

Valéria Aparecida
Costa Bonfim
Fabiana Lopes de
Oliveira

m

MODERN ARCHITECTURE: THE
FAÇADES OF COPAN BUILDING

pós- | 1

ABSTRACT

This article aims to present the importance of two preservation instruments: the Conservation Plan and the Manual of Use, Operation and Maintenance, which were developed for the façades of the Copan Building, but they can also inspire similar documents for any modern architecture building. The practice of both instruments could, if they were required by the governments departments responsible for the preservation, help managers and homeowners to take care of the heritage building properly and conscious, without changing the architectural features of the building providing durability to their subsystems.

KEYWORDS

Conservation plan. Maintenance. Modern architecture. Façade cladding. Copan building.



[HTTP://DX.DOI.ORG/10.11606/ISSN.2317-2762.POSFAU.2020.162808](http://dx.doi.org/10.11606/ISSN.2317-2762.POSFAU.2020.162808)

Pós, Rev. Programa Pós-Grad. Arquit. Urban. FAUUSP. São Paulo, v. 27, n. 50, e162808, 2020.

A CONSERVAÇÃO DA ARQUITETURA MODERNA: AS FACHADAS DO EDIFÍCIO COPAN

RESUMO

Este artigo objetiva apresentar a importância de dois instrumentos de preservação do patrimônio arquitetônico moderno: o Plano de Conservação e o Manual de Uso, Operação e Manutenção desenvolvidos para as fachadas do Edifício Copan, mas que podem inspirar documentos similares para outros edifícios de arquitetura moderna. Se ambos instrumentos fossem exigidos pelos órgãos responsáveis pela preservação patrimonial, poderiam auxiliar os gestores e proprietários a cuidar do bem tombado de forma adequada e consciente, sem alterar as características arquitetônicas do imóvel, proporcionando durabilidade aos seus subsistemas construtivos.

PALAVRAS-CHAVE

Plano de conservação. Manutenção. Arquitetura moderna. Revestimento de fachada. Edifício Copan.

BACKGROUND

In the period leading up to the celebrations of the IV Centenary of the City of São Paulo, the Brazilian economy was undergoing a moment of expansion which, allied with private initiative's interest in producing "housing at cost price" in a city suffering from housing deficit, caused a real estate boom in the early 1950s (SAMPAIO, 2002). It was in this situation that the entrepreneur Octavio Orozimbo Roxo Loureiro conceived a housing and hotel complex to be built in time for the city's anniversary festivities. To this end, he sought a partnership with an American hotel chain, Intercontinental Hotels Corporation, with which the Pan-America - Hotels and Tourism Company (Copan) was formed (LEMOS, 2014).

Designed to be the "Rockefeller Center" of São Paulo, the complex was to consist of two buildings: a residential one, S-shaped to take advantage of the geometry of the land, which would house 860 apartments of different types, and another for the hotel, with a rectangular floor plan and 500 apartments aligned with Avenida Ipiranga. The latter would be developed by the American company specialized in the sector, while the former and the implementation of the whole were developed by Oscar Niemeyer (BONFIM, 2019).

The complex would also include a cinema for 3,500 people, a 500-seat theater, bars, restaurants, a swimming pool to serve both guests and residents, a commercial gallery on the ground floor with shops, and a floor called a "terrace" (see Figure 1) - which consisted of an architectural solution taking what normally happened on the ground floor to a higher level, the open ground floor of Modern

pós- | 3

Figure 1 – Floor plan of the Hotel and Residential building
Source: São Paulo City Hall Archive (1952), plan redesigned by Daniella Freitas do Valle.

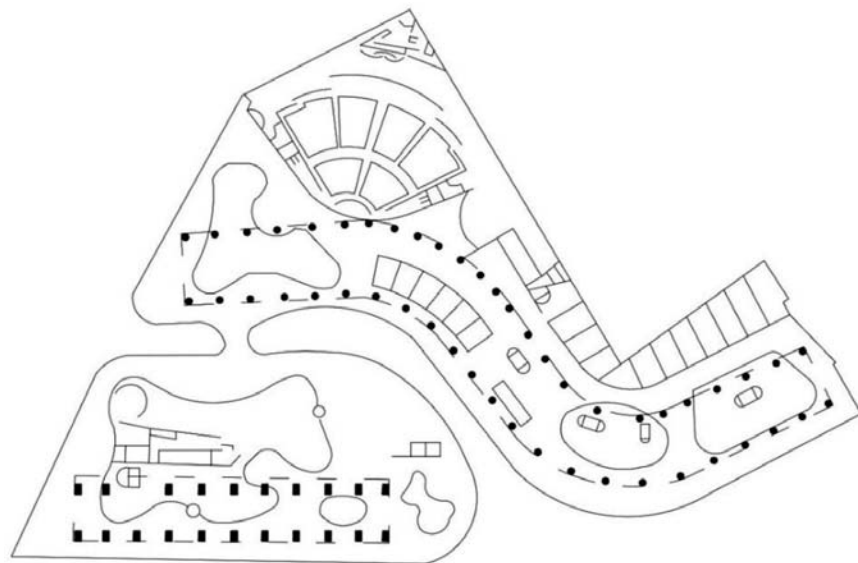


Figure 2 – Announcement of the opening in the *Folha de S. Paulo* newspaper on May 24, 1952
Source: Mário de Andrade Library Archive.

AO CONFORTO DA SUA GENTE!

Edifícios
COPAN

A sua residência própria — parte integrante da Grandiosa "Mação Turística", com a sua imponência e vantagens e em plena Avenida Ipiranga.

Apartmentos de diversas tipos e áreas, com serviços totalmente independentes, elevadores de mais amplo e moderno padrão, e em situação de todos os prazeres e facilidades de pagamento.

De Cr\$180.000,00
a Cr\$1700.000,00
= com entrada a partir de Cr\$10.000,00

A Arquitetura brasileira alinha o espírito da sua época, da sua intensa modernidade, com a apresentação do Marquês Turístico e dos Edifícios COPAN, destinados a promover a dar a São Paulo um ponto de atração de turismo internacional — o "Buckingham Palace" de São Paulo; e segundo a dar aos paulistas a residência central que lhes dá o seu caráter próprio e que os alinha ao mundo, magnífica, plena de conforto, não a seu gosto de todos, mas a própria criação de um modo de vida próprio.

O Marquês Turístico e os Edifícios COPAN constituem, por todos os aspectos, a Onda do Século, em que o homem se vê servido de todo o conforto, dentro e a parte de sua própria.

Lançamento Público
AMANHÃ DOMINGO
das 9 às 22 horas

AVISO IMPORTANTE:
Dado o enorme interesse despertado em torno do terreno para a construção dos Edifícios COPAN, os planos para a obra foram atualizados e todos os detalhes deverão ser apresentados e aprovados no prazo de 15 dias, a partir de hoje, até às 22 horas.

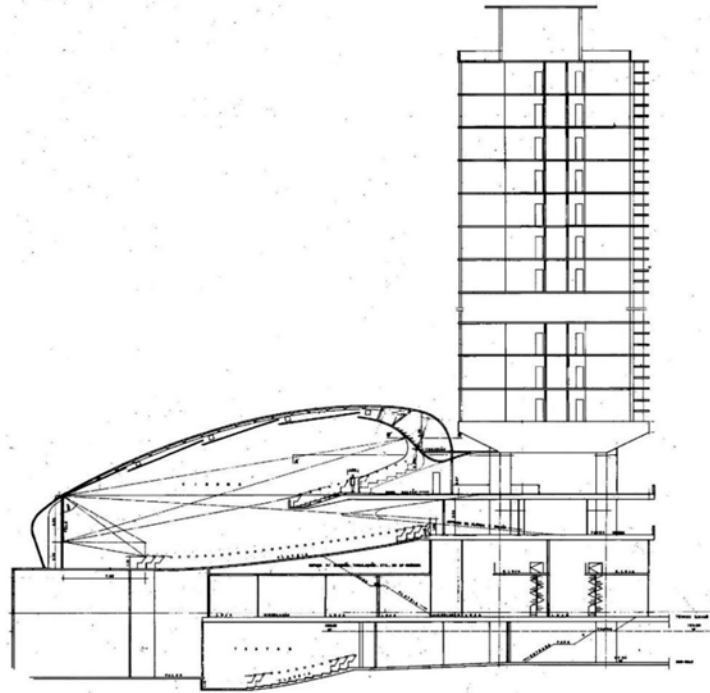
Movement architecture (LEMOS, 2014). The terrace would be accessed by a helical ramp and a walkway would connect the residential block to the hotel.

To carry out the projects in the city of São Paulo, in 1951, architect Oscar Niemeyer opened a satellite office headed by Carlos Lemos (LEAL, 2003), with a power of attorney to sign for the Copan designs. Subsequently, with the progress of the building work for constructing Brasília, Niemeyer instructed Lemos to continue the project and monitor the design changes requested during the construction (LEMOS, 2014).

Construction began on the iconic Copan 1952 (Figure 2), but work stoppages, for political and economic reasons, extended it until 1971-1972 (LEMOS, 2014). During this period, the American hotel chain left the partnership, countless construction companies succeeded each other until, in 1957, Bradesco acquired the National Industry and Construction Company (CNI), which had worked at the beginning of the building work, and eventually concluded the construction, but not before making significant changes to the original design - for example, the reconfiguration of blocks E F in body 4, which initially were 4-bedroom apartments with a balcony, changing them to one-bedroom apartments and kitchenettes, increasing the number of units to the current 1,160; removing the theater; reducing the cinema; replacing the helical ramp with a staircase giving access to the terrace; and closing in the terrace and transforming it into office space (Figures 3 and 4).

In the end, only the residential building was built (Figure 5). The hotel building never got off the drawing board and in its place a bank branch was designed by the architect Carlos Lemos, who dissuaded the banker from the idea of a neoclassical building and managed to maintain the complex dimension proposed by Niemeyer (LEAL, 2003).

Figure 3 – Cross-section of the Copan building
Source: São Paulo Municipal Archive.



pós- 5

Figure 4 – Floor plan
Source: Adapted by the author.

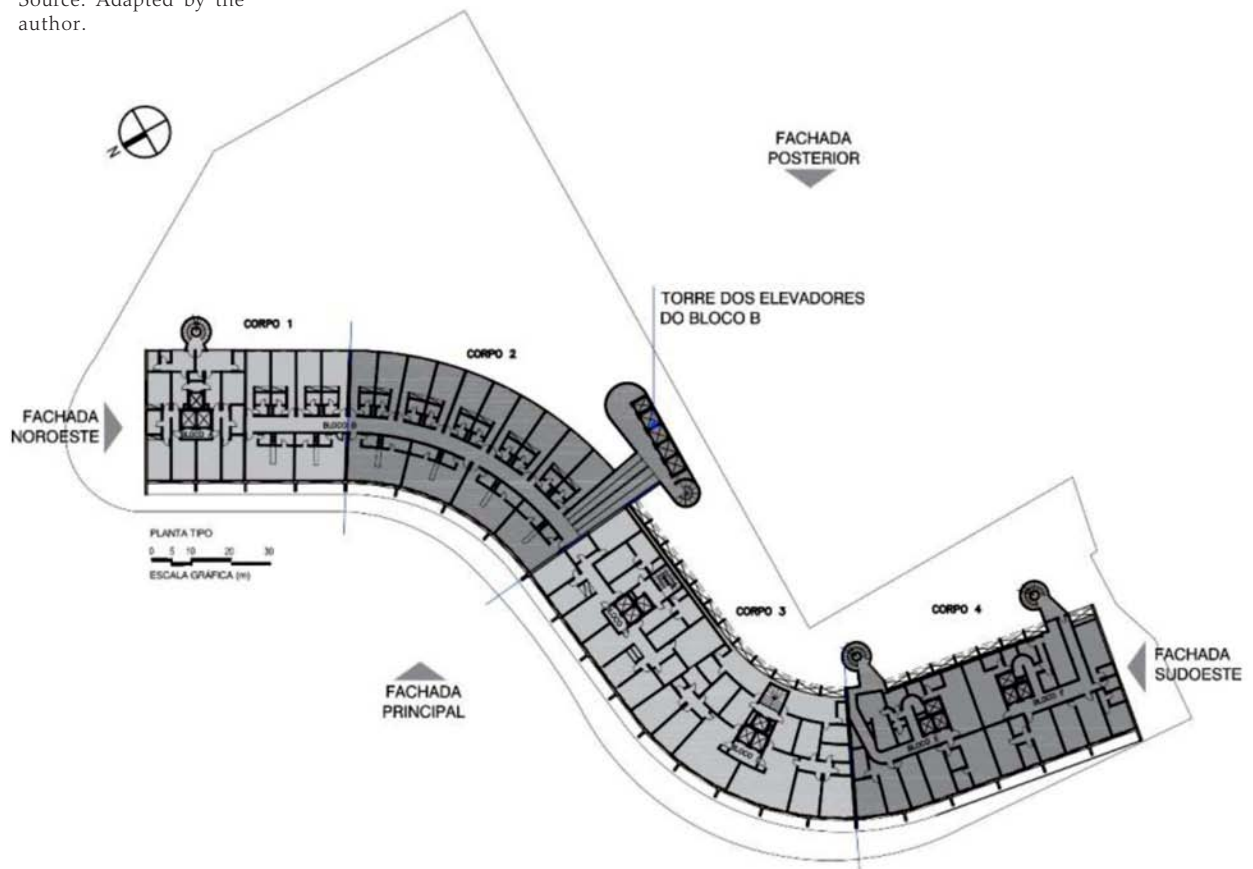




Figure 5 –Final phase of construction of the Copan
Source: Copan Archive.

During the 1970s and 1980s, the center of São Paulo city suffered a process of degradation, partly caused by decreased investment in the area. The advanced state of decay of the buildings was plain to be seen: some buildings were even abandoned, while others were transformed into tenements (GALVÃO, 2007). And what happened in the city center was reflected in what had been designed to be the São Paulo Rockefeller Center.

Efforts to turn around the decay of the Copan building began in the 1990s, a period in which electrical and hydraulic systems were replaced, elevators changed, escape routes created, fire extinguishers and hydrants were replaced, the garbage incinerator and its underground fuel tank, were deactivated, among other changes (BONFIM, 2019). As for the façades, the remaining stock of tiles produced for Copan, which measures approximately 2,200m², was acquired in the early 1990s. These tiles were used to repair the damaged ends of the *brise-soleil* and to replace missing ones.

However, the work of time, combined with a lack of preventive maintenance, caused the façades to reach an advanced stage of degradation: tiles falling on the sidewalk endangered passing pedestrians. Thus, to prevent accidents, protective trays and screens were set up (BONFIM, 2019).

In 2012, through Resolution No. 19, the Municipal Council for the Preservation of the Historical,

Cultural and Environmental Heritage of the City of São Paulo listed the Copan among a group of six modernist architecture buildings in the so-called “São Paulo modern stain”, due to its historical, architectural and landscape value. The buildings are: Copan; Public Defenders’ Offices; Court of Appeals of São Paulo – the former São Paulo Hilton Hotel; Banco Brasileiro de Descontos – Bradesco; Jaçatuba Building; Bratke Building; Gilbratar Building and Major and Renata Sampaio Ferreira Building.

In 2014, the Copan’s façades underwent an extensive technical survey by a specialized company in order to ascertain their physical conditions. The following year, an executive façade cladding project was developed and, in 2015, work began to remove the loose parts (tiles and roughcast layer) on the southwest and northwest façades. The façades for which the mortar coating was redone are currently missing the tiles (BONFIM, 2019).



Figure 6 – Degradation of the façade published in 1991 by the newspaper *Folha de S.Paulo*
Source: Copan Archive.

PROBLEMS AT THE COPAN

Everything at the Copan is on a grand scale, even its problems, and the façades are no exception. For decades, its façades have suffered from degradation due to lack of maintenance and the natural wear and tear of its elements and components. A photograph published in a 1991 report shows the extensive area of shedding on the northwest façade of the building (Figure 6).

However, the pathological manifestations on the façades of Copan are not limited to the falling tiles, there is also the detachment of the mortar coating; cracks; crumbling concrete; exposed and corroded reinforcement frame; gaps in the joints; biological colonization; dirt; among others.

In view of the problems presented, there is a clear need to remedy the causes of the pathological manifestations, in order to reestablish the performance of the external coating subsystem, but with the same methodological and scientific rigor used in the conservation of ancient architectural heritage (SALVO, 2007). This is the challenge of preserving modern architecture in the face of the need for restoration, as it is necessary to be familiar with the degradation processes of the materials and components used at the time, the peculiarities and weaknesses of their construction systems, the outdated facilities, as Carvalho (2005) points out, respecting the needs and the original materials within a viable budget, changing as much as necessary, but as little as possible (ICOMOS, 2013).

pós- 7

DOCUMENTATION

The documentation of the data referring to the Copan façades, for example, the information in the original architectural and structural designs, in the façade cladding project, in the technical reports, in the analysis of the results of the tests carried out, in the monitoring of the building work to remove loose parts, in preparing the as built, in characterizing the materials and components used and the critical analysis of all the data collected provided a more comprehensive view of this heritage and helped in developing the preservation instruments. The compilation of the information collected enabled a collection of documents to be assembled that goes beyond the limits of the building itself and also registers the materials and construction techniques used at the time of its construction, and can serve as a parameter for studies of other buildings from the same period. The Copan Building design generated more than a thousand boards, of which 1,206 are digitalized (GALVÃO, 2008). Despite the immense number of boards, it is noted that the material is not complete, for example, architectural drawings for the southwest, northwest and rear façades

are missing. However, the level of detail indicates the existence of a design supporting the construction, but the graphic material of which has not survived to the present day.

In the São Paulo Municipal Archive, 4 distinct phases of the city hall designs were found, three of which are in the process that was approved and constructed and the first, which dates from May 1952, appears in a different process, together with the hotel. In this design, Copan appears without its famous brise-soleil and with a winding ramp unsupported by pillars (Figure 7).

The analysis of the graphic pieces enabled the information from the architectural projects to be compared with that on the structure. Through an extensive survey carried out on site, measuring architectural and structural elements, the as built was prepared, which made it possible to cross reference the information on what was built with the original designs and, with this, it was concluded that the structure design was based on the design approved by the city, but that the changes made during construction were not made compatible by the architecture (Figure 8).

Figure 7 – Partial view of the Front Façade with the ramp without pillars
Source: São Paulo City Hall Archive.

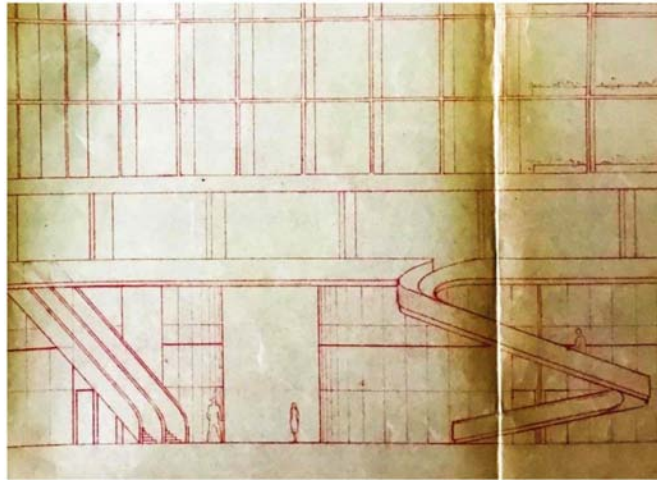
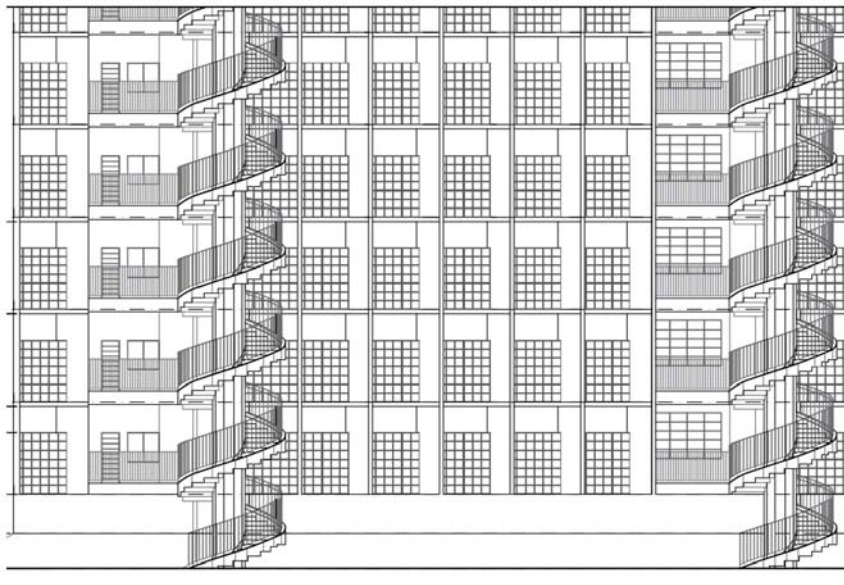


Figure 8 – Partial As built of the Rear façade (Blocks F and E)
Source: Prepared by the author.



The subsystems analyzed include direct foundations with caissons and compacting piles; the reinforced concrete structure and smooth steel bars, currently considered to have inadequate adhesion; the artisanal solid ceramic brick frames, possibly from the Ribeirão Pires region, and the external cladding subsystem made of roughcast and plaster layers, the compositions and material proportions of which were reconstituted in laboratory trials and, finally, the white and gray porcelain tiles laid and grouted with mortar composed of lime, sand and white cement (BONFIM, 2019).

In 2014, the management of the building hired the Falcão Bauer Control Center to prepare a diagnosis of the pathological manifestations on the façades and, after extensive inspection by a specialized team, a map of the damage to the southwest, northwest and Block B elevator tower was drawn up. The same company also carried out tests to reconstitute the roughcast mortar and to determine tensile bond strength. The first aimed to identify the composition of the mortar and the amount of cement, lime, sand and soluble sulphates, which could provide evidence of the cause of the peeling, while the second was intended to verify the adhesion conditions of this layer. Analyzing the results in the light of ABNT (Brazilian Association of Technical Standards)/ NBR (Brazilian Standard) 13749 (2013), the numbers were below the standard, indicating problems with adherence. Therefore, the recommendation was to totally demolish the roughcast layer and hire a company to carry out an executive restoration project (BONFIM, 2019).

In the same year, the company contracted for the façade cladding project reanalyzed the tests previously carried out and conducted further complementary tests, in which products were tested for superficial agglomeration of the original roughcast layer, adhesive mortar and tiles, finding that there was no need to completely demolish the roughcast layer, but only those parts with adhesion problems.⁷

The work to remove the loose parts started in September 2015 and, subsequently, the reconstruction began of the mortar coating, but at that time there was no agreement between the building management and the preservation agency regarding the tiles to replace the original ones. The building work was halted in late 2016, and what is currently observed are the southwest and northwest façades without tiles, the main façade covered by a protective screen and a tray at the bottom, while the rear façade is in an advanced stage of deterioration. .

PRESERVATION INSTRUMENTS

Following the restoration of the Copan Building façades (Figure 9), conservation policies will have to be adopted based on systematizing preventive maintenance actions, in order to delay deterioration and the need for major, costly restoration interventions (BONFIM, 2019) .

The documentation process, discussed above, supports the development of two preservation instruments: the Conservation Plan and the Use, Operation and Maintenance Manual for the façades of the Copan Building.

While the Conservation Plan addresses aspects related to significance, both identifying and retaining these values, showing what should be preserved; the Use, Operation and Maintenance Manual presents, from a technical perspective, the methodology for preserving these symbolic characteristics through a preventive maintenance system.

The Conservation Plan establishes what is significant in a building and the conservation policies necessary to maintain these meanings over the years. It addresses all relevant data in a system of priorities and relates the proposed conservation actions to the resources available (KERR, 2013). To develop a Conservation Plan for the Façades of the Copan Building, the methodologies used in the Heritage Lottery Fund, England, or the Heritage Branch, Canada, and that developed by Australian architect James Semple Kerr, were analyzed, the latter being used because it contains well-defined parameters for developing conservation policies to meet the complexity of the Copan's façades, it being necessary to establish judicious and well-defined policies.

Based on critical analysis of the information collected from the documentation, the necessary support was obtained for understanding the cultural and material significance of the building as heritage, at the same time as it was possible to understand its behavior over time and, with that, preservation policies to retain cultural values, preserve the material characteristics and the authenticity of the heritage could be proposed.

The aim of the Copan Building Conservation Plan is to present owners and managers with the importance of the building as heritage. The format adopted can serve as a model or example for other modern architecture buildings also needing to prepare this document for their conservation. Obviously, the proposal can be adapted to any building, but its parts address the main items to be included in a Conservation Plan.

The Copan Building Conservation Plan has seven parts. The first contains the introduction, a glossary with the terminology used throughout the text and graphics (plans, cross sections and elevations).

The second part gives a historical contextualization as a timeline, the characteristics of the façades, such as materials and components, dimensions etc. The Evidence Analysis field, records changes the façades underwent over the years, such as the metallic complement of the helical staircase, closing of the transition beam on the rear façade, changes to the rear façade by users, such as closing in hollow elements, indiscriminate replacement of the original frames and even changes in the size of the openings. And, finally, the cultural significance assessment.

The third part contains the declarations and levels of significance hierarchized in a list for each of the building's façades.

The fourth part deals with conservation policies for the general configuration of the building, for the basement, for the façades (main, rear, southwest and northwest), for the provision of services and retention of the heritage characteristics, for care with construction, policies related to change control and related to management.

The fifth part gives the final considerations and the sixth the references used. The seventh includes the annexes.

The Conservation Plan, therefore, highlights the importance of recognizing what should be preserved, since the lack of recognition may jeopardize the heritage, by allowing, for example, indiscriminate replacement, addition or deletion of elements and components. Likewise, it addresses cultural significance, hierarchically describes the cultural significant elements and presents conservation policies, the aim of which is to assist managers in decision making in order to preserve the architectural heritage in the present and in the future.

The Use, Operation and Maintenance Manual for the façades of the Copan Building was structured based on the guidelines in Brazilian Standards NBR 14037/2014 and NBR5674/2012, divided into nine parts.

The first part, the introduction, addresses the guidelines for using the manual and the procedures for carrying out inspections, maintenance actions, filling out forms and the procedures for filing and creating the record, so that any and all inspection or maintenance action can be easily tracked. In this first part, the terms and definitions used in the text are described. The second part gives a descriptive memorial of the building, with its architectural features and graphics.

In the third part, the external cladding subsystem, the original materials and components and those used in the recovery building work are described.

The fourth part addresses the preventive maintenance program with an action plan broken down according to component, giving the frequency of each action, the points that must be analyzed during the action and which agent should be responsible for it.

The fifth part describes how to monitor and record maintenance actions on the façades. This part contains the inspection, maintenance and reports to be filled out and filed in the respective files.

The sixth part contains a list of suppliers and designers.

The seventh part lists the normative and bibliographic references used, while the eighth deals with updates and revisions of the manual, and finally, the ninth and final part contains the annexes with drawings of the enlargements of the elevations of the façades, in order to facilitate demarcation. during inspections.

Preventive maintenance (described in the fifth part), is an oft neglected aspect, the importance of which only comes to the fore when there is a need for large and costly interventions. When it comes to architectural heritage, this aspect becomes even more delicate, because when the original material or component is in a very advanced stage of degradation, it is not always possible to restore it and it must be replaced, leading to loss of authenticity of the heritage. The memory lost with the material can no longer be recovered. Recovering appearance, when possible, is very expensive. Therefore, preventive maintenance is a great ally in conserving heritage, provided it is done systematically, respecting the original characteristics, so important for the preservation of architectural memory.

Therefore, the importance of these two preservation instruments is implicit here, as one helps to understand what is significant and needs to be preserved, while the other presents the technical aspects of preservation. Through them, we aim to deal more comprehensively with the complexity inherent to conserving this example of modern architecture, pointing out what is significant and should be preserved and what actions are necessary to preserve the material while retaining its cultural significance (ICOMOS, 2011).



Figure 9 – Partial view of the Northwest and Main Façade with the protection screen
Source: Authors collection.

Therefore, the importance of similar instruments being required by the agencies responsible for heritage preservation is emphasized, in order to assist managers and owners in the care of the listed property, from simple, every day actions such as cleaning, to inspection and maintenance actions, preventive measures, described in a specific procedure to follow. Such actions, when performed with the appropriate frequency, mitigate the progress of deterioration and, consequently, of large and costly restoration interventions - which become inevitable in the face of no maintenance against the work of time, which weaken the subsystem leaving it more susceptible to degradation -, compromising aesthetic aspects and the architectural memory of its façades, which are the most striking and identifying characteristics of the building.

CONCLUSIONS

Recognizing the urgency in preserving examples of modern architecture has brought to light the challenges involved, ranging from identifying significance to the methodological processes for conserving heritage, with emphasis on the importance of preventive maintenance to delay degradation and, consequently, the need for major restorative interventions.

Documenting the materials and techniques used in constructing the Copan, in addition to aiding in the development of preservation instruments, can assist other researchers, managers and professionals who come to intervene in buildings built around the same time and with similar characteristics.

It is necessary to understand the causes and extent of pathological manifestations, but recommending the procedures to be undertaken must be limited to design solutions, since the critical analysis, intrinsic to the design process, allows solutions to be adopted for restoring performance and respecting heritage, design is essential to carrying out restoration interventions.

The proposed preservation instruments are intended to assist managers in preserving heritage, delaying the need for intervention and making it clear that it is better for the memory and less costly to preserve than to restore. Therefore, every modern building of architectural value must prepare its own Conservation Plan and Use, Operation and Maintenance Manual for the conservation of its characteristics, with assertive conservation actions.

Finally, conserving the heritage of modern architecture is intrinsically related to recognizing its values and to preventive maintenance, with a view to mitigating the need for successive restorations and replacements of the original elements and components, due to wear and tear of the material over time, and lack of preservation actions, but when these measures are imperative, they must be based on the same technical and methodological rigor used in secular heritage and not carried out indiscriminately, jeopardizing the architectural memory.

REFERENCES

- ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS. *NBR 13749: Revestimentos de paredes e tetos de argamassas inorgânicas*: especificação. Rio de Janeiro: ABNT, 2013.
- BONFIM, Valeria Aparecida Costa. *A conservação da arquitetura moderna: as fachadas do Edifício Copan*. 2019. Dissertação (Mestrado em Tecnologia da Arquitetura) – Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo, São Paulo, 2019.
- CARVALHO, Cláudia S. R. *Preservação da arquitetura moderna: edifícios de escritórios construídos no Rio de Janeiro entre 1930 e 1960*. 2005. Tese (Doutorado em História e Fundamentos da Arquitetura e Urbanismo) – Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo, São Paulo, 2005.
- GALVÃO, Walter J. F. *Copan/SP: a trajetória de um mega empreendimento, da concepção ao uso*. 2007. Dissertação (Mestrado em Tecnologia da Arquitetura) – Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo, São Paulo, 2007.
- GALVÃO, Walter J.F.; ORNSTEIN, Sheila W. Análise da funcionalidade dos apartamentos do edifício Copan/SP. In: SEMINÁRIO INTERNACIONAL ESPAÇO SUSTENTÁVEL, 7., 2008, São Paulo. *Anais* [...]. São Paulo: Nutau, 2008.
- ICOMOS. *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance*. Burkwood: Icomos, 2013. Disponível em: <https://bit.ly/3b86E0x>. Acesso em: 15 abr. 2020.
- ICOMOS. *Carta de Madrid: critérios para a conservação do patrimônio arquitetônico do século XX*. Madrid: Icomos, 2011. Disponível em: <https://bit.ly/2KafQFW>. Acesso em: 15 abr. 2020.
- KERR, James S. *Conservation Plan: a guide to the preparation of conservation plans for places of European cultural significance*. 7. ed. Sydney: Icomos, 2013.

LEAL, Daniela V. *Oscar Niemeyer e o mercado imobiliário de São Paulo na década de 1950: o escritório satélite sob direção do arquiteto Carlos Lemos e os edifícios encomendados pelo Banco Nacional Imobiliário*. Campinas, 2003. Dissertação (Mestrado em História) – Instituto de Filosofia e Ciências Humanas, Universidade Estadual de Campinas, Campinas, 2003.

LEMOS, Carlos A. C. *A história do Edifício Copan*. São Paulo: Imprensa Oficial do Estado de São Paulo, 2014. (Trilogia do Copan, v. 1).

SALVO, Simona. Restauro e ‘restauros’ das obras arquitetônicas do século 20: intervenções em arranha-céus em confronto. *Revista CPC*, São Paulo, n. 4, p. 139-157, 2007. Disponível em: <https://bit.ly/2V9fplk>. Acesso em: 15 abr. 2020.

SAMPAIO, Maria Ruth do Amaral. (org.). *A promoção privada de habitação econômica e a arquitetura moderna: 1930-1964*. São Carlos: Rima, 2002.

Editor’s note

Submitted on: 01/10/2019

Approved on: 19/01/2020

Translated by: RMO Empresarial

Valéria Aparecida Costa Bonfim

Universidade de São Paulo. Faculdade de Arquitetura e Urbanismo.

Rua do Lago, 876, Butantã – 05508080 – São Paulo – SP.

ORCID: <https://orcid.org/0000-0002-6555-3103>

valeriabonfim@usp.br

Fabiana Lopes de Oliveira

Universidade de São Paulo. Faculdade de Arquitetura e Urbanismo.

Rua do Lago, 876, Butantã – 05508080 – São Paulo – SP.

ORCID: <https://orcid.org/0000-0003-4053-5969>

floliveira@usp.br