

Characterization of damage to Brazilian built Heritage: case study in the old electoral justice building, in Teixeira, Paraíba

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Abstract: This work presents a case study in the Electoral Justice building of Teixeira-PB, located in the countryside of the *Sertão Paraibano* and in the immediate geographic region of Patos - PB, specifically in the municipality of Teixeira. The objective was to analyze the situational state of the facades of the electoral justice building in Teixeira - PB, aiming at future intervention works in the building. This is an exploratory and explanatory research, with a quali-quantitative approach. The methodology of the article comprised a bibliographical study, for possible analyzes between studies already carried out on facades of historic buildings and the object of study of this research: the former building of the Electoral Justice of Teixeira - PB. Through analysis of photographic records, damage identification sheets (FID) and a damage map were prepared, covering all the facades of the building. Finally, the application of the GUT Matrix methodology (Gravity, Urgency and Tendency) was carried out to categorize the most aggravating pathological manifestations in the building, aiming to contribute to the understanding of the situation of the building, in order to contribute to eventual restoration services in the building. In view of the analyses, a large index of anthropic mechanisms was noticed, that is, the damages found could be solved and/or prevented by carrying out preventive or corrective maintenance, planned and executed by a technical staff specialized in restoring historic buildings. Therefore, this research starts from the need and importance of conserving historical assets of an urban reality as a way of preserving and valuing the memory of the people and proposes to investigate and document the result of interventions carried out in the building, its constructive system, the damages found on the facades and the situation in relation to the degradation of the building.

Keywords: Historical heritage. Conservation. Damage map. GUT Matrix Methodology.

1. Introduction

The built historical heritage, through memories and meanings, linked to its construction, ensures the cultural legacy of a society, transmitting its history through Daudén time (2022). Also, according to these authors, the term refers to built assets, isolated buildings or a group of buildings, which may be of different types, with striking cultural characteristics. According to Lima et al. (2022), the built heritage provides the collective contact of the common inhabitants of cities with empirical references of social memory, therefore, it is extremely important that the legacy of an entire generation is preserved, ensuring that its historical, architectural and cultural riches do not disappear.

Under this bias, heritage preservation is internationally consolidated. However, in recent literature regarding the study of pathological manifestations in historical buildings (Barros et al., 2021; Costa et al., 2022; Gomide, 2018; Lemos et al., 2022; Lima, 2019; Moura Júnior et al., 2022; Rodrigues et al., 2021; Souza, 2020; Stolz et

al., 2020), it can be seen that although the analyzed monuments have great historical value, their preservation is not safeguarded, since the debates as for policies for the protection of Brazilian built heritage are still incipient.

According to Tavares (2011), the built historical heritage is subject to degradation due to several factors that can compromise the integrity and functionality of the building and even a future loss to local history, considering that the presence of pathological manifestations in buildings can affect all parts of the construction, whether in the structural, architectural or facilities part. Thus, according to the manuals of IPHAN - Institute of National Historic and Artistic Heritage (2000) the restoration project comprises two complementary stages. The first stage is characterized by the conceptual nature of the intervention and the second corresponds to the technical nature, where all proposed solutions are presented and detailed. However, it is noticed that the restoration design process is often misunderstood, making up only the basic design phase as understood in the IPHAN manual. Therefore, the inapplicability of the executive restoration project, being a development of the basic project, already duly approved by IPHAN, can cause damage either by the collapse of the structure, damage to the aesthetics and loss of functionality of materials, which can cause embarrassment and psychological concern on people who attend the building (Brito et al., 2021).

Actions for the preservation of built historical heritage urgently need to be reviewed and put into practice, in an attempt to guarantee the cultural appropriation and identification of the population with the buildings. Therefore, the recovery of its useful life performance involves a diagnosis of anomalies based on critical and investigative analyzes about the origin of the identified problems and their respective causative agents. Still according to Brito et al. (2021), in addition to the visual diagnosis of pathological manifestations, it is essential to detail the causes, origins, mechanisms, responsible agents, as well as treatment suggestions for these anomalies. It is in this context that the importance of the role of the elaboration of the FID and the damage map is inserted, responsible for the graphic-photographic representation of the buildings, as well as the detailing of the materials that make up the building, the characteristics of the damages and possible treatments.

For the elaboration of these documents, due to the lack of attention to old buildings, such as the case of the electoral justice building in the municipality of Teixeira, Paraíba, and based on the focus on the preservation of the architectural heritage, FIDs were prepared, which proved to be essential for the production of the damage map of the facades of the electoral justice building. Thus, the study aimed to identify, characterize and propose improvements to the pathological manifestations found, using diagnostic engineering techniques and problem solving from the Gravity, Urgency and Tendency Matrix (GUT). Such research is of paramount importance, as there is a need to preserve one of the buildings that make up the built heritage of the municipality, which is in a state of abandonment, when compared to modern construction standards.

2. Diagnostic Engineering as a tool to combat the emergence of pathological manifestations

According to Silva et al. (2020), planning is the basis for the construction of a building. For the author, when this process is carried out effectively, from conception to completion of construction, what is intended is the extension of the act of using this space. In this sense, one of the great challenges of engineering and, consequently, for civil engineers, is the effectiveness of buildings, with regard to safety conducted on site, as well as the use of appropriate materials for each moment of construction, so that this environment meets the conditions for the useful life of the building (Olimpio & Jesus, 2019).

In order for this maxim to be fulfilled, more effective follow-up is needed with regard to the constructive process of constructions. Bearing in mind that several simple buildings, after completion and in a short time of use, already show signs of pathological manifestations, misuse and constructive failures, emphasized through related problems from infiltrations to problems related to the design of constructions. Thus, preventing the proper functioning, safety and comfort of users (Lima, 2019).

However, what has been observed over the years is the lack of maintenance in buildings in the national context. Because even when the possible loss of the building due to deterioration is evident, carrying out inspections and maintenance by suitable professionals is extremely low. Moreover, when these factors are analyzed specifically in buildings with historical value for the Brazilian community, the situation is even more

worrying, due to several issues, such as the lack of financial resources or even planning policies for the building with regard to the heritage preservation (Faria et al., 2008).

For Veras (2018), Civil Construction is characterized as one of the most emphatic areas of civil engineering today. In fact, with the advancement of Civil Construction, studies with the purpose of significantly aiming at extending the durability of constructions have increased. In view of the indispensability of providing security and comfort to the community, as well as issues related to the economic and political growth of countries, more and more subareas of Civil Engineering are emerging in order to fully provide the effectiveness of constructions, as in the case of Diagnostic Engineering.

Having the engineer Tito Lívio Ferreira Gomide as its creator, Diagnostic Engineering aims to guide the services provided to the construction sector, in order to reduce constructive anomalies and the costs of requested technical assistance (Teixeira & Silva, 2019). According to Gomide (2018, p. 1), diagnostic engineering is "the art of creating proactive actions, through diagnoses, prognoses and technical prescriptions aimed at total quality".

In this sense, Diagnostic Engineering presents itself as the purpose of safeguarding buildings through specialized professionals in the area, in which it is possible to determine the performance levels of constructions, as well as diagnose the pathologies evidenced, investigating expertly the possible complications in the structure of the building. and presenting the effective solutions for the pathological manifestations presented there. Thus, it is convenient to understand what pathological manifestations are and how they are characterized in the patrimonial context.

2.1 The study of the Pathology of Constructions

In medical sciences the word pathology is used to refer to the study of diseases with structural and functional alterations in the cells and tissues of human beings. Of Greek origin, it is formed from the junction of two other Greek terms, "*pathos*" (disease) and "*logy*" (study) (Pereira et al., 2018). Despite often being used in medicine, several other areas use the semantics of the word to refer to other types of diseases, as in the case of Diagnostic Engineering.

The study of pathologies in buildings is fundamental for the longevity of a building. Considered the expertise of civil engineering (Gomide, 2018), its study is based on medicine - referring to the study of human pathologies, with the aim that diseases can be properly diagnosed, accompanied by a qualified professional and/or solved. Concomitant with the study of pathologies in medicine, the study in diagnostic engineering allows the understanding of the causes that affected the anomalies or failures in the building. In Civil Construction, these pathologies can be consequences of inadequate execution, design errors, low quality material, lack or scarcity of building maintenance, these problems that can be generated by the negligence of the person responsible for conducting the work or manager (Freitas & Freitas, 2015).

For Olivari (2003), pathological manifestations are characterized as the unhealthy fragment of a building, which is made possible through the failures that occurred in the construction of the building, as well as throughout its useful life. According to the author, it is an area that seeks knowledge about the causes that affected these pathological failures in the construction, as well as the necessary corrections in order to alleviate or remedy the damage to the building itself.

In this context, the Pathology of Constructions is the science that attempts, in a methodological way, to investigate the defects affected during the execution of the construction, as well as after the completion of the work, with expert monitoring. It studies defects in materials, elementary components of the building, such as building installations in general, in terms of diagnosis and prognosis, establishing investigation mechanisms, forms of manifestation, prevention measures for pathological manifestations and recovery of damages affected (Sena, 2020).

2.1.1 - Built historical heritage: pathological manifestations as impediments in the fight against cultural loss

Brazilian buildings that have cultural symbolic value are marked by several challenges regarding their proper preservation, arising from financial issues, such as the lack of building maintenance services. These issues enable the emergence of various pathological manifestations in these buildings (Cavalcanti Neto, Carneiro & Gianecchini, 2011).

To this end, Coelho, Silva and Zouain (2020) discuss this process of government neglect regarding the proper preservation of the country's built heritage and claim that both the national culture and society itself are harmed due to the consequences generated, since the conservation of the Built heritage enables future knowledge of the history of a given location, as well as cultural empowerment and strengthening of an entire society. Therefore, it is evident that measures to remedy this problem must be taken.

The appearance of constructive damage makes access to the historical and cultural assets provided by buildings unfeasible, and may even affect the structural collapse of the building. The main pathological manifestations that affect constructions are cracks, fissures, moisture stains, reinforcement corrosion, biological agents and inefficiency of drainage systems (Brito et al., 2021).

NBR-6118 (2014), regarding cracks and fissures, determines that they are pathological manifestations commonly presented in structural elements. A crack is a linear fracture partially or completely developed in the structural element. There is no logical separation between cracks and fissures, what distinguishes both is the classification of the depth and characteristics of the opening of the pathology, with the maximum characteristic opening being around 0.2 mm to 0.4 mm, according to the norm.

Bastos, Sales and Costa (2017) exemplify that the anomalies resulting from the failure or absence of waterproofing are the result of excess moisture in the building. This pathology can be found, according to the authors, in different ways, as in the case of moisture infiltration - there is the passage of moisture from the outside to the inside of the building; ascending humidity - humidity originating from the soil, usually this pathology affects the floors or walls; humidity by condensation - when air meets high humidity; work humidity - humidity present in the act of work, in mortars and concrete, for example; and, finally, accidental humidity - fluids affected by failure in the installations, these generate infiltrations.

Furthermore, it is also worth mentioning the anomalies due to failure of concreting as one of the most recurrent agents of deterioration of historic buildings, due to the external action of time. According to Hussein (2013), failure in concreting corroborates with a degraded surface with low resistance, being one of the biggest pathological problems of corrosion in reinforcement in structural elements, since the reinforcement of pillars and beams, for example, are exposed by cracks in the concrete and, consequently, external agents such as air make the structural elements unfeasible for the process of sustaining the building, generating risks for the community and for the historical-cultural context of Brazil.

2.1.2 - Techniques for identifying and documenting construction damage

Given the need to preserve the built historical heritage, several policies and techniques were developed for its integral preservation. For Pinto Filho (2021), the performance and durability of a building are verified only if the expert diagnostic tools are fully applied by qualified professionals, as verification and solutions of possible anomalies evidenced, even if the maintenance of the building is positive.

The best-known instrument for recognizing and preserving historic buildings is tipping, a heritage protection tool created by IPHAN. Listing is a process of state nature, that is, of public power, which seeks to preserve assets that have historical, cultural, architectural, environmental and symbolic social value, preventing their mischaracterization, destruction and loss (Brazil, 2020).

However, although an essential tool in combating the mischaracterization and even destruction of historic buildings, listing is considered, in most cases, as a property limitation. It is extremely important to understand that listing, as a social policy, is an instrument for the protection and promotion of the cultural heritage of cities and the dynamization of government policies (Silva; Silva, 2014). To this end, Silva and Silva (2014, p. 44) determine:

(...) it is important that we go beyond the vision of tipping as a limitation of property, through incentives such as the adoption of compensatory measures such as IPTU exemption for the good that is in good condition and with its relevant architectural and decorative characteristics respected; exemption from ISS on renovation, restructuring or conservation services of properties of historical or cultural interest or of interest for environmental preservation, provided that they are aimed at replacing them or maintaining them in their relevant original characteristics; Exemption from the Fee for Works in Private Areas recognized as of historical, cultural or ecological interest, as long as they

are aimed at replacing them or maintaining them in their relevant original characteristics. In addition to public policies, they are instruments for the individual to be interested in protection and maintenance of the listed property.

Buildings with symbolic and historical value to society need to be studied separately, as they have important architectural characteristics and styles. In fact, for the integral diagnosis through the pathological study of the building, the structural characterization is important, as well as the context in which the building is located, such as history, design and interventions. It is necessary to have the appropriate collection of tools for collecting and preserving the collected data (Santos & Santos, 2020).

Of the techniques currently used by scholars in the area, surveys using photographic records and metrics for the preparation of collections of plants and facades, with the aim of preparing damage maps, stand out. Damage maps, as important documents in the study of pathological manifestations, are graphic documents supported by information from the historic building studied, translating into representations, such as graphic symbols in the registered locations, the various categories and levels of deterioration identified (Tirello & Correa, 2012). Thus, aiming at the proper documentation and future preservation of the buildings to be investigated, in order to follow the evolution of pathological problems and be an analysis tool for the necessary interventions, evidently configuring itself as an essential diagnostic instance of historical-cultural assets.

Furthermore, still referring to the study of pathological manifestations, Tirello and Correa (2011) emphasize that the damage maps result in an illustrative document grouping a large amount of information consistent with the quality, quantity and intensity of the materials and structures investigated in these buildings. This tool uses plans and elevations in its diagnostic process, as specificities of damage and recognized alterations in the structure of the building. Likewise, they are usually illustrated with the superimposed representation of graphic elements on the pathological manifestations shown there, such as hatches, colors, symbols and subtitled numbers. This information generally illustrates the characteristics of the material, the agents and the causes of degradation.

Although an important tool, damage maps, as well as the recent study of Diagnostic Engineering, increasingly require research that contributes and strengthens their diagnostic investigation. As Santos and Santos (2020, p. 2) stated, "The absence of Brazilian regulations for drawing up damage maps is an obstacle, however, it can be overcome through technical and academic research and with the contribution that has been made by CECI (Center for Advanced Studies on Integrated Conservation)". In this sense, the damage maps and their survey techniques are characterized as important methods in the process of conservation of the built historical heritage, in the fight against cultural neglect and in the precariousness of the historical assets of the Brazilian municipalities.

3. Methodology

This study is defined as to its exploratory and explanatory objective, as to the approach it consists of a qualitative-quantitative type of research and, in view of the technical procedures, this work fits into the bibliographic and field type.

Exploratory research aims to provide greater familiarity with the research problem. Its planning tends to be very flexible, because it is interesting to consider the most varied aspects related to the phenomenon studied. Descriptive research aims to represent the characteristics of a given population, such as the ones that aim to raise opinions, attitudes and beliefs of a population (Gil, 2017).

Quantitative research involves numerical data and employs statistical techniques to classify and analyze them. As for technical procedures, this research is classified as a field survey – characterized when people are questioned directly to become better acquainted. It is a request for the personal and professional information of each member of the population about the problem being studied, and then, through quantitative analysis, the conclusions corresponding to the collected data are obtained (Gil, 2017). Therefore, the research was carried out in three stages, the figure below (Figure 1) describes the methodological stages evidenced by the study.

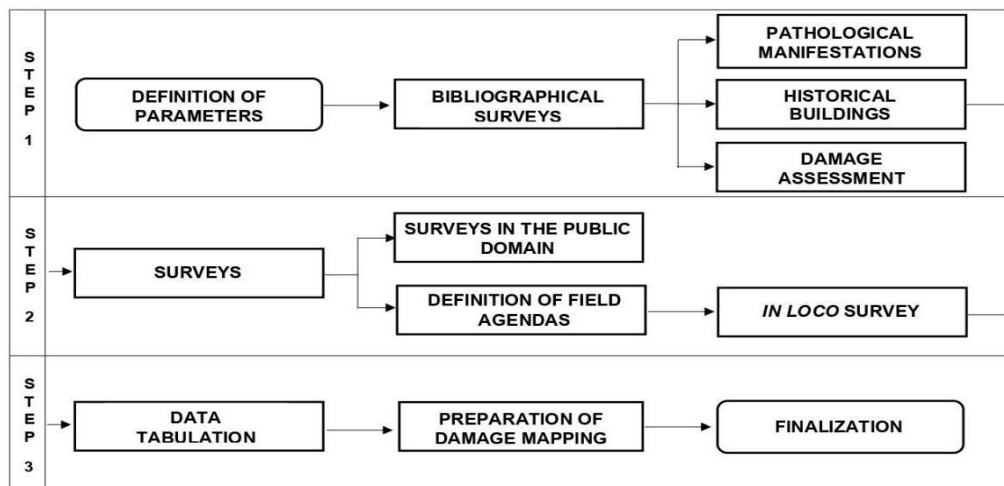


Figure 1 - Methodological stages of the study

Source: Prepared by the authors (2023)

Initially, bibliographic research was carried out in order to understand and compare the degradation process in buildings of a historical nature, facilitating the understanding, as to the origin and agents causing the most recurrent damages in the building under study: the old building of the electoral justice of the municipality of Teixeira, Paraíba. To this end, surveys were carried out in the databases of the Scientific Electronic Library Online (SciELO), Platform for the Coordination of Improvement of Higher Education Personnel and Google Scholar, using the keywords “pathological manifestations” and “damage to historic facades”.

After that, selections of eventual works that contributed to the study were carried out. This selection followed the criteria of articles published in journals, which participated in a blind peer review, the selected works should be about studies on pathological manifestations on facades of historic buildings or methods of analysis of constructive damages affected on facades of buildings of historic buildings. This stage of research and literature review took place over a period of three months (October/2022 - December/2022).

Before delving into the analysis carried out on the building, it is important to highlight the difficulties encountered in entering the building, given that the former electoral justice building was handed over to the federal government, with its relocation to a new building making access impossible, since municipal employees do not have access to the interior of the building, therefore, the analysis was carried out taking into account an external characterization contemplating all the facades of the building.

Then, in order to analyze the most recurrent damages on the facade of the building, a vast analysis of the current situation was started, from field visits, given the impossibility of examining the building completely, photographic records were made contemplating all the external part of the building, followed by the preliminary inspection for the production of the façade design of the former electoral justice building, using computer-aided design software.

Subsequently, a case study was carried out involving visual analyzes with the collected records, in order to verify the constructive system, the damages present in the facades, as well as the cause, the origin and the mechanism, this was divided into mechanical, electromagnetic, thermal, chemical and biological in order to facilitate the understanding of its appearance, this criterion of causative agents was adopted following the study by Stolz et al. (2020).

After evaluating the records, the mapping of damages was carried out, produced from the design of the building's facades. Own identifications were characterized for each pathological manifestation found, through hatches and legends, aiming at better presentation and understanding.

Subsequently, the GUT (Gravity Urgency and Tendency) methodology was applied. Based on Quality Management and related to the plan-do-check-act (PDCA) cycle, the GUT matrix aims to answer the following questions with a focus on prognosis: “What should be done first?” and, “where to start?”. Therefore, in this study, the application of the tool was developed in four stages, namely: a) listing the problems or analysis points, b) assigning values to each problem according to the parameters established in the evaluator's view,

c) classifying them as to their prioritization and d) making appropriate strategic decisions (Araújo, 2018). Thus, scores were assigned for each damage found, focusing on the severity, urgency and tendency of this manifestation in the building. Finally, it was possible to obtain a prioritization order found, giving due importance to each situation.

4. Results and discussion

After the methodological proposal, ten original articles were selected that worked on the theme of the incidence of pathological manifestations in historical buildings within the aforementioned period for the study (2019-2023). From the collected and analyzed data, a representative summary of the main results obtained by the studies and their aspects related to the influence of the appearance of pathological manifestations in historical buildings was elaborated, in such a way as to mark out the results found in this case study. To this end, Table 1 represents the studies raised by the team.

Table 1 – Identification of selected scientific works (2019-2023)

STUDY	STUDY TITLE	YEAR
Barros et al.	Recurrent pathological manifestations in modernist buildings: The case of the Luiz Nunes Pavilion in Recife/PE	2021
Costa et al.	Pathological manifestations on the facades of historic buildings: a case study of the Church of Nossa Senhora do Carmo in São Luís - MA	2022
Lemos et al.	Pathological manifestations on the facades of historic buildings - damage map: case study of the UNICAP Museum of Archaeology and Natural Sciences in Recife - PE	2022
Lima et al.	The use of Damage Mapping and Visual Inspections for diagnosis of pathological manifestations in historic building: Joaquim Nabuco Palace	2021
Lima et al.	Pathological manifestations in facades of historic buildings - damage map: case study of the Santuário Nossa Senhora de Fátima church	2022
Moura Júnior et al.	Pathological manifestations and damage map in historical heritage: a case study of the Basilica and Convent of Nossa Senhora do Carmo in Recife-PE	2022
Rodrigues et al.	Analysis of pathological manifestations on the facade of a heritage building in the city of Recife - PE: Ginásio Pernambucano	2021
Stolz et al.	Pathological manifestations in a historical building in Vale dos Sinos/RS	2020
Silva et al.	Damage characterization in historic buildings: a case study in four buildings in the midwest of RN	2020
Teixeira et al.	Elaboration of a damage map for a historic building: a case study in facades with paint coating of the Escola Politécnica da Universidade de Pernambuco	2019

Fonte: Elaborado pelos autores (2023)

After reading and analyzing the studies selected by the survey, it can be seen that the methodology widely disseminated by the works comprised: 1) historical research on the construction analyzed for knowledge, especially of the historical factors of the building, 2) on-site visit for surveys and records, 3) cataloging of damages found, 4) preparation of files and Damage Maps found in the building and 5) data analysis. This methodological bias provides for the cataloging of causative agents and evidenced constructive damage, bearing in mind the maxim that understanding the causative agents is a basic part of mitigating the eventual appearance of future pathological manifestations (Periard, 2011).

In this perspective, the study of pathological manifestations becomes vital, not only for extending the useful life of historical heritage and the evolution of engineering, but also for understanding how the action of aggressive agents works and their negative effects on the structure and, thus, enabling the correct diagnosis of maintenance or recovery (Freitas et al., 2015).

Moreover, from the data collected in the bibliographies, it was evident that anthropic action is influential in the appearance of pathological manifestations. In this study, it was based on the classification adopted by the work of Tavares (2011), which defines five classes of possible agents that cause pathological manifestations, namely: 1) mechanical agents; 2) electromagnetic agents; 3) chemical agents; 4) thermal agents; and 5) biological agents. Table 2 below determines the classifications adopted by the study.

Table 2 – Possible causes of pathological manifestations in constructions

CAUSATIVE AGENT	EXTERNAL			INSIDE	
	Nature	Atmosphere	Ground	Project	Occupation
MECHANIC	Gravity	Loads of snow, ice and rainwater	Ground pressure and water pressure	Permanent Loads and Material Employed	Overloads of use
	External Efforts	Freezing pressure of water, thermal and hygroscopic expansion	Settlements and Slipsides	Shrinkage, creep, forces and strains imposed	Handling Efforts
	Kinetic Energy	Wind, hail and external impacts	-	Water hammer	Internal impacts and abrasion
	Vibrations and noise	External noises, gusts of wind, thunder, aircraft and explosions	Earthquake, traffic and vibrations from external	Noise from buildings, building vibrations	Internal noises, vibrations internal machine
ELECTROMAGNETIC	Radiation	Solar radiation and radioactivity	-	Radioactive Lamps and Equipment	Radiant panels
	Electricity	Lighting	Current leakage	-	Current Distribution and static electricity
	Magnetism	-	-	Magnetic fields	Magnetic fields

CHEMIST	Water and solvents	Humid air and rain	Surface water and groundwater	Water splashes, condensation, detergents and alcohol	Water distribution, wastewater and infiltration
	Oxidants	Oxygen, ozone and nitrogen oxides	-	Laundry water, (healthy hypochlorite) and water oxygenated	Electrochemical Potentials Negative
	Reducers	-	Sulfides	Combustible agents and ammonia	Electrochemical potential combustible agents
	Acids	Carbonic acid, bird droppings and sulfuric acid	Uric acid and carbonic acid	Vinegar and citric acid	Sulfuric acid and carbonic acid
	Basis	-	Carbonates	Caustic Soda, Potassium Hydroxide and Monic	Sodium hydroxide, cement and lime
	Salts	Salt Mist	Nitrates, phosphates, chlorides and sulfates	Sodium chloride (salt)	Calcium chloride, sulfates and gypsum
	Neutrals	Dust and soot	Limestones/Silica	Fats, oils and paints	-
THERMAL	Temperature	Hot air, freezing and thermal shocks	Freezing and Ground Heat	Heat emitted from cigarettes and other objects combustibles	Heat, fire from overheating and electrical installations installations
BIOLOGICAL	Microorganisms plants	Bacteria	Bacteria, molds, fungi, and roots	Vegetation	-
	Animals	Insects and birds	Rodents	Domestic animals and human action	-

Source: Adapted from Tavares (2011)

The diagnosis of problems evidenced by constructive damage should not be labeled only safety issues, but the responsibility of the most varied conceptions of the project itself, execution, interventions and maintenance of these constructions. Thus, knowledge of the forms of manifestation of constructive anomalies is essential, in order to provide a clear identification of their causes, for the proposition of repair solutions with indication of appropriate interventions (Sousa, 2020).

In the bibliographical studies surveyed, it was noticed that chemical (100.00%), biological (92.8%) and mechanical (92.8%) agents were predominant in boosting the appearance of pathological manifestations in historic buildings. As for the electromagnetic causative agent, none of the historic buildings showed manifestations resulting from this agent. Therefore, the main pathological manifestations presented in the buildings in order of incidence were: 1) peeling of the pictorial layer of the coating (92.8%), 2) cracks (78.5%),

3) detachment of the ceramic coating and stains of humidity (57.1%), 4) presence of vegetation and deterioration of architectural elements (35.7%) and 5) vandalism (28.6%). The results obtained are described in the table below (Table 3).

Table 3 – Incidence of pathological manifestations in the light of the literature surveyed (2019-2023)

Analyzed Studies	Historic buildings analyzed by the surveyed literature	Quantity	Causing agents	(%)	Quantity	Constructive damage found	(%)
10	14	1	Mechanical Agent	92,8	1	Fissure	78,5
					2	Breaks	35,7
					3	Crack	14,2
					4	Ceramic Detachment	57,1
					5	Section loss	7,14
		2	Biological agent	92,8	6	Dirt	50,0
					7	Termite Attack	7,14
					8	Mold	28,5
					9	Loss of elements	14,2
					10	Vandalism	28,6
					11	Vegetation	35,7
					12	Efflorescence	21,4
					13	Fissure	78,5
					14	Breaks	35,7
					15	Crack	14,2
		3	Thermal agent	21,4	16	Fissure on the ceramic surface	7,14
					17	Deterioration of architectural elements	35,7
		4	Chemical agent	100,0	18	Grout deterioration	7,14
					19	Empowerment	21,4
					20	debarking	92,8
					21	Plastering	7,14
					22	Moisture stains	57,1
					23	Efflorescence	21,4
					24	Deterioration of architectural elements	35,7
					25	Mold	28,5

Source: Elaborated by the authors (2023)

From this perspective, the environmental conditions in which the building is located directly affect the useful life of its components. Elements such as water, humidity, temperature and even microorganisms directly or

indirectly interfere with building components, causing damage that is generally irreversible. In this way, Diagnostic Engineering promotes the mechanism and technical action of the diagnostic process of unhealthy fragments of a building, which is made possible through the failures that occurred in the construction of the building, as well as throughout its useful life (Santos et al., 2020). It is clear, then, that identifying the mechanism of action is a key part of taking measures that mitigate the influence of anthropic factors or the environment in which the buildings are inserted.

4.1 Characterization of the study area

The studied building is the Electoral Justice Registry of Teixeira-PB, one of the building components of the municipality that bring relevance and safeguard the municipal history. Named in honor of Judge Adeilson of the district of Teixeira, the former electoral justice forum of the municipality of Teixeira is located on Rua Tenente Manoel de Oliveira Lira, in the central area of the municipality of Teixeira in Paraíba. With an area of approximately 205 m², it is characterized by a predominantly postmodern architecture with traces of influence still from the modernist period, dating from the second half of the 20th century (Daudén, 2022). The figure below (Figure 2) shows the location of the building proposed by this study.



Figure 2 - Location of the Electoral Justice building in Teixeira-PB

Source: BRAZIL, 2010

The old Teixeira electoral office, before being located at Rua Tenente Manoel de Oliveira Lira, changed its location several times and also its name. The first headquarters of the municipality's electoral justice was located in the Santa Maria I neighborhood, in the central area of the municipality. After several changes, it was only at the end of the 20th century that the building was relocated to Rua Tenente Manoel de Oliveira Lira.

With years of use and without routine maintenance by the Federal Government, the building is banned/abandoned, which led to the relocation of the headquarters to several buildings in the municipality. Because the restoration of the building of the former municipal electoral justice forum would entail a high expense for the government, with priority being given to the relocation of the building. The figures below (Figure 3) show the situation of the building studied in this work.



Figure 3 - Situational status of the old Juiz Adeilson electoral forum building (Teixeira-PB) - (a) Right lateral perspective (b) Left lateral perspective (c) External perspective

Source: Prepared by the team (2023)

4.1.1 - Situational status of the old Juiz Adeilson electoral justice building

When dealing with the degradation of historic buildings, the variables that tend to accelerate this process over time correspond to the mode of use and exposure to environmental weather. Therefore, one can understand the great importance of carrying out conservation or rehabilitation actions, with prudence, this includes the proper identification of existing damage, considering the mechanisms of degradation of the object (Silva et al., 2020).

In order to define the appropriate therapies, desired corrections and elimination of mechanisms, analyzes of the study site were carried out, using data referring to the photographic survey of the facades. After surveying the building's documentary data, metric and photographic data, we set out to analyze the damage found. Maps of damage to the building's facades were prepared with the help of cataloging sheets of the damage found. The materials were elaborated following the proposed scheme for the elaboration of damage maps in the study by Brito et al. (2021), as can be seen in Figure 4. Due to the structure of the building, the facades were named according to their orientation, namely: front, rear, right and left side.

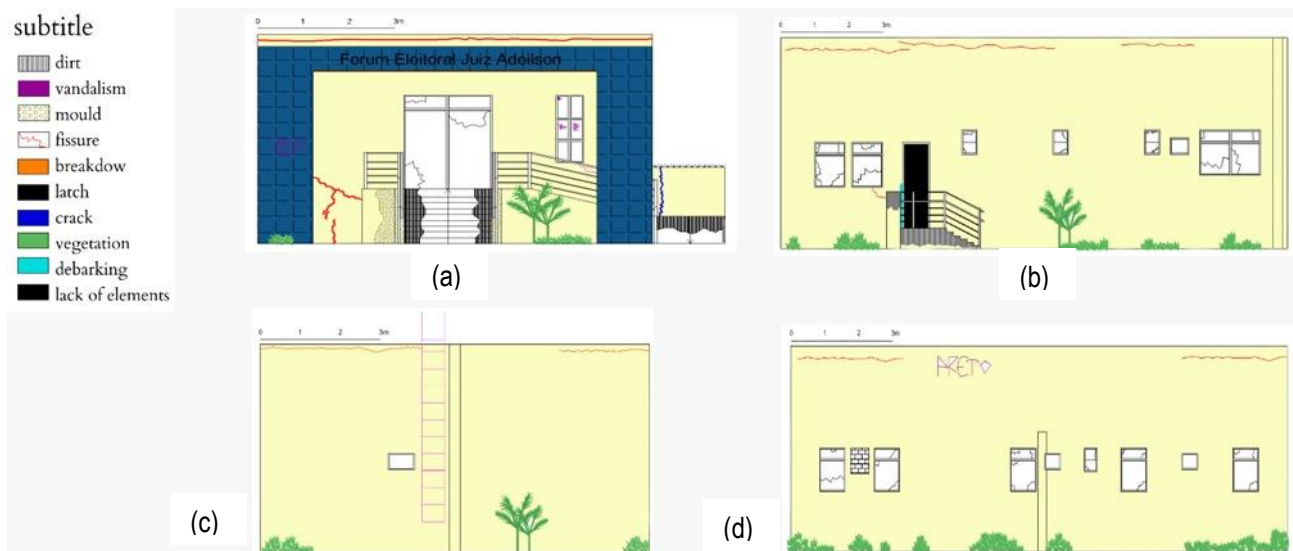


Figure 4 - Damage map of the former Teixeira electoral justice building - (a) front facade (b) right side facade (c) rear facade and (d) left side facade

Source: Prepared by the authors (2023)

The following pathological manifestations were found in the building: Absence of elements, mold, peeling of the pictorial layer, ceramic peeling, blistering, cracks, dirt, crack, crack, vandalism, vegetation and visual pollution. In general, the most recurrent pathological manifestations, according to the visual analysis, were:

dirt, vandalism and presence of vegetation, which will be presented in the figures below. By analyzing the mechanisms found, it was found that most of the manifestations are of anthropic origin (biological agent), that is, due to abandonment and/or lack of maintenance, configuring serious risks to the aesthetics of the building and even to the structure. The absence of maintenance, whether corrective or preventive, stimulates the degradation process (Souza, 1998).

On the front facade and left side, it is possible to see how the peeling of the paint film acts as a result of the presence of humidity and subsequent exposure to high temperatures. According to Sousa (2020), peeling can be classified as the separation between the paint film and the surface. For your intervention, you should scrape or brush the area in order to remove all the loose parts, clean the area, apply the preparatory base coat and apply the new paint. The visual aspects of this type of pathological manifestation can be seen in Figure 5.



Figure 5 - Visual aspects of the presence of peeling of the pictorial layer

Source: Prepared by the authors (2023)

With regard to the absence of material and visual pollution/elements not belonging to the original project, they are linked to interventions carried out inappropriately, reaffirming the disregard for the built historical heritage of Teixeira, since its origin is directly linked to the lack of maintenance and the devaluation of the building. Regarding the absence of material seen in Figure 6a, it consists in the deterioration of the fixed canopy, of the canvas type on the front facade, which has as an intervention suggestion the insertion of the missing elements, by a compatible one, respecting the harmony with the other elements and its original function. The visual pollution present in Figure 6b, on the other hand, is related to the process of inadequate interventions in a frame present on the right side facade, where the frame was sealed using ceramic brick masonry, however, the process was carried out inappropriately, leaving the substrate exposed to the weather, which can result in pathological manifestations throughout the useful life of the building, the intervention suggestion consists of preparing the substrate and applying a coating compatible with the original, with due repainting of the missing part.



Figure 6 - Visual aspects of pathological manifestations - (a) absence of material and (b) visual pollution/elements not belonging to the original project

Source: Prepared by the authors (2023)

In a detailed analysis regarding the absence of elements, it is noted on the front facade that one of the most recurrent damages is mold, also known as biofilm. The presence of this damage is linked to the absence of a fixed marquee, of the canvas type existing on the upper part of the facade, the marquee was used for protection due to the action of bad weather, such as precipitation, however, with the degradation of the element, the presence of humidity and the lack of planning to carry out its replacement, resulted in the accumulation of moisture, contributing to the mischaracterization of the building, as can be seen highlighted in Figure 7. According to Lima et al. (2022), it is possible to avoid this problem through some measures, such as the use of waterproof materials in the construction stages, opting for good sunlight, as well as cross ventilation, insofar as it does not harm the well-being of individuals. . When it comes to the exterior of the building, when there is greater contact with constant humidity, it ends up making the therapy process for this damage difficult, so it is necessary to carry out interventions aimed at repairing the agent that caused the humidity.



Figure 7 - Visual aspects of the presence of mold/biofilm caused by the absence of the marquee

Source: Prepared by the authors (2023)

One of the most recurrent manifestations on the facades was the existence of blistering. According to Stolz et al. (2020) explains, this degradation is characterized by changes in the coating, where the surface of the plaster detaches from the plaster, forming bubbles, whose diameters progressively increase. The external walls have favorable conditions for this degradation to occur, considering the climatic conditions of the area, exposure to bad weather and the apparent lack of preventive and corrective maintenance.

Another pathological manifestation that can be highlighted, because it is also caused by the lack of maintenance and is very recurrent, is the presence of vegetation, which occurs all around the building, as can be seen in Figure 8.

Vegetation can offer structural risks to the construction, since, if organic matter had been introduced into the structure in the execution phase, there would be the presence of reactive substances throughout the structure, facilitating the contact of the concrete with sulfates and alkalis, being harmful to its life. useful. In the absence of maintenance, the areas accessible to water will eventually be colonized by roots, they can settle in cracks and, thus, potentiate them, compromising the structure (Lima et al., 2022). In the case of the old electoral justice building, the plants found do not pose any risk to the built heritage, as they have shallow roots, affecting only the architectural aesthetics of the place. However, while a building is located in an area rich in vegetation, there is a high probability of termite foci on the ground, which benefit from the lack of maintenance of buildings, as is the case of the building under study (Barros et al., 2021).



Figure 8 - Presence of vegetation

Source: Prepared by the authors (2023)

Then, it is possible to highlight the neglect with the heritage due to the presence of pathological manifestations such as dirt and vandalism, which impair the aesthetics of the place. In the study by Lemos et al. (2022), this type of pathological manifestation is specified in a special degree and deserves special attention, since they are the only ones with their origin from directly human actions, extremely common in buildings located in urban areas, they are pathological manifestations composed of paints used by vandals, as can be seen in Figure 9. In the case of the building under study, the pathological manifestations are visually identified by the presence of phrases or names written on the outside of the structure using commercial paints.



Figure 9 - Visual aspects of the presence of vandalism

Source: Prepared by the authors (2023)

As for the damages that have a mechanical causative agent, cracks, fissures and ceramic displacement stand out. After identifying the pathological manifestations found in the building, mapping of these on the facades

was carried out. As for ceramic displacement, in the study by Costa et al. (2022) it is specified that the damage can be characterized by the loss of adhesion of the coating to the base, cyclical movements of the structure, leading to the fall of some coating plates. For proper therapy, the author explains the need to remove pieces that are not cracked or cracked, followed by cleaning the area and replacing the pieces with their own mortar and grouting after 1 week.

To carry out the mapping of cracks and fissures, a fissurometer was used to assist in classifying the damage. The standard, from the Brazilian Association of Technical Standards - ABNT, NBR 9575 (2010), which concerns waterproofing, selection and design, defines cracks as openings of up to 0.5mm, and cracks as openings of up to 1mm. In the case in question, the presence of cracks and fissures was observed, appearing on all the facades of the building. According to Rodrigues et al. (2021), this type of damage is mainly caused by overloads or stress concentrations, thermal changes in humidity, excessive deformation, retraction of products based on hydraulic binders or chemical changes in building materials.

According to Sousa (2020), to avoid cracks and fissures, it is important to have adequate expansion joints where the project requires them, they are places to relieve tensions and provide safe space for the structure to move without damaging the building. Cracks can be found throughout the front facade of the building, in Figure 10 cracks located at the junctions of materials can be seen, it is the presence of a longitudinal crack between the wall of the original facade and a masonry wall executed after construction of the building. Thus, it can be seen that its origin is linked to the incompatibility of the materials present on the two surfaces and/or the lack of expansion joints between the meeting regions. In addition, it is important to monitor this pathology in the presence of this structural integrity.



Figure 10 - Longitudinal crack located at the junction of materials

Source: Prepared by the authors (2023)

4.2 Application of the GUT methodology

The GUT (Gravity, Urgency and Tendency) priority matrix emerged in 1981, through the studies of Charles H. Kepner and Benjamin B. Tregoe as a method for situational analysis to be used as a parameter to define priorities considering several action options. For the authors, this tool complements quality management and is related to the PDCA cycle, referring to the act of planning, acting, checking and doing (Fáveri et al., 2016).

For Araújo (2018), this diagnostic and management tool is used to prioritize decision-making, taking into account the severity, urgency and trend of the action already taken. For the author, the tool aims to prioritize actions in a rational way, taking into account the three factors above a phenomenon, allowing to choose the least harmful action to be taken. The GUT methodology attempts to rationally answer the questions: a) What should be done first? and b) Where to start? In response to these questions, the tool orders the importance of actions influenced by the Gravity, Urgency and Tendency of the component factors in the analyzed event.

The GUT Matrix methodology presents several advantages, among them: it allows the allocation of resources in the topics considered most important; contributes to the development of strategic planning; it is simple to implement; can be used to classify different subjects; it is useful for planning activities that must be carried out in a given period (Souza, 2020).

From the GUT variables, one can act based on a scale, identifying which complications must be resolved first. The differential of the GUT Method is the simplicity of use and the possibility of assigning values to each concrete case in an objective way (Lima, 2019). The first step in preparing the GUT Matrix is to list the problems present in a given environment and, subsequently, evaluate the three variables, which are defined in the table below (Table 4).

Table 4 – Definition of classification parameters for the GUT Matrix

GUT MATRIX CLASSIFICATION PARAMETERS			
	Gravity	Urgency	Trend
DESCRIPTION	Represents the impact of the problem if it happens; the intensity It represents the impact of the problem if it were to happen; the intensity, depth of the damage that the problem can cause if no action is taken; it always verifies its effects in the medium and long term, if the problem in question is not in question is not solved	It represents the deadline, the time available or necessary to solve a certain analyzed problem. The time it takes for damage or undesirable results to emerge if no action is taken on the problem The greater the urgency, the less time is available to solve this problem	Represents the problem's potential for growth, the probability that the problem will become larger over time, i.e., the development the problem will have in the absence of action. that is, it is the development that the problem will have in the absence of action. It is the evaluation of the tendency of growth, reduction or disappearance of the problem

Source: Adapted from Araújo (2018)

The second moment of application of the GUT tool is characterized by the attribution of values that translate the parameters of severity, urgency and tendency. To carry out the second stage, this study focused on the recommendation of the study by Gomide (2018), which proposes the attribution of values on a scale from one (1) to five (5), which the closer to 1 the less problems will be generated by the analyzed event and the closer to 5, the more consequences will be presented by the event. The criteria adopted by this study are described in the table below (Table 5).

Table 5 – GUT Matrix scoring criteria

GUT MATRIX CLASSIFICATION CRITERIA			
Classification	Gravity	Urgency	Trend
1	No severity	It can wait	It will not change
2	Not very serious	Not very urgent	It will get worse in the long run term
3	Severe	As fast as possible	It will get worse
4	Very serious	It is urgent	It will get worse in a short time a short time
5	Extremely severe	Needs immediate action immediate action	It will get worse rapidly

Source: Adapted from Araújo (2018)

Table 6 below presents the classifications of the pathological manifestations identified in this case study through the photographic reference and the damage map, according to the variables of the GUT method presented above. In this way, the products obtained with the application of the method express the analysis of the problem of each manifestation, resulting in the prioritization order of each damage.

Table 6 – GUT Matrix

Pathological Manifestation	Gravity	Urgency	Trend	G x U x T
Dirt	1	3	4	12
Vandalism	1	3	1	3
Absence of elements	1	2	1	2
Mold	3	4	4	48
Ceramic debonding	3	3	4	36
Fissure	1	2	3	6
Breaks	4	3	4	48
Crack	5	5	5	125
Empowerment	2	3	4	24
Vegetation	1	3	4	12
Debarking	2	2	3	12

Source: Prepared by the authors (2023)

The results obtained in the application of the method demonstrate that some pathological manifestations have the same degree of priority and others, on the other hand, a very high degree. Therefore, it should be noted that this study was unsuccessful in characterizing the exact incidence of damage found in the studied building, due to the fact reported in the methodology of the team's lack of access to the walled locations on the facade of the building (left and rear facade) .

To this end, it is noted in particular that the presence of dirt and cracks, despite having a high incidence, received low scores, which did not lead to urgency in their resolution; this was due to the fact that they do not present significant risks to the lives of users, such as cracks, mold and cracks which, on the other hand, showed little occurrence, however, with high severity since they need immediate intervention since they are progressing quickly.

Cracks along with corrosion of frames and vandalism receive lower scores because they do not present risks, since they are pathological manifestations caused on the surfaces of materials, and thus, are easily resolved. Thus, Table 7 orders the priority degree of intervention for each pathological manifestation found in the study, in accordance with the literature used in the study.

Table 7 – Order of priority according to the GUT Tool

Order of priority	Pathological manifestation	G x U x T
1°	Crack	125
2°	Breaks	48
3°	Mold	48
4°	Ceramic debonding	36
5°	Empowerment	24
6°	Dirt	12
7°	Vegetation	12
8°	Debarking	12
9°	Fissure	6
10°	Vandalism	3
11°	Absence of elements	2

Source: Prepared by the authors (2023)

As observed, the pathological manifestations related to cracks, cracks and mold, despite having a low incidence, express themselves significantly in terms of establishing the order of resolution priorities, since in a short time it is progressing. Therefore, it is clear the need for intervention in the ceramic peeling, blistering, dirt, vegetation, peeling of the pictorial layer, fissure, vandalism and absence of elements.

It is notable that most of the pathological manifestations identified in the case study do not present serious risks to users, with the exception of cracks, cracks and mold. In turn, they cause discomfort and may trigger health risks in terms of the high presence of moisture that causes much of the other damage. Therefore, they all need attention and care, especially not to evolve.

5. Conclusions

In this article, themes related to the pathological manifestations present in the old building of the electoral justice of Teixeira were discussed, choosing to highlight in the text the most recurrent ones and due to anthropic interference, also addressing the importance of preserving and restoring the material heritage of the municipality.

Through this study, it was possible to understand the current situation of the Electoral Justice building, which is in a state of abandonment without due care of its architectural and historical value for the *teixeirenses*. For the long-term preservation of memory, culture and local identity, it is vital that the general needs of the building are met, because, although the city has monuments of great historical value, the debate on heritage conservation policies is still incipient and its degradation may lead to the disappearance of local history in the future.

According to the large index of mechanisms that have a causative agent in human action, we can understand that the manifestations found could be solved and/or prevented, with the help of a specialized technical team, guaranteeing an adequate restoration project, and the use of compatible materials and elements, so that the needs of the building are met, causing less disharmony in its original characteristics.

As strategies for future research, we propose the study of the other constructive systems of the building, in order to verify the general analysis of the building. As well as investing in research that aims at diagnostic methodologies without losing the integrity of the studied object. In this way, the literature will follow scientific advances and the process of combating the emergence of pathological manifestations will be fully effective.

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