all visited in person for further examination; visual surveys were documented in analyzing forms.

Such action allowed a visualization of the real degradation of the facades of tiles in these sites. All the facades of tiles from the period were analyzed in Porto Alegre, Jaguarão and Rio Grande.

It is interesting to highlight the presence in significant quantity of tiles in salient patterns (picture "A") and tiles of cat's beard pattern (picture "B") coming from Porto and surrounding, according to the author (Figure 1).

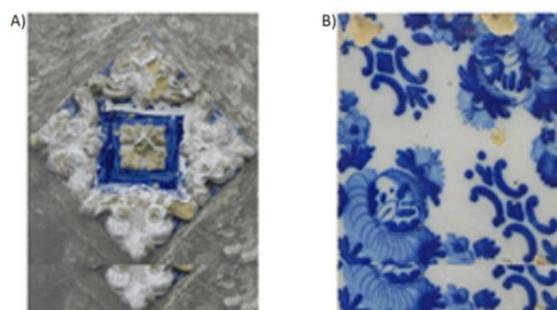


Figure 1: Picture "A" and "B": salient pattern and cat's beard pattern, respectively.

Yet in Lisbon, tiles of the same patterns and distinguished patterns were explored to proceed the analyzing and, at the same time, rare cases with no parallels. All types of physical degradation found was analyzed, the process was held in different stages, taking place in Brazil and Portugal.

The stone powder (pó-de-pedra) tiles were only analyzed in Lisbon, since that type of tiles does not exist in Brazil.

III. RESULTS AND DISCUSSION

The degradation of tile can occur for physical, chemical or biological process. This paper shows a macroscopic physical degradation of some tiles subjected to weather condition in some cities in the south of Brazil and Lisbon.

The physical degradation of tiles is a result of simultaneous competition of an external aggression and of a tile fragility due to its manufacturing. Therefore, a degradation of a tile does not happen in a time compatible with what we can observe. (Used tiles of facades for up to 150 years) just for the environment effect or for fragility due to manufacturing (defect or other), but by the association of both aggression factors: aggression (environment) and fragility (of the piece) [4].

The environment, where the tile of facades is, presents diverse aspects: aggression, that include, among others, the presence of water and humidity of the tiles from its support. This way, it is essential a parallel study between degradation of the piece and the making where the piece is, in order to perform a mapping of the humid areas, either by rising humidity or by humidity derived from water pipes, eaves, windows, balconies or doors of these supports.

The fragility of these tiles is reflected according to the same author, in general, in an inadequate adherence from the glazed to the cooked clay. This can happen by several manufacturing compositions of the raw material used in the manufacturing and in the manufacturing techniques themselves, e.g., the cooking temperature or the cooling process. A further impact is caused by a secondary process, such as, the expansion of cooked

clay, dissolution, which action is made possible by an intrinsic fragility to the affected tiles and the effect is always the impairment of the linking between the glazed and the cooked clay.

This way, it's still according to what the author has experienced, to add influences of the corresponding fragility, eventually, an inadequate adherence of the glazed, due to a group of origin situation and diverse nature, resulting in a physical degradation that will end up in the falling of the glazed.

Aiming to demonstrate the several types of the physical degradation that happened to the tiles of facades in the quoted cities, we present, as following, a comparison between the different levels of degradation of the tiles of facades, in different places of the quoted cities (Figures 2 and 3).



Figure 2: Different levels of degradation of tiles of facades with falling of glazed in Lisbon.



Figure 3 : Different levels of degradation of tiles of facades with falling of glazed in Brazil.

A tile by its nature is impermeable to water. A facade needs to emit humidity. Hence applying tiles to humidified facades (supports) is not appropriate.

Thus, the water that stays in the support humidifies the tile cooked clay forcing expansions and chemical alterations that, when associated to specific fragility of the piece, they cause the tile degradation.

It is important to highlight that to make the degradation occur, it is necessary that these tiles be exposed to such conditions for long periods or suffer frequent cycles of soaking followed by dryings.

The adhesion of the tiles to the supports is also relevant, because the expansions of the ceramic bodies forced by the soaking lead to the detachment of the tiles even when not forced evident physical degradation.

Although the humidity be a predominant factor in the degradation, it is important to detach that the humidification of the supports do not ever cause a severe degradation.

Along several analyzed locals, there are buildings where the humidity is abundant and there is increasing vegetation on the facade, where we can sharply notice the humid zones, but yet without detachment generalized by the pieces. This is assigned, probably to the fact [4], of the quality of the bonding mortar in presence of water, to the limited expansion of cooked clay and, especially, to the laying technique, that respects joints between the tiles, allowing the expansion without mutual contact. In the most analyzed cases, when displacement occurs, the tile does not have any physical degradation, which confirms the fact described above. It was noticed that from 90% of the analyzed facades in Brazil to this study, the tiles of facades are highlighted from the support and most times being the same one reconstituted for pieces completely different from the current ones.

Types of physical degradation of Brazilian and Portuguese tiles:

According to a survey in the analyzed cities, it is possible to notice the presence of the following types of physical degradation:

a) The glaze cracking. Caused by the inconsistency of expansibility between baked clay and glazed, known as crackle. Crackle that is found in facade tiles does not occur at the manufacturing moment, but when it is associated to another phenomenon due to the support humidity, the expansion only of the baked clay and not in the glazed in the presence of water.

Most semi-industrial tiles analyzed in Lisbon present crackle, as main or secondary degradation. Crackle can affect all the tile surfaces or just some areas. Crackle is often impossible to be noticed at a first sight, even because of the fact that it is fixed to the wall, make it difficult to the observer see depending on the angle it is located.

In fact, crackle is only easy to see when the cracking is wide enough to allow the entrance of dirtiness, being defined by a dark color. This way, it is often thought that the tile is not cracked, as in the visualized facades in the Brazilian cities. The fact is that when they are analyzed with a magnifying glass or out of the wall (in highlighted tiles), the presence of the crackle is sometimes visible.

Thus, it is impossible to say that the presence of the visible crackle in tiles of facades does not occur very often in Porto Alegre, Jaguarão and Rio Grande cities, differently from Lisbon (Figure 4).



Figure 4: Crackle tiles from Lisbon and Rio Grande, respectively.

Most of the cases analyzed in Brazil present crackle almost unnoticed by the human eye. In some cases it is noticed the gentle presence of crackle in tiles next to more humid zones but it was observed its presence in all analyzed facades, even though it was necessary a magnifying glass to diagnose some of them.

The established relation between these two countries is that in all analyzed cities crackle occurs because there is often harder gravity in areas next to the ground, where rising humidity is greater or, then, under windows. Both cases occurred in every of the analyzed facades.

This happens because a piece of tile can absorb more or less water than another one. The pieces exposed to zones with more humidity will easily absorb more water than those far from these zones, so it will probably present a sharper crackle. In Brazil, crackle is almost unnoticed to the human eye because the supports are drier than the Portuguese ones, not for the exposition to the climate factors (both suffer the same conditions) but because the water turbulences inside buildings in Brazil are present in a satisfied stage, different from many cases studied in Portugal and also by the fact that the Brazilian walls are much drier inside (they absorb less external humidity).

Therefore, it was found that the rising crackle on exposed tiles the rising humidity followed by the humidity for water ducts and below slots is the most common kind of degradation in Lisbon and the crackle in initial phases (almost unnoticed to the naked eye) it is the most common kind of degradation on facades in the south of Brazil, presenting in greater or smaller intensity, depending on the site.

b) Falling of the glazer: This kind of degradation causes an irrecoverable loss on the tile decoration. They are recurrent from the adherence between the baked clay and the glazer that cannot resist to an environment aggression; in the studied cases, the humidity.

The falling of the glazer first leaves the flat cooked clay surface in the course of time and with no protection maybe being consumed, especially

because of the crystallization in its soluble salts inner side.

Through a survey in Portugal and Brazil the loss of glazer occurs in tiles of facades in five distinct types. The falling from the slots is the second major degradation in the analyzed tiles in Lisbon, expressed by a detachment with slots enlarging aspects that progress to the inner side until losing almost all glazer; and in the southern Brazil, it presents itself as the most common apparent degradation.

Another kind of falling by glazer is the falling by mosaic: the third most frequent kind of degradation in Lisbon and the fourth kind in the Brazilian cities. Caused by weak adherence between the baked clay and the glazer that leads to a cracking Type [4] in the presence of humidity. The glazer separated from baked clay in small pieces presented in the crackle form. In Rio Grande city only a facade of a building presents a high degree of mosaic falling, located in an unfavorable solar position (little sun incidence), what can have favored the increasing humidity and consequent cracking, leading the occurrence of the fall by mosaic.

Yet in relation to the glazer peeling, there is another rare degradation in the Lisbon: the falling from convexities [4], that occurs, usually, in salient tiles, which is very rare in the Portuguese capital. Present degradation in all analyzed cities, in Rio Grande, being then, the third kind of the most common degradation in the analyzed pieces in Brazil. It was found that the salient tiles present in Rio Grande, and Jaguarão present this pathology. It is important to highlight that the salient tiles pattern, have already been replaced in its original support, present in some recent constructions.

c) Baked clay disintegration is another type of degradation present in some tiles. Mimoso observes that the disintegration occurs in Lisbon when the tiles have lost the glazer and were subjected to continued conditions of environmental aggression (humidity), especially if they were along with the presence of soluble salts. It is evident that the degradation for the baked clay destruction can occur in long term in the presence of water (humidity), but it is faster in the presence of salt [4].

The baked clay degradation occurs both in the tiles from Lisbon as well as in Rio Grande in a lower frequency than the other degradations, being evident in the most humid zones. According to the oral report of the “Sobrado de Azulejos” (The Tile Building) (the only construction in RS state) that has all tiles of facades before through the process of restoration in the 90’s, most external facade tiles present baked clay degradation.

IV. CONCLUSION

During the present work there were 53 cases analyzed for purposes of conclusion in Lisbon, 3 cases in Porto Alegre, 1 case in Jaguarão and 4 cases in Rio Grande.

Meteorological data surveyed, already cited before, shows that tiles of facades in Lisbon, as well as in the other analyzed cities, were submitted to a moderate heat in the summer months (more intense in the facades radiated by the sun) and to a cold, also moderate (temperatures seldom negative that do not cause water freezing) in the winter months and, at the same time, suffer the action of continuous rainfall along the years. These data suggest that the presence of humidity and the relation between the expansion of baked clay and the glazer with a difference of an environment temperature are factors that determine several types of physical degradation in the found tile facades, being, on the other hand, to the freeze-thaw phenomena.

With all the cautions that advise the representative of the small sample constituted by the Brazilian cases, what is visually found, is that the Brazilian tiles present better condition of conservation than the Lisbon tiles.

It is possible to formulate the hypothesis that although a similar rainfall, the wetting of the supports in Brazil is less significant, probably because the drying occurs faster after each rainfall episode. It is not possible to say that this happens by the fact of a less amount of rainwater at each time and the drying occurs in a faster way. It is believed that this happens according to the Brazilian construction wall are not as thick as the ground level, according to a smaller ground thickness, facilitating the drying.

Overall, it is observed that the analyzed facades in Lisbon present a long durability when not exposed to humidity. They present sharp degradation in some analyzed constructions, but in general, the degraded tiles still present reasonable conditions, being apt to a restoration process, with no substitution of pieces.

In the analyzed Brazilian cities, most facades are well preserved. Few constructions present sharp degradation, however the degraded tiles in these facade were unable to be restored, so degraded they were.

All found degradation are due to processes of baked clay humidification, either because they are rising humid or because of humidity coming from damaged pipes in the walls or even of the exposed pipes that were broken or yet because water of coming from the roofs or slots. Thus is possible to map the humid zones of each facade through coating tile degradation, and that the frequent and steady humidity combined to some possible manufacturing defect of a piece or only a tile feature less favorable

to resist to humid environment being the great responsible for almost all found pathologies.

Based on the results of the studies, it is possible to say that the tiles of facades conservation in Portugal and Brazil require the existence of dry supports being necessary during intervention and restoration process, the immediate identification of humid spots in the facade in order to proceed its elimination or control. Only this action can prevent the process of degradation and assure the durability of interventions.

The damaged glazers have not been considered restorable in an economically viable and lasting manner and in Portugal the replacement of pieces by similar ones is a habit, with an apparent intervention through the different aspects given by materials and current technology. In Brazil, the interventions of restorations are used to follow the same ways adopted by the Portuguese.

It should be stressed that the study approaches, a comparison between the facades in the southern Brazil to those in Lisbon, do not necessarily apply to other Brazilian regions [5,6,7,8]. Brazil is a country mostly tropical and, therefore, a major part of its regions (north, northeast, southeast and Midwest) shows different climatical conditions from Rio Grande of Sul, presenting different types and degrees of degradations from those analyzed in RS [7]. Such types of degradation in the tropical regions in Brazil are the aim of a posterior study by the author.

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REFERENCES

- [1] A. M. P. Domingues, *The ceramic ornamentation in the architecture of romanticism in Portugal*, PhD thesis in History of Art, Faculty of Arts, University of Porto. Portugal, 2009.
- [2] A. P. Assunção, *Sacavém Tableware: Contributions to the study of the ceramic industry in Portugal: 1856 a 1974*, Inapa, 1997.
- [3] M. Barata, *Tiles in Brazil, centuries, XVII, XVIII, XIX. Rio de Janeiro*, Thesis presented to the School of Fine Arts of Rio de Janeiro, 1955, 226pp.
- [4] J. M. Mimoso, and S. Pereira, A research on manufacturing defects and decay by glaze loss in historical Portuguese azulejos, *Relatório 24/2011*, Laboratório Nacional de Engenharia Civil, Lisboa, 2011.

- [5] Brazilian Technical Standards Association, NBR 15220-3, *Thermal Performance of Buildings: Part 3*, Brazilian bioclimatic zoning and construction guidelines for single-family social housing, Rio de Janeiro, 2005, 1-66.
- [6] S. E. Haupt, J. Copeland, W. Y. Y. Cheng, Y. Zhang, C. Ammann, and P. Sullivan, A Method to Assess the Wind and Solar Resource and to Quantify Interannual Variability over the United States under Current and Projected Future Climate, *Journal of Applied Meteorology and Climatology*, 55(2), 2016, 345-363.
- [7] G. T. Cardoso, and F. Vecchia, Comparison of thermal performance between test cells with different coverage systems for experimental typical day of heat in Brazilian Southeastern, *Frontiers of Architectural Research* 3(1), 2014, 271-282.
- [8] X. Zhang, Z. Xiong, X. Zhang, Y. Shi, J. Liu, Q. Shao, and X. Yan, Using multi-model ensembles to improve the simulated effects of land use/cover change on temperature: a case study over northeast China, *Clim Dyn*, 46(3), 2015, 765-778.