

Preventive and Corrective Predial Inspection and Maintenance: A Case Study in a Residential Building in Amazonas

Lourival Cordeiro da Silva

lourivalcordeiro12@gmail.com

Centro Universitário FAMETRO – Brasil

Viviane Cristiny dos Santos Mendonça

mendoncaviviane37@gmail.com

Centro Universitário FAMETRO – Brasil

Igor Bezerra de Lima

igorblima@hotmail.com

Departamento de Engenharia do Centro Universitário FAMETRO - Brasil

David Barbosa de Alencar

david002870@hotmail.com

Instituto de Tecnologia e Educação Galileo da Amazônia – ITEGAM – Brasil

Camilly Murrieta Vasconcelos Oliveira Bezerra

camilymv@hotmail.com

Instituto de Tecnologia e Educação Galileo da Amazônia - ITEGAM

Abstract

This article aims to describe the main manifestations found in the external area of the residential building. The case study was performed through visual inspections of the structures, identifying the causes and proposing a correction method for these anomalies. Based on the literature review in books, articles, norms and laws, we sought to understand the definitions related to the inspection and preventive maintenance and corrective to the performance of the building, presenting the main points of interest using as reference the ABNT NBR 5674: 2012 - "Maintenance of buildings" and ABNT NBR 15575: 2013 "Performance of Housing Buildings". After all the on-site survey was carried out, the intervention strategies were presented, ensuring that the facilities receive the necessary maintenance according to the needs of each environment. Therefore, it is concluded that the lack of maintenance in the residential building has caused discomfort in the residents and the expected performance for the building. Therefore, it is very important to have proper planning and conducting the building inspection throughout the building's life, and should have specialized and qualified professionals to perform preventive and corrective maintenance, so it will be possible to rescue its performance, ensuring durability, comfort and real estate appreciation.

Keywords: Building Inspection, Preventive and Corrective Maintenance;

1. Introduction

Due to several accidents caused by constructive failures, lack of inspections and maintenance, has been causing deaths and collapses due to carelessness of buildings. Taking as an example the seven-story building that collapsed in Fortaleza on October 15, 2019, leading to the death of some residents. If the building had the Owner's Manual with the necessary recommendations for preventive maintenance and a building inspection plan they could have a good performance in the development and the comfort of its users, which in contrast was maintained due to poor union management. The importance of hiring a responsible technician is of great importance to avoid inconvenience and poor execution of the services provided by the hired company. More liquidators seek less qualified companies and professionals to have lower cost to execute the contracted retirement plan. The building inspection should be understood as a study of the building, where it will present details of how the quality of the building is and if it presents nonconformities that impair its durability and devaluation of the building.

The case study was conducted in a residential building in Manaus-AM and, through visual inspections of the structures, it was possible to identify the causes of the manifestations found and propose an essential recovery method to rescue its performance, aiming to adapt the building to the quality. intended and to guarantee durability.

2. Theoretical Foundation

2.1 Building Inspection

According to IBAPE (2012) "Building Inspection is the tool that classifies nonconformities found in the building as to their origin, degree of risk and indicates technical guidelines necessary to improve maintenance".

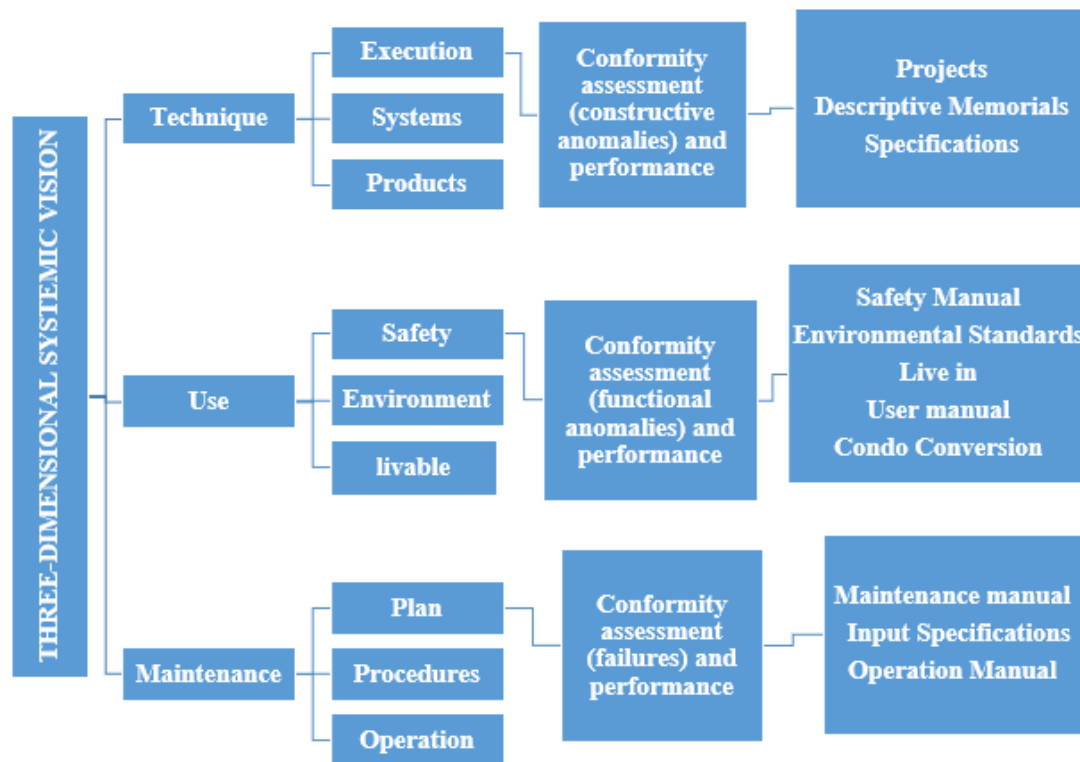
According to GOMIDE (2009), it defines the Building Inspection as being a technical survey of the building to ascertain its technical conditions and to determine the preventive and corrective measures necessary for the good conservation and maintenance of the building.

According to the Building Inspection Standard of IBAPE / SP (2015):

The objective of identifying the general state of the building and its building systems, observing the aspects of performance, functionality, useful life, safety, state of conservation, maintenance, use and operation, considering the expectations of users.

The concept of Building Inspection, "was defined as the evaluation of the technical conditions, use and maintenance of the building in order to guide the maintenance and achieve Total Building Quality" (GOMIDE; PUJADAS; FAGUNDES NETO, 2006).

The building evaluation can only be performed by professional engineers and architects, who are registered in the Regional Council of Engineering and Agronomy - CREA and the Council of Architecture and Urbanism - CAU. In the technical visit it will be possible to register the constructive problems and the pathological manifestations, in order to present the means of prevention and correction of the property providing comfort for users. Flowchart 1 shows the three-dimensional systemic view and the conformities are indicated according to the severity, urgency and disposition of each one. Thus, a plan will be proposed for the maintenance of the building according to the need pointed out during the technical visit.



Source: (GOMIDE; PUJADAS; FAGUNDES NETO, 2006).

2.2 Building Inspection Rating

Item 6.1 of the IBAPE / SP Building Inspection Standard (2012 p. 6), conceptualizes the three levels of rigor as follows:

6.1.1 Level 1 - Building Inspection performed in buildings with low technical complexity, maintenance and operation of their elements and building systems. Usually used in buildings with very simple or nonexistent maintenance plans.

6.1.2 Level 2 - Building Inspection performed in buildings with medium technical complexity, maintenance and operation of their elements and building systems, of medium construction standards and with conventional systems. Usually used in buildings with several floors, with or without maintenance plan, but with outsourced companies hired to perform specific activities such as: maintenance of pumps, gates, water reservoirs, among others.

6.1.3 Level 3 - Building Inspection performed in buildings with high technical complexity, maintenance and operation of their elements and building systems, [...]. At this level of building inspection, a Maintenance based on ABNT NBR 5674 is performed in the building. The Building Inspection at this level is prepared by qualified professionals from more than one specialty.

According to IBAPE / SP (2015, p. 13), “building inspection work considers the building as the human body and, as in a medical checkup, evaluates each part or constructive element”.

According to the Building Inspection Standard of IBAPE / SP (2012), “all the documentation required for the building inspection sequence, makes a division containing three types of documents: technical, administrative and maintenance and operation documentation”.

The main steps for conducting building inspection will be briefly presented in table 1.

Table 1 - Main steps for conducting a building inspection.

MAIN STEPS FOR PERFORMING A BUILDING INSPECTION
STEP 1: Survey of data and documents of the building. Administrative, maintenance and operation technicians (plan, reports, history, etc.)
STEP 2: Interview with the manager or union to find out information about the use of the building, history of renovation and maintenance, among other interventions.
STEP 3: Conducting building surveys, carried out with a multidisciplinary team or not, depending on the type of building and the complexity of existing building systems.
STEP 4: Classification of deficiencies found in surveys, by construction systems, according to their origin.
STEP 5: Classification of problems (anomalies and failures), according to priority level, as established by standard
6th STEP: Preparation of the list of technical priorities, according to the priority classification of each problem found. This list is ordered from most critical to least critical.
STEP 7: Preparation of recommendations or technical guidelines for solutions to the problems found. These guidelines may relate to the adequacy of the maintenance plan or repairs and remediation for troubleshooting.
STEP 8: Maintenance quality assessment, as established by standard
STEP 9: Evaluation of the use of the building. It can be classified as regular or irregular. Observe the original conditions of the building and its building systems, beyond the limits of use or shape.

Source: IBAPE / SP 2015.

For the validation of the building inspection must present all the necessary documents that is made by the responsible of the building selecting which are applicable for each inspection, according to:

- administrative documentation;
- Technical documentation;
- Maintenance and operation documentation;

The building inspection is performed by the responsible technician who will prepare the report and present the nonconformities of the characteristics observed during the technical visit, classifying the degree of risk and relating to the appropriate maintenance method.

2.3 Building Maintenance

“The term maintenance had its historical origin with the military, with the meaning of keeping in combat units, the troops and the military equipment in combat conditions. (FERREIRA, 2010) ”.

Building maintenance contributes to the preservation of natural resources sources and interventions

necessary for safety, functionality and comfort, aiming to guarantee the useful life of a building, avoiding the need for a new building.

According to NBR 5674 (2012), defines building maintenance, "in a set of activities to be performed to conserve or restore the functional capacity of the building and its constituent parts to meet the needs and safety of its users."

For GOMIDE, NETO AND PUJADAS (2006), defines:

Maintenance is a common activity in the industrial area, but the same is not true of buildings. Despite the recent evolution of studies of these activities in Brazil, the reality reveals improvisations and lack of professionalism in most Brazilian buildings.

Maintenance is prominent in the overall cost of buildings, presenting some variables during the process and cannot be done suddenly and without planning. It should be understood as a technical service, whose responsibility requires adequate training of all involved during the maintenance process.

2.4 Classification of Building Maintenance

There are, however, several types and levels of maintenance. Gomide et al. (2006) apud Castro (2007), basically identify the following modalities:

Predictive: is the inspection activity aimed at the study of systems and equipment, in order to predict possible anomalies or failures in them, based on their performance and behavior, and from this, implement and direct preventive maintenance procedures. ;

Preventive: This is the activity that kicks in before repair is needed. Requires a schedule, with pre-established dates, following technical criteria determined by the supplier or manufacturer of the product. It is essential to record all activities performed;

Corrective: is the activity aimed at repairing or restoring failures or anomalies, whether planned or not. It necessarily implies the total or partial shutdown of a system. It is the type of maintenance that presents the costs plus the activity that aims to identify the causes of failures and anomalies, helping high execution;

Detective: It is in maintenance plans, with the goal of attacking the source of the problem, not just the symptom of it.

The absence of maintenance increases the risk of accidents, both from total collapses that may affect its users, and from the detachment of parts, especially façade elements (OLIVEIRA 2013).

The authors Gomide, Neto and Pujadas (2006), describe that there are several forms of classification of Maintenance types, but, first, it is necessary an analysis linked to the classification with the feasibility of performing the services ”.

- Existing Failures and Anomalies - are linked to problems arising from maintenance service and operation of buildings;
- Maintenance Plan Activities - presents information and guides maintenance activities.
- Type of Intervention - will present the type of maintenance to be addressed.

This type of classification helps the professionals to identify the cause of the failure and the appearance of the anomalies, helping the proper maintenance for the building, increasing its useful life.

2.5 Building Performance

According to FRANGOPOL et al. (2012), “In order to maintain or improve the reliability and functionality of structures, integrated management planning should be adopted, appropriate to the entire building life cycle”.

According to GNIPPER and MIKALDO Jr (2007, p. 02), [...] “the performance requirements are related to the actual use of the building, the resistance it should offer to the wear it causes and the consequences it will produce. about the environment ”.

The NBR 15575: 2013 is divided into six parts each behind the definitions and concepts for better understanding, establishing the performance requirements that must be met in buildings, checking if the building is meeting the minimum required by the standard.

- Part 1: General Requirements;
- Part 2: Requirements for structural systems;
- Part 3: Requirements for flooring systems;
- Part 4: Requirements for the internal and external vertical sealing system;
- Part 5: Requirements for the roofing system;
- Part 6: Requirements for the water health system.

The preventive building maintenance plan directly interferes with the estimation of the building's useful life and its correct design combined with a considerable increase in the final useful life value, as shown in Figure 1.

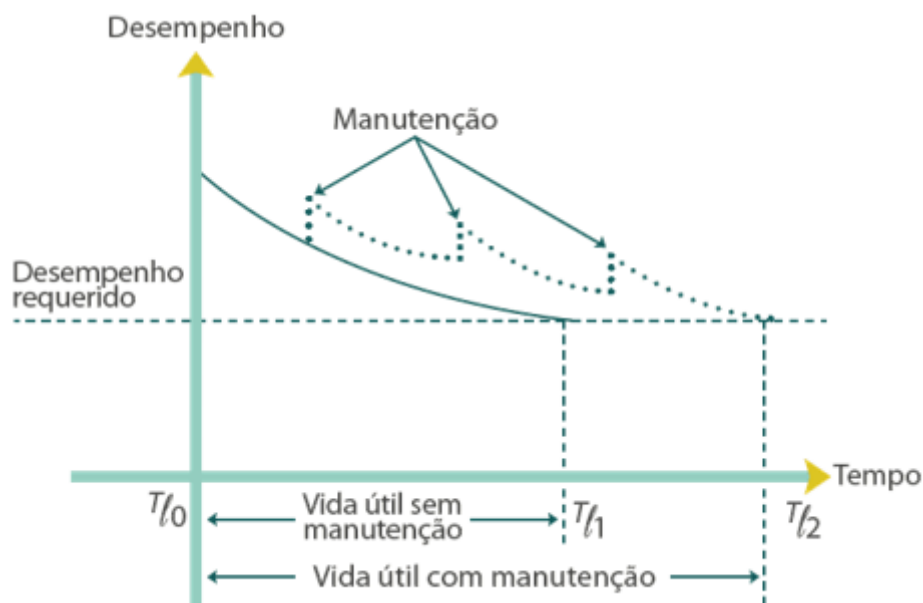


Figure 1 - Performance recovery by maintenance actions.

Source: NBR 15575-1, 2013.

The performance of constructions shall guarantee the builder to the owner a backing as to the proper functioning of the construction over a minimum service life. Once for the construction process, the current requirements and technical standards are met.

2.6 The Origin of Problems in Buildings

As soon as the building is delivered to the residents they must have preventive maintenance and monitoring during its useful life. These pathological manifestations have several characteristics, and can be described as to nature, based on visual observations, and can be classified according to symptoms and likely consequence.

Degradation is due to lack of proper maintenance schedules, lack of periodic inspections, damage to structural elements by impact, erosion by abrasion, cement shrinkage, excess deformation of reinforcement (PINA, 2013).

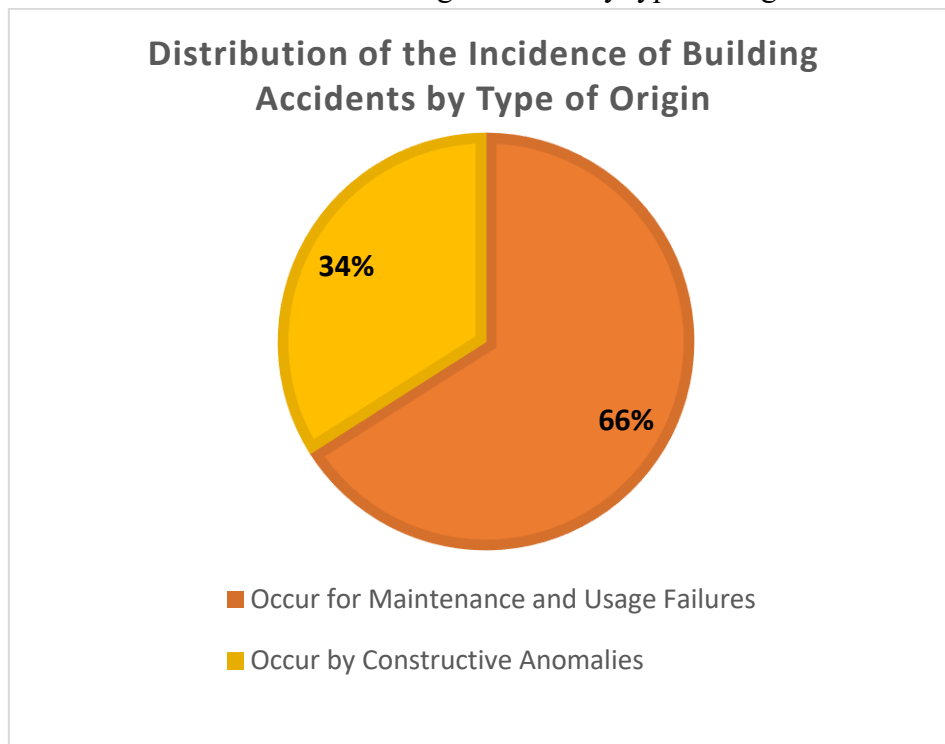
Second CROITOR (2008):

Buildings undergo a natural degradation process due to the action of climate agents and the use of the building. The natural deterioration of improvements can be delayed through preventive maintenance actions, but cannot be stopped. Therefore, eventually any and all construction will need to undergo rehabilitation.

“The renovations in buildings aim to recover, improve or extend the conditions of habitability, performance. These changes made to the existing building can be with or without change of function ”(CLEIDE, 2016). According to NBR 15575 (2013), “buildings must have a life span of at least 50 years, and due to lack of maintenance and improper use, buildings are experiencing problems well before this deadline, and most are related the execution of the work ”.

The IBAPE 2015 presents in graph 1, the possible causes of the appearance of pathologies, and the early loss of performance and constructive addictions. About 66% of incidents of building accidents occur due to failures during maintenance and use and 34% occur due to constructive anomalies due to the material used or errors during the execution.

Graph 1 - Distribution of the incidence of building accidents by type of origin.



Source: IBAPE / SP, 2015.

The lack of maintenance of these buildings causes deterioration of the building, as the surrounding areas, and may be affected by the type and quality of materials used, poor proportion of the trace, lack of technique and care in execution. In these cases, the renovation can be done in order to upgrade the building systems and to meet the changing needs of the environment.

The main problems presented in the buildings are: cracks, dislocations, concreting failures, moisture stains, mold, infiltration, among others;

- Cracks are narrow cracks, shallow and without continuity. They may appear after years, or a few hours after execution.
- Cracks are caused by material stresses, which can occur on beams, pillars, slabs and others.
- Moisture does not occur on walls, floors and slabs and can occur at any stage during execution and degrade construction quickly.

2.6 Preparation of User Manuals

Standard NBR 14037 (2014), establishes the minimum requirements for the preparation of the operation manual, use and maintenance of the buildings, the preparation of the manual, must be made by a company or technical responsible and the delivery of it must be made by the builder to the owner. informing the following observations:

- Inform the owners and the condominium of the technical characteristics of the built building;
- Describe recommended procedures for the conservation, use and maintenance of the building;
- In didactic language, inform and guide the owners and the condominium regarding their obligations and the maintenance and conservation activities;
- Prevent the occurrence of failures or accidents resulting from improper use;
- Contribute to the building achieving the project life. This manual should be written in a didactic form so that the owner understands his obligations regarding use and maintenance information.

If the union does not have the manual CREA of the city under study has the model to download, there is information on the need for regular and preventive maintenance by companies and qualified professionals, all information is to facilitate the management of the condominium.

3. Methodology

The methodology used was the qualitative does not seek to enumerate and / or measure the events studied, is more a collection of descriptive data about people, places and seeks to understand the phenomena according to the perspective of participants of the situation under study (GODOY, 1995). For the development of the study was taken into account the visual aspects of the manifestations found in the external area of the condominium and used as bibliographical references books, articles, technical standards on the subject of poor conservation of buildings and the importance of maintenance in buildings. The case study was based on the problems encountered in the residential building, and through these surveys a form of maintenance for the building was proposed.

3.1 Preliminary Visit to Building

The Residential Building under study is located at Avenida Buriti S / N - Industrial District - Manaus - AM, Internal Address Rua 3. Each block has 16 apartments with an area of 45m², with the right to a parking space.

Block H was used as a basis for study, as shown in figure 2, the choice was due to the services provided to the liquidator for surveys and records of non-compliance found on site, this checklist will provide the responsible professional to prepare the inspection report of the necessary services, for possible preventive and corrective maintenance, which will be performed by specialized companies.

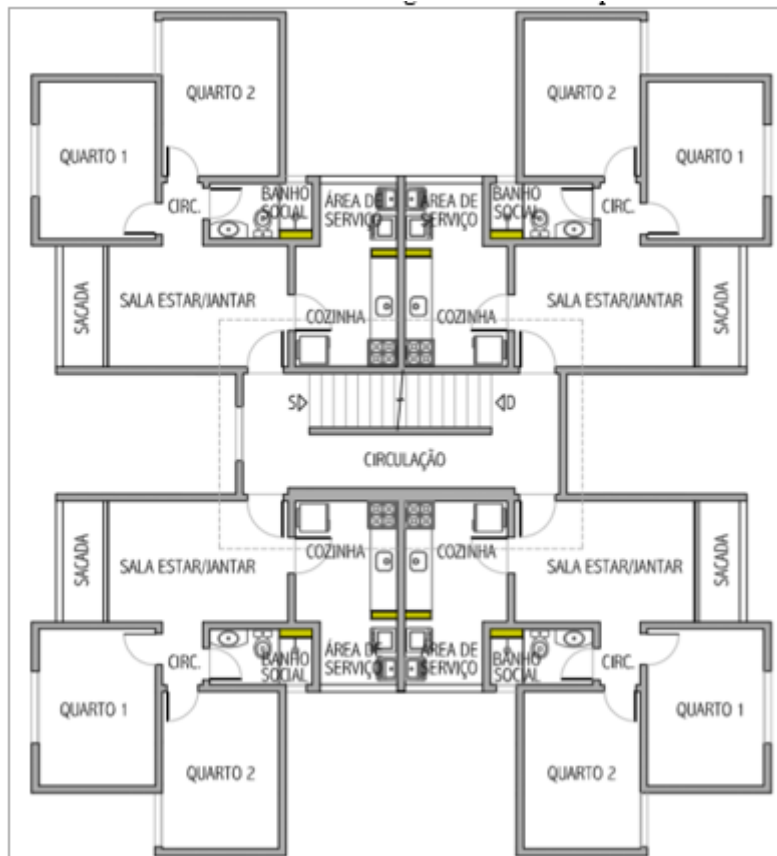


Figure 2 - Architectural plan of block H.

Source: Author's Collection, 2019.

3.2 Visual Aspects

During the on-site visits, it was possible to make a photographic survey of the current situation of the residential building, which served as a reference and proof of the pathological manifestations found. The data collected during the technical visit allowed the identification of some manifestations found and classified according to the studied references and the descriptions will be presented in the results.

3.3 Classification and Proposals for Corrective Measures

The step is to determine which executive method should be applied in solving the problems encountered, taking into account constructive, economic and time aspects, thus ensuring the effectiveness of the service performed. A misdiagnosis will imply interventions that will not be able to cure the disease, hindering the

analysis and future problems to the structure table 2.

Table 2 - classification of anomalies and failures.

ANOMALIES	FAILURES
Endogenous	Planning
Exogenous	Execution
Natural	Management
Functional	Operational

Source: IBAPE, 2012.

After listing the anomalies will be classified according to the severity being critical, medium and minimum, which consist in correcting the damage, recovering the original performance of the structures and increasing their reinforcement.

4. Results and Discussions

For the preparation of data collection during the technical visit the liquidator must make available to the supervisor all the necessary documentation, and with this the professional must plan the entire inspection taking into consideration the building's constructive characteristics.

From this building inspection, a checklist was prepared with the necessary annotations for the collection of photographic data covering all equipment of the building systems to be inspected, which show in more detail the anomalies found in the building. This step is based on the presentation of the necessary information to understand the problem occurred according to the results found in the building inspection survey.

4.1 Crack Appearance

Figures 3 and 4 show the facades with paint peeling, cracking, seepage, breakdown and mold. Paint aging is a functional anomaly that needs care every 3 years at a minimum.

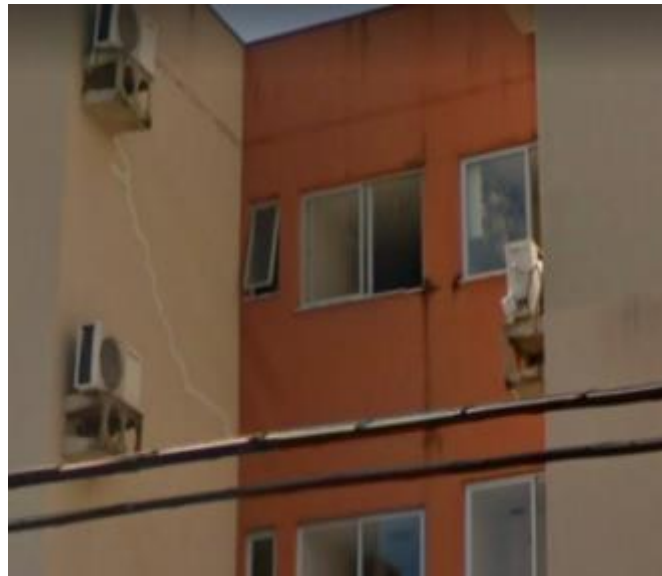


Figure 3 - Cracks in the facade of the residential building.

Source: Author's Collection, 2019.

The anomalies found in the façade were the diagonal cracks in the masonry caused by repression, due to improper use of materials and possible errors during execution, so it was classified as Endogenous.



Figure 4 - Cracks in the facade of the residential building.

Source: Author's Collection, 2019.

The recommended technical recommendations for the correction of cracks are:

Remove the affected coating, Clean all region and loose materials, Ap Cleave the area to be coated, Apply mortar for external plaster, And finally sanding and painting.

Figure 5 shows the walls with intense mildew stains, seepage and cracks. Most of the incidences are due to humidity caused by rain, lack of care. It is considered a natural anomaly, occurring by nature phenomena, the technical recommendations indicated for correction are:

To clean the mold is indicated the use of high pressure jet, Remove the affected coating, Clean all region and loose materials, Ap Cleave the area to be coated, Apply mortar to plaster, Apply waterproofing, Apply sealing cracks and then sand and paint.



Figure 5 - Infiltration and mold.

Source: Author's Collection, 2019.

Figure 6 presents cracks that are caused by infiltration, excessive sun, rain, poor execution of plaster, overloads or differential repressions. The recommended technical recommendations for the correction are: Remover Remove the affected coating, Clean all region of dust and loose materials, Pass 2 coats of acrylic sealant, Iron acrylic paste, Paint with latex paint.



Figure 6 - Appearance of cracks.

Source: Author's Collection, 2019.

The porcelain tile showed detachment in the tip figure 7, the replacement will be performed. We request from the Union the Reform Plan and the Technical Responsibility Annotation - ART for the construction and execution of the floor settlement, where it informed us that it does not have the requested documents.



Figure 7 - Porcelain tile with a detached tip.

Source: Author's Collection, 2019.

The fire fighting equipment is in perfect working order and within the expiration date, there is a raised reservoir with the volume of 60 thousand liters of water which under no circumstances can be used or emptied (except for cleaning it). The water in this reservoir feeds all fire hydrant systems through a unique pumping. Periodic maintenance of extinguishers should be in accordance with table 3.

Table 3 - Periodic maintenance of extinguishers.

EXTINGUISHER TYPE	MAINTENANCE		
	LEVEL 1	LEVEL 2	LEVEL 3
	INSPECTION	RECHARGE	SURVEY
Pressurized Water - AP	12 months	12 months	5 years
Carbon dioxide	6 months	12 months	5 years

Source: Author's Collection, 2019.

These were the anomalies found in the building under study, are described the manifestations and their diagnoses, very common and with direct consequences of the behavior of concrete substrate, either by natural movement through joints, or by the unexpected behavior of the base due to various deficiencies.

After the surveys observed in the building was prepared a table highlighting the item inspected the classification according to severity, estimated value for correction and days required for repairs.

It can be noticed that there are variations in the days and values presented in table 4, this is due to the materials adopted for the repairs, because the choice of the appropriate treatment system greatly influences the cure time of each material, the estimated value for repair is R \$ 42,480.00 and will take 15 days to complete the reform in block H.

Table 4 - Order for Repairs.

ELEMENTOS VISTORIADO	CRITICO	MÉDIO	MÍNIMO	VALOR	DIAS
Fissuras, descascamento da pintura e bolor		X		12.250,00	6 dias
Limpeza da fachada		X		5.230,00	3 dias
Pintura		X		25.000,00	6 dias
Total =				42.480,00	15 dias

Source: Prepared by the author, 2019.

After all the building inspection processes, a technical report will be prepared exposing the general conditions of the building and the items that will be inspected according to the current Norms, presenting the following information: owner, location, description of the object of study, constructive standard , typology, date of the report and ART name and number of the technical responsible.

The corrective maintenance process was in accordance with the anomalies found and the diagnoses of the causes, in order to intervene with appropriate measures to solve the problems. The importance of performing preventive maintenance avoids unnecessary expenses, when the construction company moves the incorporation of the property to the condominium, in this process is sent the owner's manual indicating the necessary care with the project, failure to comply will cause damage and excessive expenses for corrective maintenance. , becoming more expensive than preventive maintenance, because the building elements are already in an advanced state of deterioration.

5. Final Considerations

Every building must have a maintenance system, aiming to identify and correct the anomalies that occur, diagnosing their causes, presenting the necessary recovery techniques to restore the established performance, increasing the useful life. Given this study it is verified the importance of building inspection and preventive maintenance indicated in the owner's manual delivered before the incorporation of the construction company to the condominium. Maintenance is an obligation of the union and management, as it must comply with the periodicity periods of the maintenance program and have contracts with specialized companies for all equipment that is subject to wear and tear or that require specific maintenance.

During the technical visit to the residential building, it is clear that the major problems encountered are due to cracks, infiltrations, paint peeling and porcelain peeling. Problems detected were manifested by lack of condominium management, which could be prevented early on with proper treatment. Finally, it is concluded that due to failures in the administration of condominium fees there was a neglect on the part of the union, requiring a maintenance plan for recovery activities in accordance with the action strategy established by a specialized and qualified professional.

6. Bibliographic References

- ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS. NBR 5674: Manutenção de edificações - Procedimento. Rio de Janeiro, 2012.
- ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS (ABNT). NBR 14037: Diretrizes para elaboração de manuais de uso, operação e manutenção das edificações: Requisitos para elaboração e apresentação dos conteúdos. Rio de Janeiro 2014.
- ABNT NBR 15575-1 – Edificações habitacionais – Desempenho – Requisitos Gerais, Rio de Janeiro, 2013.
- ABNT NBR 15575-2 – Edificações habitacionais – Desempenho – Requisitos para os sistemas estruturais, Rio de Janeiro, 2013.
- ABNT NBR 15575-3 – Edificações habitacionais – Desempenho – Requisitos para os sistemas de pisos, Rio de Janeiro, 2013.
- ABNT NBR 15575-4 – Edificações habitacionais – Desempenho – Requisitos para os sistemas de vedações verticais internas e externas, Rio de Janeiro, 2013.
- ABNT NBR 15575-5 – Edificações habitacionais – Desempenho – Requisitos para os sistemas de coberturas, Rio de Janeiro, 2013.
- ABNT NBR 15575-6 – Edificações habitacionais – Desempenho – Requisitos para os sistemas hidrossanitários, Rio de Janeiro, 2013.
- ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS (ABNT). NBR 14037: Diretrizes para elaboração de manuais de uso, operação e manutenção das edificações: Requisitos para elaboração e apresentação dos conteúdos. Rio de Janeiro 2014.
- Brito, de J. e Branco, F. - Manutenção Pró-ativa de Obras de Arte, Revista Ingenium, 2ª Série, n.º 57, Ordem dos Engenheiros, pp. 42-47, 2001.
- CASTRO, U. R. – Importância da Manutenção Predial Preventiva e as Ferramentas para sua Execução. Belo Horizonte – MG, 2007.
- CLEIDE, Maria; Normas de gestão da manutenção e reformas – curso técnico de edificações. Rio grande do norte, 2016.
- CROITOR, E.P.N.; OLIVEIRA, L.; MELHADO; S.B. Etapa de diagnóstico de um projeto de reabilitação: Estudo de caso francês. In: WORKSHOP BRASILEIRO DE GESTÃO DE PROCESSO DE PROJETO NA CONSTRUÇÃO DE EDIFÍCIOS, 7., 2007, Curitiba, PR. Anais... Curitiba, 2007.7p.
- FLORES, I. - Estratégias de Manutenção - Elementos da Envolvente de Edifícios Correntes. Dissertação de mestrado, IST, 163 p, 2002.
- FERREIRA, H.C. A manutenção predial em face a norma NBR 5674/1999 – Manutenção de Edificações – Procedimento. 2010, Trabalho de Conclusão de Curso (Graduação em Engenharia Civil) – Universidade Federal do Paraná, Curitiba, 2010.
- FRANGOPOL, D. M.; SAYDAM, D.; KIM, S. Maintenance, management, life-cycle design and performance of structures and infrastructures: a brief review. Structure and Infrastructure Engineering: Maintenance, Management, Life-Cycle Design and Performance. V.8, n.1, 2012.
- GODOY, A. S. A pesquisa qualitativa e sua utilização em administração de empresas. Revista de Administração de Empresas. São Paulo, v. 35, n. 4, p.65-71, jul./ago. 1995A.

GODOY, A. S. Introdução a pesquisa qualitativa e suas possibilidades. *Revista de Administração de Empresas*. São Paulo, v. 35, n. 2, Mar./Abr. 1995B, p. 57-63.

GOMIDE, Tito Lívio Ferreira; PUJADAS, Flávia Zoéga Andreatta; FAGUNDES NETO, Jerônimo Cabral Pereira. *Técnicas de Inspeção e Manutenção Predial*, ed. Pini. São Paulo, 2006.

GNIPPER, Sérgio F.; MIKALDO JR. Jorge. *Patologias frequentes em sistemas prediais hidráulico sanitários e de gás combustível decorrentes de falhas no processo de produção do projeto*. Curitiba, 2007. Disponível em: Acesso em: Acesso em 01 de Out. de 2019.

IBAPE/SP – Instituto Brasileiro de Avaliações e Perícias do estado de São Paulo - “Inspeção Predial – A Saúde dos Edifícios”, 2015.

IBAPE/SP – Instituto Brasileiro de Avaliações e Perícias de Engenharia de São Paulo – Norma de Inspeção Predial, 2012.

OLIVEIRA, C. S. P. de. *Análise Crítica de Experiências e Discussão de Estratégias para Implantação de Leis de Inspeção de Elementos de Fachada*. [s.l.: s.n.] 2013.

PINA, Gregório Lobo de. *Patologia nas habitações populares*. Rio de Janeiro, 2013. Disponível em: Acesso em: 01 de Out. de 2019