Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / *Online Support* - ISSN 1980-0827 Suporte CD-ROM / *CD-ROM Support*
Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 2, 2024

Damage Map of Facades of Historic Buildings: Case Study of the Madre de Deus Church in Recife-PE

Thulio Roberto Silva do Nascimento
Master's student, UPE, Brasil.
tn.eng.civil@gmail.com

Stephany Rayane Silva Rodrigues
Master's student, UPE, Brasil.
srsr@poli.br

Lydia Marques Barreto
Master, UPE, Brasil.
lydia_barreto@hotmail.com

Eliana Cristina Barreto Monteiro
Doctor Professor, UPE/UNICAP, Brasil.
eliana@poli.br

Willames de Albuquerque Soares
Doctor Professor, UPE, Brasil.
was@poli.br

Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / Online Support - ISSN 1980-0827 Suporte CD-ROM / CD-ROM Support
Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 2, 2024

SUMMARY
Facades, in addition to their aesthetic function, play a fundamental role in the preservation of a building, acting as a protective barrier against external aggressive agents. Therefore, maintenance activities are essential to prolong the lifespan of this system and prevent the degradation of its components. When it comes to historical heritage, beyond the sustainability brought by maintenance activities, conserving the architectural richness of a specific era is vital for the history and culture of a place. The damage map is a crucial document for developing a restoration project for historical and religious buildings. The present research was developed with the purpose of stimulating the appreciation of heritage riches and collaborating with the development of actions aimed at the preservation and conservation of the National Cultural Heritage, through the creation of a damage map and analysis of the pathological manifestations of the facades of the Madre de Deus Church, Recife/PE. The Madre de Deus Church was selected based on criteria such as: classification by the National Historic and Artistic Heritage Institute; social importance; accessibility; and data availability. Research on the building's history and visual inspections were carried out. The main manifestations identified were dirt/biofilm and stains due to the presence of moisture. The South Facade is the most critical of the building, requiring more significant interventions for restoration, which may be related to the higher incidence of winds and rains.

KEY-WORDS: Damage Map. Historical Buildings. Pathological Manifestations.

1 INTRODUCTION

The city of Recife began its occupation around the "third decade of the 16th century when it was a narrow strip of sand protected by a line of reefs that formed an anchorage" (Brazilian Institute of Geography and Statistics, 2014). However, even before it was occupied as a city, it served a role of great national and international importance and came to be the busiest port in Portuguese America by the 17th century (Anchorage, 2020).

Today, the city boasts many mansions, buildings, palaces, squares, and monuments on its streets that assume different uses and declare its history, flaunting its unique architectural richness. These works fit into the definition of "Cultural Heritage" addressed at the General Conference held by the United Nations Educational, Scientific and Cultural Organization — UNESCO — (1972) in Paris and are recognized as historical and cultural heritage by the National Institute of Historic and Artistic Heritage — IPHAN.

Buildings are constructed to have a long useful life. Throughout their service time, they must satisfy the needs of the users, who, in turn, need to carry out maintenance activities to contribute to the building's durability. Thus, treating buildings as something disposable is unfeasible from an economic standpoint and unacceptable from an environmental perspective (ABNT, 2024; ABNT, 2012).

The facade is the element that constitutes the building's envelope and protects it from the action of external aggressive agents that can compromise its performance. The execution of assertive maintenance for the conservation of this heritage, which suffers from the direct action of aggressive external agents, is essential for the construction's durability since it prevents the progression of failures (Costa et al., 2024). Moreover, the costs of performing regular predictive maintenance are lower than those of restoration services, and, in the case of historic buildings, there is also care in maintaining the original features (Junior, 2022).

Tinoco (2007) defines a damage map as the rigorous and detailed graphic-

photographic representation of all the pathological manifestations of a building. According to Bersch et al. (2020), the development of damage maps allows for a better understanding of the larger and more urgent anomalies in interventions, thus enabling more effective decisions for restoration actions. Understanding the mechanisms of degradation is also essential to define the most appropriate treatment with the aim that actions address the root of the problem.

Religious constructions make up a typology of historic buildings that stand out among others in the city. These buildings are found in large numbers in the region and present extreme architectural detail richness, in addition to having been in operation for decades, or even centuries, serving the Recife community and tourists from around the world.

2 OBJECTIVES

To analyze the occurrence of pathological manifestations on the facades of the Madre de Deus Church, located in the Urban Complex of the Old Neighborhood of Recife-PE, by creating a damage map, in order to direct maintenance actions and contribute to the appreciation, as well as the conservation of the city's historical heritage.

3 METHODOLOGY

The selection of the historical religious building studied in the research was made based on the following criteria:

- Listing by the National Institute of Historical and Artistic Heritage (IPHAN);
- Social importance/relevance;
- Accessibility for inspections;
- Availability of data.

The historical analysis process began through bibliographical research and consultations with agencies involved in the protection of national cultural heritage.

The construction of the historical survey of the building over the years allowed the characterization of the historical value of the cultural asset and the relevance it played throughout the evolution and growth experienced by the city of Recife.

Consultations were carried out in the collection of the National Institute of Historical and Artistic Heritage (IPHAN), available at the State Superintendence in Pernambuco. Through the information collected, the protection classification attributed to the Church of Madre de Deus was made possible and its significance for the old neighborhood of Recife was substantiated.

The technical inspections consisted of visual inspections of the facades, carried out without causing damage to their components. Sketches were prepared for each facade studied separately, with the aim of recording the pathological manifestations identified in the field. In addition, photographic records were made that allowed for detailed study of the facades at later times and verification of the consistency of the indications of occurrence of manifestations obtained during the inspections and contained in the sketches. The data collected were analyzed and, subsequently, damage maps of the building's facades were prepared. They indicated the

pathological manifestations, as well as the regions affected by them, using different graphic representations, duly indicated in a standardized legend.

4 RESULTS AND DISCUSSIONS

4.1 Object of study

Cited by Almeida (2007) as one of the temples that stands out most among the historical monuments of northeastern Brazil, the Church of Madre de Deus (Figure 1), located on Rua Madre de Deus, in the neighborhood of Recife-PE (Figure 2), was listed by the National Institute of Historical and Artistic Heritage, together with its collection, in the 1930s — more precisely in July 1938 — and is located in the listed polygon of the Architectural, Urban and Landscape Complex of the old neighborhood of Recife (Instituto do Patrimônio Histórico e Artístico Nacional, 2024).

Figure 1 - Main Facade of the Madre de Deus Church

Source: Authors (2024).

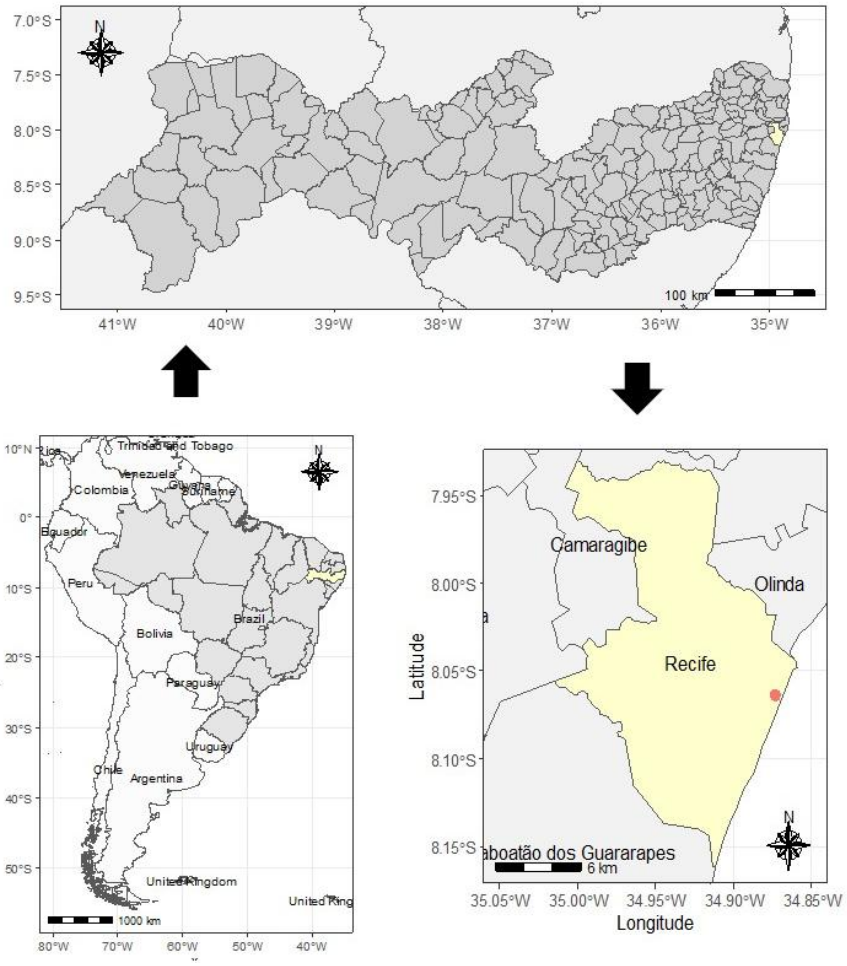
Rocha (1967) states that the building “emerged at the end of the 17th century, as a chapel of the Convent of Madre de Deus, built by the first religious congregation established in Brazil: the Priests of the Oratory of St. Philip of Neri”. According to the author, construction began in 1679, with the donation of land by Captain Antônio Fernandes de Matos.

Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / Online Support - ISSN 1980-0827 Suporte CD-ROM / CD-ROM Support
Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 2, 2024

Guerra (1970) points out that the construction technique used in the building did not offer much safety, as the church had been built with “thick bricks, not baked, but simply dried in the sun, which they called adobes”.

The small church of Madre de Deus had little physical space and offered little comfort to accommodate the many faithful. It was only through the royal charter of April 5, 1707, that the construction of a new Church of Madre de Deus and its hospice was permitted, so that Father João Duarte do Sacramento decided to demolish the small church in order to build “a majestic temple” (Guerra, 1970). According to Rocha (1967), the new church was built between 1706 and 1720 with a beautiful façade “where sandstone from our reefs was used abundantly” and with a well-balanced interior.

Figure 2 – Location of the Madre de Deus Church



Source: Authors (2024).

Almeida (2004) details the characterization of the volumetry and internal architecture of the temple, recording as follows:

> [...] in the Church of Madre de Deus, the floor plan of the so-called hall churches (Sila Telles) was adopted. Hall churches are characterized by having a wide nave (and choir),

Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / Online Support - ISSN 1980-0827 Suporte CD-ROM / CD-ROM Support
Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 2, 2024

side chapels inserted inside the walls, which can be seen by looking around; the chancel (shallow); the existence of side corridors to the nave and the chancel, both leading to the transversal sacristy, all inserted in the rectangle of the building.

The studies at the Madre de Deus hospice were so highly valued that on March 15, 1755, a royal decree was issued that allowed its students to enroll at the University of Coimbra, without the need for an admission process (Guerra, 1970).

Over time, some modifications were made to the building. Guerra (1970) states that on June 17, 1826, the Recife Customs House was installed in the hospice building, which was handed over to the provincial government due to the request recorded in the imperial notice of December 23, 1825, and that in 1841 some changes were made to the initial architectural features of the church.

The author also mentions a remarkable event in the history of this small church that occurred in 1961, when the captaincy was facing an epidemic that caused great damage, and its backyard served as a public cemetery.

After suffering a fire in May 1971, the Church of Madre de Deus underwent restoration work managed by IPHAN, which was completed in 1984, and more recently, in 2005, new work was carried out. After much research, a restoration that aimed to perfectly recover its Baroque style was developed with the involvement of more than 30 professionals (Almeida, 2007).

4.2 Pathological manifestations

The pathological manifestations identified with the highest incidence throughout the building were dirt/biofilm, moisture stains, wood deterioration, vandalism and paint peeling (Table 1). The South Facade presents the percentage of area compromised by faults, followed by the West Facade.

Table 1 – Percentage of area affected by pathological manifestations.

Pathological manifestation	South Facade	West Facade	East Facade	North Facade
Dirt/Biofilm	42,63%	22,22%	31,15%	19,78%
Moisture Stains	3,35%	11,73%	1,86%	4,98%
Corrosion	0,51%	-	1,80%	0,20%
Paint Peeling	1,43%	2,95%	1,44%	0,02%
Vandalism	5,35%	1,70%	0,80%	-
Wood Deterioration	2,54%	8,03%	1,48%	-
Damaged Glass	0,18%	0,86%	-	-
Material Loss	0,55%	0,83%	0,01%	-
Plaster Peeling	-	0,08%	-	-
Total	**56,56%**	**48,41%**	**38,53%**	**24,98%**

Source: Authors (2024).

The greater occurrence of anomalies such as moisture stains and infiltrations on these facades may be related to the greater incidence of rain and wind action (Mazer et al., 2016). Bersch et al. (2020) also identifies the influence of architectural elements, such as protrusions,

Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / Online Support - ISSN 1980-0827 Suporte CD-ROM / CD-ROM Support
Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 2, 2024

on the evolution of damage, identifying a greater incidence of failures in the upper and lower regions, due to the conduction of rain and the occurrence of winds.

4.2.1 South facade

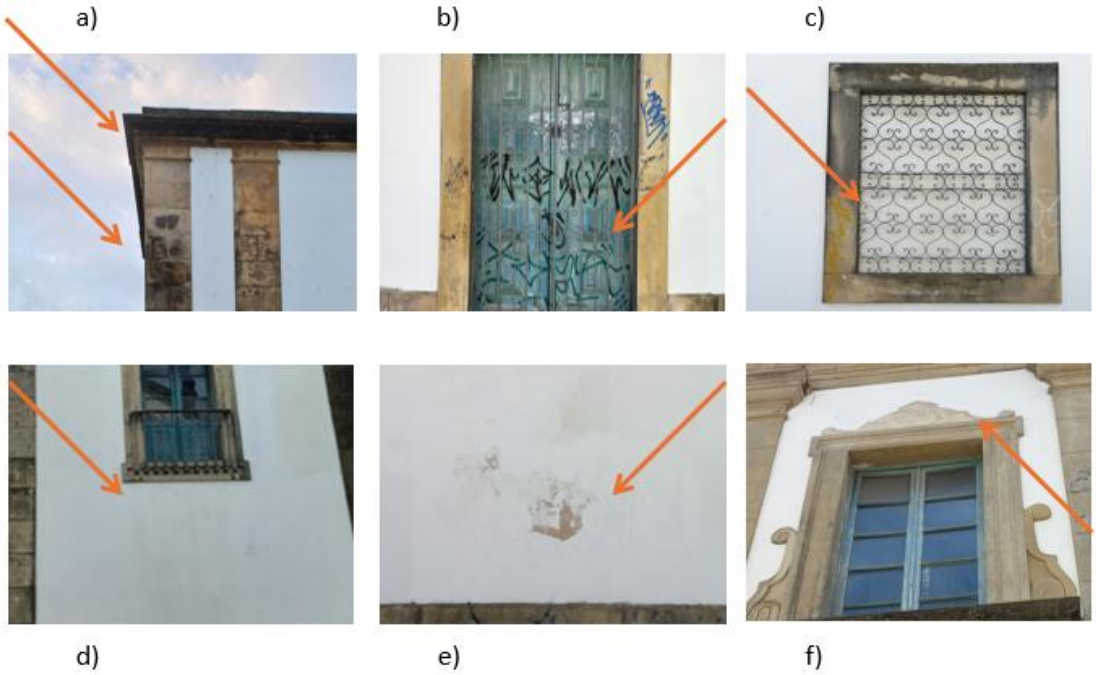
The building's South Facade is exposed to rain and sea breezes, which explains the significant percentage of dirt/biofilm (42.63%) and moisture stains (3.35%) in this orientation (Figure 3). Vandalism is also a flaw that affects a considerable part of this facade, which has the highest percentage of compromised area and a wide variety of flaws (Figure 4). Both vandalism and dirt/biofilm are found more expressively in the lower regions of the facade, including on doors and stonework. The loss of material represents a risk to passers-by and damage to the historical value of the building.

Figure 3 - Damage Map of the South Façade of the Church of Madre de Deus

Source: Authors (2024).

Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / Online Support - ISSN 1980-0827 Suporte CD-ROM / CD-ROM Support
Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 2, 2024

Figure 4 - Pathological manifestations identified on the South Facade of the Madre de Deus Church
a) Dirt/biofilm b) Vandalism c) Loss of material d) Moisture stains
e) Peeling paint f) Loss of material



Source: Authors (2024).

4.2.2 West facade

The rear facade of the Madre de Deus Church faces the Capibaribe River (west). The damage found was: dirt/biofilm, moisture stains, deterioration of wood frames, damaged glass, peeling paint and plaster, vandalism, cracks and loss of material (Figure 5). Figure 6, shown below, indicates the most frequent occurrence.

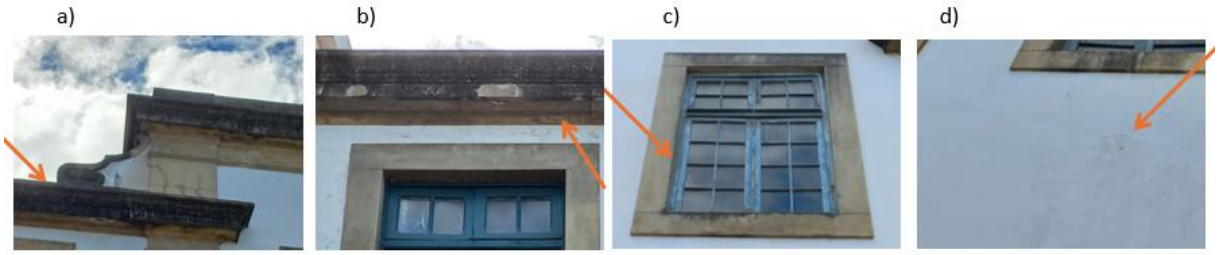
It can be seen that the identification of peeling paint (Figure 7) occurred in specific regions of this facade. Most of the wooden frames show significant deterioration (the abundance of sunlight from the west certainly contributed to this). Corrosion of grilles was found on the elements that make up the doors and one of the windows, which is no longer completely original, assuming a partial closure with the gap with a white finishing element.

Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / Online Support - ISSN 1980-0827 Suporte CD-ROM / CD-ROM Support
Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 2, 2024

Figure 5 - Damage Map of the West Facade of the Madre de Deus Church

Source: Authors (2024).

Figure 6 - Pathological manifestations identified on the West Facade of the Madre de Deus Church
a) Dirt/biofilm b) Dirt/biofilm c) Wood deterioration d) Moisture stains



Source: Authors (2024).

Figure 7 - Other manifestations identified on the West Facade of the Madre de Deus church
a) Damaged glass b) Peeling paint c) Loss of material and corrosion of railings
d) Loss of material and vandalism

Source: Authors (2024).

Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / Online Support - ISSN 1980-0827 Suporte CD-ROM / CD-ROM Support
Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 2, 2024

4.2.3 East facade

The front facade (East Facade) of the church, like the South Facade, is exposed to rain and winds from the sea, therefore, the occurrence of dirt/biofilm and moisture stains are the most significant in this orientation (Figure 8). The protrusions resulting from the architectural configuration, mainly in the upper part, which is difficult to access for cleaning and maintenance activities, contribute to the accumulation of moisture and residues and the emergence of these pathological manifestations in this region (Figure 9).

It can be seen that the damage caused by vandalism is located in the lower parts of the facade, as well as the areas of the doors that show deteriorated wood. The grilles with corrosion on this facade are the window guardrails that are located just above the doors, directly affected by the weather.

4.2.4 North facade

The north facade was in a better state of conservation, with few and isolated pathological manifestations (Figure 10). No vandalism was found, certainly due to the existence of a wall that limits access for passers-by.

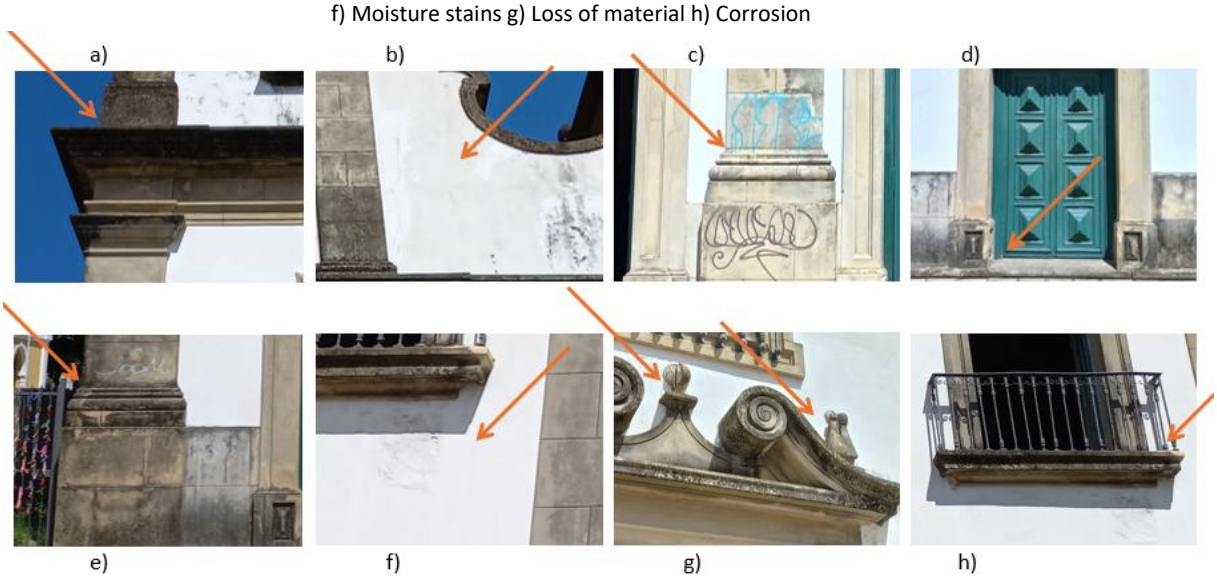
The most significant manifestations were dirt/biofilm and moisture stains in the lower regions of the facade and on the building's ornaments, as shown in Figure 11.

Figure 8 - Damage Map of the East Facade of the Madre de Deus church

Source: Authors (2024).

Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / Online Support - ISSN 1980-0827 Suporte CD-ROM / CD-ROM Support
Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 2, 2024

Figure 9 - Manifestations identified on the East Facade of the Madre de Deus Church
a) Dirt/biofilm b) Moisture stains c) Vandalism d) Wood deterioration e) Dirt/biofilm
f) Moisture stains g) Loss of material h) Corrosion



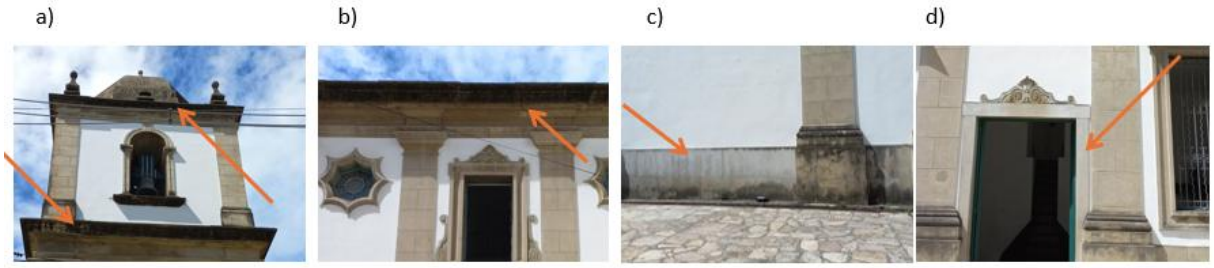
Source: Authors (2024).

Figure 10 - Damage Map of the North Façade of the Madre de Deus church

Source: Authors (2024).

Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / Online Support - ISSN 1980-0827 Suporte CD-ROM / CD-ROM Support
Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 2, 2024

Figure 11 - Main manifestations identified on the North Façade of the Madre de Deus Church
a) Dirt/biofilm b) Dirt/biofilm c) Moisture stains d) Moisture stains



Source: Authors (2024).

5 CONCLUSIONS

Based on the analysis of the material developed, it can be concluded that the most recurrent pathological manifestations in the Madre de Deus Church are dirt/biofilm, stains due to the presence of humidity and deterioration of the wood. The South Facade presents the most critical state of conservation and records the occurrence of other faults, in addition to those mentioned above, such as damaged glass, cracks and loss of ornamental material from the frames of openings (windows and doors), which may represent a risk to the integrity of individuals and property located in the surroundings (due to the height of falling materials).

The occurrence of pathological manifestations follows a certain pattern along the facades. Vandalism is more recurrent in the lower regions of the facade due to greater ease of access, which is proven by the absence of graffiti on the North Facade due to the presence of a wall that limits the approach of people.

The wood of the doors and windows is deteriorating, especially in the lower parts. The protective grilles of the lower windows are the ones that have suffered the most corrosion. Some paint peelings are found in areas close to the Windows.

Furthermore, it is clear that the anomalies identified are related to exposure to the elements and the actions of passers-by (vandalism), and can be remedied with the contribution of implementing periodic preventive maintenance plans, heritage education/awareness actions and increased surveillance/security in the surrounding area.

The creation of the damage map allowed for a better visualization of the pathological manifestations, so that suggestions for corrective actions are more assertive. Finally, we conclude that this research facilitates decision-making regarding future restoration works, promoting the appreciation and conservation of the historical and cultural heritage of Recife and the country.

6 ACKNOWLEDGEMENTS

This research was supported by the Foundation for Science and Technology Support of the State of Pernambuco (FACEPE).

7 BIBLIOGRAPHICAL REFERENCES

ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS – ABNT. NBR 5674: Manutenção de edificações - Procedimento. Rio de Janeiro: ABNT, 2012.

ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS – ABNT. NBR 15575-1: Edificações habitacionais - Desempenho Parte 1: Requisitos gerais. Rio de Janeiro: ABNT, 2024.

ALMEIDA, Frederico Faria Neves (Coord.) **Inventário Nacional de Bens Móveis e Integrados: Basílica e Convento de Nossa Senhora do Carmo.** IPHAN, 5° Superintendência Regional. Recife, 2004.

ALMEIDA, Luiz Fernando de. (Coord.). **Aula Patrimônio Alfândega e Madre de Deus**. IPHAN/MONUMENTA. Brasília, 2007.

ANCORADOURO de navios e ideias**.** Available at: http://www2.recife.pe.gov.br/pagina/hisoria. Access on: 28 May 2024.

COSTA, L. V. B., TEIXEIRA, B. C., MONTEIRO, E. C. B., & SOARES, W. de A. (2024). Pathological manifestations on hospital unit facades: case study at the appointment center of the Oswaldo Cruz University Hospital, Recife - PE . **Revista Nacional De Gerenciamento De Cidades**, v. 12, n. 85.

BERSCH, J. D., VERDUM, G., GUERRA, F. L., SOCOLOSKI, R. F., GIORDANI, C., ZUCCHETTI, L., & MASUERO, A. B. (2020). Diagnosis of Pathological Manifestations and Characterization of the Mortar Coating from the Facades of Historical Buildings in Porto Alegre — Brazil: A Case Study of Château and Observatório Astronômico. International Journal of Architectural Heritage, 15(8), 1145–1169. Available at: https://doi.org/10.1080/15583058.2020.1771475. Access on: 23 May 2024.

GHIRARDELLO, N.; SPISSO, B. **Patrimônio Histórico: Como e Por Que Preservar**. 2008. 36 p. Conselho Regional de Engenharia, Arquitetura e Agronomia do Estado de São Paulo, Bauru, 2008.

GUERRA, Flávio. **Velhas Igrejas e Subúrbios Históricos***.* Fundação Guararapes, 2 ed. Recife, 1970.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA - IBGE. **Recife.** 2022. Available at: https://cidades.ibge.gov.br/brasil/pe/recife/panorama. Access on: 01 June 2024.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA - IBGE. **Recife.** 2014. Available at: https://cidades.ibge.gov.br/brasil/pe/recife/historico. Access on: 01 June 2024.

INSTITUTO DO PATRIMÔNIO HISTÓRICO E ARTÍSTICO NACIONAL – IPHAN. **Lista dos Bens Tombados e Processos em Andamento (atualizado em fevereiro/2024).** Available at: http://portal.iphan.gov.br/pagina/detalhes/126. Access on: 20 May 2024.

JÚNIOR, J. M. M., BARRETO, L. M., SOARES, W. A., MONTEIRO, E. C. B., NASCIMENTO, T. R. S. do. Manifestações patológicas e mapa de danos em patrimônio histórico: estudo de caso da Basílica e Convento de Nossa Senhora do Carmo em Recife-PE. **Research, Society and Development**, v. 11, n. 8, 2022.

MAZER, W., SILVA, L. M. R., LUCAS, E. SANTOS, F. C. M. Avaliação de manifestações patológicas em edifícios em função da orientação geográfica. **Revista ALCONPAT**, v. 6, n. 2, p. 145-156, 2016. Available at: https://doi.org/10.21041/ra.v6i2.135. Access on: 24 May 2024.

ORGANIZAÇÃO DAS NAÇÕES UNIDAS PARA A EDUCAÇÃO, A CIÊNCIA E A CULTURA - UNESCO. **Convenção para a proteção do patrimônio mundial, cultural e natural.** Paris, 1972.

ROCHA, E. de A., MACEDO, J. V. S., CORREIA, P., MONTEIRO, E. C. B. Adaptation of a damage map to historical buildings with pathological problems: Case study at the Church of Carmo in Olinda, Pernambuco. **Revista ALCONPAT**, v. 8, n. 1, p. 51 - 63. 2018. Available at: https://doi.org/10.21041/ra.v8i1.198. Access on: 24 May 2024.

ROCHA, Tadeu. **Roteiros do Recife (Olinda e Guararapes).** Gráfica Ipanema. Recife – PE, 1967.

TINOCO, J. E. L. **Mapa de danos, recomendações básicas.** Centro de estudos avançados da conservação integrada. Olinda, 2009.