

PATHOLOGIES IN PROPERTY DUE TO ABSENCE OF WATERPROOFING - CASE STUDY: BUILDING IN THE CITY OF MANAUS

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Abstract: Buildings are susceptible to a process of degradation caused by aggressive agents and moisture is one of those harmful agents that can cause pathologies in the structure. In the absence of an adequate treatment, the prognosis is the decrease in the building's performance and useful life, in addition to negatively influencing the aesthetic issue and its commercial value (depreciation). In this context, this article intends to show the importance of waterproofing as a guarantee of the watertightness of the structure and as a preventive measure the appearance of anomalies arising from the presence of bad weather. Through a case study of a building located in the city of Manaus/AM and, starting from an in loco survey, plus bibliographical research related to the theme, we sought to identify and analyze the pathological manifestations related to these agents, checking its possible causes and consequences. With this analysis, it was concluded that there is a lack of a good level of knowledge and technical training, even the adoption of waterproofing projects, with the correct choice of waterproofing products and methods, in order to ensure a lower incidence of pathologies in the area, above all, the absence of preventive measures aimed at the conservation of the property.

Keywords: Weather, Pathological manifestations, Edification.

INTRODUCTION

According to NBR 9575 (ABNT, 2010), waterproofing aims to ensure the watertightness of the structure, preserving the building elements and components against aggressive agents. Waterproofing is a technique adopted in order to seal, bridge or seal porous materials and their flaws, such as sealing surfaces or structures.

Waterproofing is one of the most important steps in any construction; however,

it is still neglected in many works, due to the requirement of cost containment and greater agility in its conclusion (and consequent delivery), causing certain constructive steps, considered less important, to be neglected.

Therefore, what is found is the lack of information about construction techniques, and about the use of appropriate materials, plus failures or even the absence of specific projects, which help or ensure the effectiveness of the execution process. There is still, in many cases, the lack of a quality control system, in addition to a building maintenance plan. All these factors interfere, in a preponderant way, in the appearance of pathological manifestations related to waterproofing, negatively impacting the comfort, safety, aesthetics, functionality and durability of a building's useful life.

This work aims to present the need to raise awareness of people so that they are aware of the importance of waterproofing their buildings, which will ensure the habitability of the enterprise, as well as the health and well-being of all of the that dwell in it.

MATERIAL AND METHODS

The study area comprises a commercial building, built in the 80's, located in the city of Manaus-AM. It has 14 floors for circulation, in which the 1st and 14th floors were selected for the observation and analysis of pathologies, places where the greatest number of anomalies were found.

Initially, based on the development of the work, an Exploratory Research was carried out, through technical standards relating to the waterproofing system, a specialized bibliographic review related to the topic, in short, a whole framework of original sources of research dealing with the pathologies resulting from the action of high humidity, and its conceptual aspects.

Concomitantly to the literature review, such as Qualitative Research, visual inspections

were carried out, “in loco”, through checklist and photographic images, from which pathological manifestations existing in the property in question were identified.

Finally, as an Explanatory Research, all these data were analyzed, extracting a diagnosis and prognosis related to the probable causes of the occurrence of existing pathologies.

RESULTS AND DISCUSSION

In this study, the problems observed as most present were: reinforcement corrosion, carbonation, cracks, rising moisture, concrete disintegration, efflorescence, mold and infiltration from the presence and undesirable flow of water. All considered as determining factors for the pathological manifestations evidenced at the site, and are listed in Table 1, with their definitions and origins, in the selected pavements, followed by the photographic record.

Corrosion of armor - According to Souza and Ripper (1998), reinforcement corrosion is an electrochemical process that requires the simultaneous presence of moisture and oxygen to occur. Due to the insufficient coverage of the reinforcement, which allowed excess moisture to adhere to the part, together with the local temperature variation, corrosion of the steel at the base of the column occurred. (Figure 1).

Carbonation in concrete - According to Pedferri and Bertolini (2004), reinforcement corrosion can, however, be induced by the carbonation of the concrete or by the penetration of chlorides. Due to the lack of waterproofing, the structure was exposed to moisture, causing a decrease in the pH of the concrete and depassivation of the reinforcement, with the beginning of corrosion. With this, internal tensions were created and, consequently, the appearance of cracks, causing the displacement of the concrete from the structure. (Figure 2).

Efflorescence - According to Caporrino (2018), the salts in contact with water dilute and are transported to the external surface, where, in contact with the air, they solidify, causing deposits of white powder, which is a pathology identified by the appearance of whitish stains, in which excess moisture, added to the absence of waterproofing, caused the problem to manifest. (Figure 3).

Cracks - According to ABNT NBR 15575-2/2013, cracks are openings greater than 0.6mm in any situation. Therefore, cracks were identified in the plaster caused by the variation of humidity and temperature variation, causing visible damage to the coating: soft mortar and without adherence to the substrate. (Figure 4).

Mold - According to Shirakawa et al., (1995), the term mold is the designation of fungal growth, which occurs by the appearance of dark colored spots of black, brown and green. Due to excessive humidity and poor ventilation, the proliferation of fungi appeared, spreading easily to the environment, causing damage to the paintwork, with unpleasant aspects. This type of problem can result in the emergence of serious illnesses related to the airways. (Figure 5)

Concrete breakdown - According to Bauer (1987), the breakdown of concrete is characterized by its rupture, especially in salient regions of the structural elements. Considering this concept, the rupture and the surface detachment of the concrete were observed, showing its displacement on the sides of the expansion joint and, in particular, on the projecting parts of the structure. (Figure 6).

CONCLUSION

This work confirms the relevance of the waterproofing project in buildings, in order to prevent degradation by bad weather and to alleviate the damages arising from the use

DIAGNOSED PATHOLOGIES

1° PAVEMENT		14° PAVEMENT		IMAGE
TYPE	ENVIRONMENT	TYPE	ENVIRONMENT	
Corrosion	Pillar base	Corrosion	Pillar base	1
Carbonation	Slabs	Carbonation	Roof slab	2
Efflorescence	Pillars, Beams and Walls	Efflorescence	Pillars, Beams and Walls	3
Cracks	Coating on masonry (plaster)	Cracks	Slabs	4
Mold	Walls and expansion joint	Mold	Expansion joint	5
Concrete breakdown	Expansion joint	Concrete breakdown	Expansion joint	6

Table 1 - Pathologies diagnosed in the building.



Figure 1. Corrosion of reinforcement at pillar base
Source: Authors(2018).



Figure 2. Concrete carbonation
Source: Authors(2018).



Figure 3.Efflorescence
Source: Authors(2018).

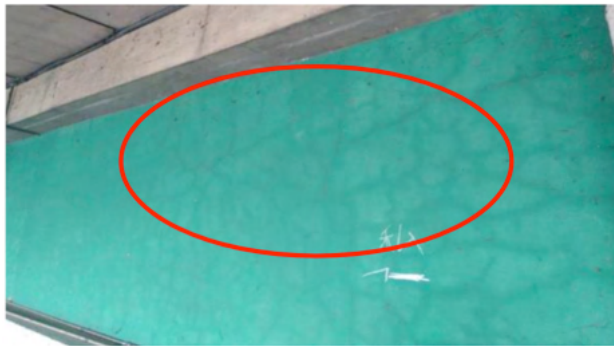


Figure 4. Crack
Source: Authors(2018).



Figure 5.Mold
Source: Authors(2018).



Figure 6. Concrete breakdown

Source: Authors(2018).

of the building itself, as the presence of excess water and other aggressive agents are capable of causing damage to the environment, as well as providing for the proliferation of microorganisms harmful to human health.

Water, in its physicochemical characteristics so necessary for life on Earth, makes up for acting as the biggest degrading agent in the field of civil construction. Its flow in the construction materials of buildings is considered a limiting factor for its durability and health, which is why it is necessary to avoid it, with an adequate, duly effective waterproofing process.

In this sense, given the number of pathological manifestations found in the building under study and because any construction has a descending performance over time, it is concluded that periodic and preventive maintenance is essential to guarantee a good state of conservation, ensuring life usefulness and the habitability of the property. In this regard, the importance of relevant planning and the participation of technical teams (professionals and qualified companies) to carry out inspections, diagnose anomalies and propose appropriate technical solutions is highlighted. the adoption of corrective measures in relation to technical interventions that were not carried out, both

in the construction phase and throughout its operation.

Therefore, in the local scenario, as pertinent measures, there is a need for broader periodic assessments and inspections of buildings in Manaus, through the regulation and implementation of a Building Inspection Plan, starting from the government or with its contribution, which makes it primarily mandatory such measures, given the existence of human lives and that, therefore, their safety must not be neglected or disregarded.

REFERENCES

ABNT, ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS **NBR 15575-2: Edificações habitacionais – Desempenho – Parte 2: Requisitos para os sistemas estruturais**. Rio de Janeiro, 2013.31p.

ABNT, ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS **NBR 9575: Impermeabilização - seleção e projeto**. Rio de Janeiro, 2010.14p.

BAUER, L. A. F. **Materiais de construção**. 5ª ed. Rio de Janeiro, 1987.

BERTOLONI, L.; ELSENER, B.; PEDEFERRI, P.; POLDER, R. **Corrosion of steel in concrete – Prevention, Diagnosis, Repair**. **Weinheim**, Alemanha: Wiley-VCH, 2004.

CAPORRINO, C. F. **Patologias em Alvenaria**. 2ª ed. São Paulo: Oficina de Textos, 2018.

SOUZA, V.C.M.; RIPPER, T. **Patologia, Recuperação e Reforço de Estruturas de Concreto**. São Paulo: PINI, 1998.

SHIRAKAWA, M.A; MONTEIRO, M.B.B; SELMO, S.M.S.; CINCOTTO, M.A. **Identificação de fungos em revestimentos de argamassa com bolor evidente**. In: I Simpósio Brasileiro de Tecnologia da Argamassa – SBTA, 1995.